STATE OF THE CLIMATE IN 2011

Special Supplement to the
Bulletin of the American Meteorological Society
Vol. 93, No. 7, July 2012

STATE OF THE CLIMATE IN 2011

Editors

Jessica Blunden

Derek S. Arndt

Associate Editors

Howard J. Diamond

A. Johannes Dolman

Ryan L. Fogt

Margarita C. Gregg

Bradley D. Hall

Martin O. Jeffries

Michele L. Newlin

James A. Renwick

Jacqueline A. Richter-Menge

Ahira Sánchez-Lugo

Ted A. Scambos

Wassila M. Thiaw

Peter W. Thorne

Scott J. Weaver

Kate M. Willett

AMERICAN METEOROLOGICAL SOCIETY

ACKNOWLEDGMENTS

The editors thank the staff of the *Bulletin of the American Meteorological Society* for their professionalism and assistance. Specifically, Lesley Williams and Melissa Fernau provided valuable editorial advice and logistical support. As always, the guidance and leadership of Bryan Hanssen and Jeff Rosenfeld was essential. The chapter editors enthusiastically thank their respective internal reviewers, and anonymous external reviewers, for working on very tight timetables to improve the document.

Chapter 2:

- Various reanalysis datasets were provided by Paul Berrisford and Hitoshi Sato (ERA-Interim), Mike Bosilovich (MERRA), Muthuvel Chelliah (NCEP CFSR), Yayoi Harada (JRA-25/JCDAS) and Cathy Smith (20CR).
- Surface humidity data were provided by several of the reanalysis authors above and by Aiguo Dai.
- Kate Willett was supported by the Joint DECC/Defra Met Office Hadley Centre Climate Programme (GA01101).

Chapter 3:

- The editors thank Joel Levy, Oceans chapter editor for the 2005–10 reports, for developing the chapter from its origins and assembling an impressive team of authors.

Chapter 4:

- Charles "Chip" Guard, NOAA/NWS/Guam Weather Forecast Office is thanked for his contributions to and assistance with the section dealing with tropical cyclones in the Western North Pacific basin.
- Bill Ward, NOAA/NWS/Pacific Region Headquarters, Honolulu, Hawaii is thanked for his detailed and very helpful internal review of the chapter.

Chapter 5:

- The NOAA authors note that, with respect to their contributions, "The views, opinions, and findings contained in this report are those of the author(s) and should not be construed as an official National Oceanic and Atmospheric Administration or U.S. Government position, policy, or decision."
- Jim Overland acknowledges the support of the Arctic Research Office of the NOAA Climate Program Office.
- Chris Derksen and Ross Brown thank their data providers: National Snow and Ice Data Centre; European Centre for Midrange Weather Forecasts; NOAA Earth System Research Laboratory; Rutgers University Snow Laboratory; and the Canadian Meteorological Centre.
- Marco Tedesco acknowledges NSF grant ARC 0909388 and the NASA Cryosphere Program, and Roderick van der Wal acknowledges Utrecht University, and several grants from the Dutch National Science Foundation (NWO), including the Spinoza Program and the Netherlands Polar Programme, for support for measurements along the K-transect in west Greenland.
- Vladimir Romanovsky acknowledges NSF grant ARC 0856864 and the Russian Academy of Science for partial support.
- Andrey Proshutinsky acknowledges NOAA support, and data and data analysis made possible by NSF grants ARC 856531, ARC 0856479 and ARC 0806306.
- The ozone and UV essay was supported by NSF grant ARC 0856268 (Ultraviolet Radiation in the Arctic) and European Commission Seventh Framework Programme grant RECONCILE-226365-FP7-ENV-2008-1 (RECONCILE project). Work at the Jet Propulsion Laboratory, California Institute of Technology, was done under contract with the U.S. National Aeronautics and Space Administration.
- Skip Walker and Uma Bhatt acknowledge NSF grant ARC 0902175 and NASA grants NNG6GE00A and NNX09AK56G.
- Karen Frey acknowledges NSF grant ARC 1107645 and NASA grant NNX10AH71G.

Chapter 6:

- Drs. Jan Lieser and Alex Fraser (ACE CRC) are thanked for their comments on the sea ice section.
- Rob Massom acknowledges support from the Australian Government's Cooperative Research Centre programme through the ACE CRC, and contribution to Project CPC18 and AAS Project 4116.
- Ted Scambos was supported under NASA grant NNX-09AM78G.
- Sharon Stammerjohn was supported under NSF/OPP 0217282.
- Matthew Lazzara and the AMRC AWS program acknowledge support from NSF grant number ANT-0944018.
- Dr. Michiel van den Broeke, Dr. Alberto Setzer, and Dr. Florence Fetterer are all thanked for their internal reviews of the chapter.

Chapter 7:

- The editors acknowledge and thank the numerous National Hydrological and Hydrometeorological Services for collecting and providing data (and many authors) for this report.

ACRONYMS AND ABBREVIATIONS

AAO	Antarctic Oscillation
ACE	NOAA's Accumulated Cyclone Energy Index
AGGI	NOAA's Annual Greenhouse Gas Index
ALT	Active layer thickness
AMO	Atlantic Multidecadal Oscillation
AMSR-E	Advanced Microwave Scanning Radiometer for Earth Observing System
AMSU	Advanced Microwave Sounding Unit
AO	Arctic Oscillation
AOD	Aerosol optical depth
AOML	Atlantic Oceanographic and Meteorological Laboratory
ATSR	Along-Track Scanning Radiometers
AVHRR	Advanced Very High Resolution Radiometer
AVISO	Archiving, Validating, and Interpretation of Satellite Oceanographic data
CAMS	Climate Anomaly Monitoring System
CDR	Climate data record
CERES	Clouds and the Earth's Radiant Energy System
CLIVAR	Climate Variability and Predictability
CPC	Climate Prediction Center
CPHC	NOAA's Central Pacific Hurricane Center
CRU	Hadley Centre's Climate Research Unit
ECMWF	European Centre for Medium-Range Weather Forecasts
ECV	Essential climate variable
EECl	Effective equivalent chlorine
EESC	Effective equivalent stratospheric chlorine
EOS	Earth Observatory System
ERB	Earth radiation budget
ERBE	Earth Radiation Budget Experiment
ERSST	Extended Reconstructed Sea Surface Temperature
ESA	European Space Agency
ESRL	Earth System Research Laboratory
EU	European Union
FAO	Food and Agriculture Organization
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
FLASHflux	Fast Longwave and Shortwave Radiative Fluxes
GCOS	Global Climate Observing System
GHCN	Global Historical Climatology Network
GISS	NASA's Goddard Institute of Space Studies
GOME	Global Ozone Monitoring Experiment
GPCC	Global Precipitation Climatology Centre
GPCP	Global Precipitation Climatology Project
GPI	Genesis potential index
GRACE	Gravity Recovery and Climate Experiment
GTN-P	Global Terrestrial Network on Permafrost
HadAT	Hadley Centre's radiosonde temperature product
HadCRUT3	Hadley Centre/CRU gridded monthly temperatures dataset
HadGEM1	Hadley Centre global model
HadISST	Hadley Centre's sea ice and SST dataset
HIRS-W	High Resolution Infrared Sounder
IBTrACS	International Best Track Archive for Climate Stewardship
ICD	Ice cover duration
ICPAC	IGAD Climate Prediction and Applications Centre
IOD	Indian Ocean dipole
ISCCP	International Satellite Cloud Climatology Project
JGOFS	Joint Global Ocean Flux Study
JMA	Japanese Meteorological Agency
JPL	Jet Propulsion Laboratory
JRA	Japanese Reanalysis
JTWC	U.S. Navy's Joint Typhoon Warning Center
LHF	Latent heat flux
MDR	Main Development Region
MERIS	Medium Resolution Imaging Spectrometer
MISR	Multiangle Imaging SpectroRadiometer
MLS	Microwave Limb Sounder

MOC	Meridional overturning current
MOCHA	Meridional Overturning Circulation Heat Transport Array
MODIS	Moderate Resolution Imaging Spectroradiometer
MSLP	mean sea level pressure
MSU	Microwave Sounding Unit
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NDVI	Normalized Difference Vegetation Index
NERC	National Environmental Research Council
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
NOMADS	National Operational Model Archive and Distribution System
NSIDC	National Snow and Ice Data Center
OAFlux	Objectively Analyzed Air-Sea Fluxes
ODGI	Ozone Depleting Gas Index
OHCA	Ocean heat content anomaly
OISST	Optimal Interpolation SST
OLR	Outgoing longwave radiation
OMI	Ozone Monitoring Instrument
ONI	Oceanic Niño Index
OPI	OLR precipitation index
OSCAR	Ocean Surface Current Analysis-Real Time
PATMOS (-x)	Pathfinder Atmospheres (Extended Product)
PDO	Pacific decadal oscillation
PIRATA	Pilot Research Array in the Tropical Atlantic
PMEL	Pacific Marine Environmental Laboratory
PSC	Polar stratospheric clouds
PSS	Practical salinity scale
QBO	Quasi-biennial oscillation
QuikSCAT	Quick Scatterometer
RAMA	Research Moored Array for African-Asian-Australian Monsoon Analysis Prediction
RAOBCORE	Radiosonde Observation Correction
RATPAC	Radiosonde Atmospheric Temperature Products for Assessing Climate
RICH	Radiosonde Innovation Composite Homogenization
RSS	Remote Sensing Systems
SAM	Southern annular mode
SCD	snow covered duration
SCE	snow cover extent
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Chartography
SeaWiFS	Sea-viewing Wide Field of View
SHF	Sensible heat flux
SLP	Sea level pressure
SOI	Southern Oscillation index
SPCZ	South Pacific convergence zone
SSM/I	Special Sensor Microwave Imager
SSH	Sea surface height
SSS	Sea surface salinity
SSTA	Sea surface temperature anomaly
SWE	Snow water equivalent
TCHP	Tropical cyclone heat potential
TCWV	Total column water vapor
TOA	Top of atmosphere
TOMS	Total Ozone Mapping Spectrometer
TRITON	Triangle Trans-Ocean Buoy Network
TRMM	Tropical Rainfall Measuring Mission
TWC	Terrestrial water storage
WBC	Western boundary current
WBM	Water Balance Model
w.e.	water equivalent
WGMS	World Glacier Monitoring Service
WHOI	Woods Hole Oceanographic Institute
WMO	World Meteorological Organization
WOA	World Ocean Atlas
WOCE	World Ocean Circulation Experiment

REFERENCES

Ackerman, S. A., R. E. Holz, R. Frey, E. W. Eloranta, B. C. Maddux, and M. McGill, 2008: Cloud detection with MODIS. Part II: Validation. *J. Atmos. Oceanic Technol.*, **25**, 1073–1086.

Adlam, L. S., M. R. Balks, C. A. Seybold, and D. I. Campbell, 2010: Temporal and spatial variation in active layer depth in the McMurdo Sound Region, Antarctica. *Antarctic Sci.,* **22**, 45–52.

Adler, R. F., and Coauthors, 2003: The version 2 Global Precipitation Climatology Project (GPCP) monthly precipitation analysis (1979-present). *J. Hydrometeor.*, **4**, 1147–1167.

Aiyyer, A., and J. Molinari, 2008: MJO and tropical cyclogenesis in the Gulf of Mexico and eastern Pacific: Case study and idealized numerical modeling. *J. Atmos. Sci.*, **65**, 2691–2704.

Åkerman, H. J., and M. Johansson, 2008: Thawing permafrost and thicker active layers in sub-arctic Sweden. *Permafrost Periglacial Processes*, **19**, 279–292.

Allan, R. J., and T. J. Ansell, 2006: A new globally complete monthly historical gridded mean sea level pressure data set (HadSLP2): 1850-2004. *J. Climate*, **19**, 5816–5842.

——, J. A. Lindesay, and D. E. Parker, 1996: *El Niño Southern Oscillation and Climatic Variability.* CSIRO Publications, 405 pp.

——, C. J. C. Reason, J. A. Lindesay, and T. J. Ansell, 2003: 'Protracted' ENSO episodes and their impacts in the Indian Ocean region. *Deep-Sea Res. II.,* **50**, 2331–2347.

——, P. Brohan, G. P. Compo, R. Stone, J. Luterbacher, and S. Brönnimann, 2011: The International Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative. *Bull. Amer. Meteor. Soc.,* **92**, 1421–1425.

Alley, W. M., R. W. Healy, J. W. LaBaugh, and T. E. Reilly, 2002: Flow and storage in groundwater systems. *Science*, **296**, 1985–1990.

Amador, J. A., E. J. Alfaro, O. G. Lizano, and V. O. Magaña, 2006: Atmospheric forcing of the eastern tropical Pacific: A review. *Progr. Oceanogr.*, **69**, 101–142.

Andreae, M. O., and P. Merlet, 2001: Emission of trace gases and aerosols from biomass burning. *Global Biogeochem. Cycles*, **15**, 955–966.

Antoine, D., A. Morel, H. Gordon, V. Banzon, and R. Evans, 2005: Bridging ocean color observations of the 1980's and 2000's in search of long-term trends. *J. Geophys. Res.*, **110**, C06009, doi:10.1029/2004JC002620.

Antonov, J. I., and Coauthors, 2010: *Salinity*. Vol. 2, *World Ocean Atlas 2009*, NOAA Atlas NESDIS 69, 184 pp.

Arrigo, K. R., and G. L. van Dijken, 2011: Secular trends in Arctic Ocean net primary production. *J. Geophys. Res.,* **116**, C09011, doi:10.1029/2011JC007151.

Ashok, K., S. K. Behera, S. A. Rao, H. Weng, and T. Yamagata, 2007: El Niño Modoki and its possible teleconnection. *J. Geophys. Res.*, **112**, C11007, doi:10.1029/12006JC003798.

ASMERC, 2011: *Assessment of homogeneity of temperature and precipitation time series during 1960-2010 over Iran*. ASMERC research report.

Atkinson, G. D., 1971: Forecasters' guide to tropical meteorology. U.S. Air Force Tech. Rep. 240, 360 pp.

Atlas, R., R. N. Hoffman, J. Ardizzone, S. M. Leidner, J. C. Jusem, D. K. Smith, and D. Gombos, 2011: A cross-calibrated, multiplatfom ocean surface wind velocity product for meteorological and oceanographic applications. *Bull. Amer. Meteor. Soc.*, **92**, 157–174.

Baccini, A., and Coauthors, 2012: Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. *Nature Climate Change*, **2**, 182–185.

Bajracharya, S. R., S. B. Maharjan, and F. Shrestha, 2011: Glaciers shrinking in Nepal Himalaya. *Climate Change: Geophysical Foundations and Ecological Effects*, J. Blanco and H. Kheradmand, Eds., InTech, 445–458.

Baldwin, M. P., and Coauthors, 2001: The quasi-biennial oscillation. *Rev. Geophys.*, **39**, 179–229.

Baringer, M. O., and J. Larsen, 2001: Sixteen years of Florida current transport at 27°N. *Geophys. Res. Lett.*, **28**, 3179–3182.

——, and S. L. Garzoli, 2007: Meridional heat transport using expendable bathythermographs. Part I: Error estimates from model and hydrographic data. *Deep-Sea Res. I*, **54**, 1390–1401.

——, and Coauthors, 2011: [Global oceans] Meridional overturning circulation observations in the subtropical North Atlantic [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S95–S98.

Barriopedro, D., E. Fisher, J. Luterbacher, R. M. Trigo, and R. García-Herrera, 2011: The hot summer of 2010: Redrawing the temperature record map of Europe. *Science*, **322**, 220.

Bartalis, Z., W. Wagner, V. Naeimi, S. Hasenauer, K. Scipal, H. Bonekamp, J. Figa, and C. Anderson, 2007: Initial soil moisture retrievals from the METOP-A Advanced Scatterometer (ASCAT). *Geophys. Res. Lett.*, **34**, L20401, doi:10.1029/2007GL031088.

Becker, M., B. Meyssignac, W. Llovel, A. Cazenave, and T. Delcroix, 2012: Sea level variations at tropical Pacific islands since 1950. *Global Planet. Change*, **80-81**, 85–98.

Beckley, B. D., N. P. Zelensky, S. A. Holmes, F. G. Lemoine, R. D. Ray, G. T. Mitchum, S. D. Desai, and S. T. Brown, 2010: Assessment of the Jason-2 extension to the TOPEX/Poseidon, Jason-1 sea-surface height time series for global mean sea level monitoring. *Marine Geodesy*, **33**, 447–471.

Behera, S. K., J.-J. Luo, S. Masson, S. A. Rao, H. Sakuma, and T. Yamagata, 2006: A CGCM study on the interaction between IOD and ENSO. *J. Climate*, **19**, 1688–1705.

Behrenfeld, M. J., E. Boss, D. A. Siegel, and D. M. Shea, 2005: Carbon-based ocean productivity and phytoplankton physiology from space. *Global Biogeochem. Cycles*, **19**, GB1006, doi:10.1029/2004GB002299.

——, and Coauthors, 2006: Climate-driven trends in contemporary ocean productivity. *Nature*, **444**, 752–755.

——, K. Halsey, and A. Milligan, 2008: Evolved physiological responses of phytoplankton to their integrated growth environment. *Phil. Trans. Royal Soc. B*, **363**, 2687–2703.

——, D. A. Siegel, R. T. O'Malley, and S. Maritorena, 2009: Global ocean phytoplankton [in "State of the Climate in 2008"]. *Bull. Amer. Meteor. Soc.*, **90** (8), S68, S70–S73.

Bell, G. D., and M. Chelliah, 2006: Leading tropical modes associated with interannual and multidecadal fluctuations in north Atlantic hurricane activity. *J. Climate,* **19**, 590–612.

——, and Coauthors, 2000: The 1999 North Atlantic and eastern North Pacific hurricane season [in "Climate Assessment for 1999"]. *Bull. Amer. Meteor. Soc.*, **81** (5), S19–S22.

——, and Coauthors, 2007: Tropical cyclones: Atlantic basin [in "State of the Climate in 2006"]. *Bull. Amer. Meteor. Soc.*, **88** (6), S48–S51.

——, and Coauthors, 2008: Tropical cyclones: Atlantic basin [in "State of the Climate in 2007"]. *Bull. Amer. Meteor. Soc.*, **89** (7), S68–S71.

——, and Coauthors, 2009: Tropical cyclones: Atlantic basin [in "State of the Climate in 2008"]. *Bull. Amer. Meteor. Soc.*, **90** (8), S79–S83.

——, and Coauthors, 2010: Tropical cyclones: Atlantic basin [in "State of the Climate in 2009"]. *Bull. Amer. Meteor. Soc.*, **91** (7), S84–S88.

——, and Coauthors, 2011: [Tropics] Tropical cyclones: Atlantic basin [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S115–S121.

Bellassen, V., N. Viovy, S. Luyssaert, G. Le Maire, M.-J. Schelhaas, and P. Ciais, 2011: Reconstruction and attribution of the carbon sink of European forests between 1950 and 2000. *Global Change Biol.*, **17**, 3274–3292.

Beránger, K., L. Siefridt, B. Barnier, E. Garnier, and H. Roquet, 1999: Evaluation of operational ECMWF surface freshwater fluxes of oceans during 1991–1997. *J. Marine Syst.*, **22**, 13–36.

Bernhard, G., and Coauthors, 2011: Ozone and UV radiation. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 24–33. [Available online at http://www.arctic.noaa.gov/reportcard.]

Berry, D. I., and E. C. Kent, 2011: Air-sea fluxes from ICOADS: The construction of a new gridded dataset with uncertainty estimates. *Int. J. Climatol.*, **31**, 987–1001.

Bhambri, R., T. Bolch, R. K. Chaujar, and S. C. Kulshreshtha, 2011: Glacier changes in the Garhwal Himalayas, India, 1968–2006 based on remote sensing. *J. Glaciol.*, **97**, 543–556.

Bhatt, U. S., and Coauthors, 2010: Circumpolar Arctic tundra vegetation change is linked to sea-ice decline. *Earth Interact.*, **14** (8), 1–20.

Blake, E., E. J. Gibney, D. P. Brown, M. Mainelli, J. L. Franklin, T. B. Kimberlain, and G. R. Hammer, 2009: *Tropical Cyclones of the Eastern North Pacific Basin, 1949-2006*. Historical Climatology Series 6-5, NOAA National Climatic Data Center, 162 pp.

——, C. W. Landsea, and E. J. Gibney, 2011: The deadliest, costliest, and most intense United States tropical cyclones from 1851 to 2010. NOAA Tech. Memo. NWS NHC-6, NOAA National Hurricane Center, 47 pp. [Available online at http://www.nhc.noaa.gov/pdf/nws-nhc-6.pdf.]

Bodhaine, B. A., B. G. Mendonca, J. M. Harris, and J. M. Miller, 1981: Seasonal variation in aerosols and atmospheric transmission at Mauna Loa Observatory. *J. Geophys. Res.,* **86** (C8), 7395–7398.

Bolch, T., T. Yao, S. Kang, M. F. Buchroithner, D. Scherer, F. Maussion, E. Huintjes, and C. Schneider, 2010: A glacier inventory for the western Nyainqentanglha Range and the Nam Co Basin, Tibet, and glacier changes 1976–2009. *The Cryosphere*, **4**, 419–433.

——, T. Pieczonka, and D. Benn, 2011: Multi-decadal mass loss of glaciers in the Everest area (Nepal Himalaya) derived from stereo imagery. *The Cryosphere*, **5**, 349–358.

Böning, C. W., A. Dispert, M. Visbeck, S. R. Rintoul, and F. U. Schwarzkopf, 2008: The response of the Antarctic Circumpolar Current to recent climate change. *Nature Geosci.*, **1**, 864–869.

Bonjean, F., and G. Lagerloef, 2002: Diagnostic model and analysis of the surface currents in the tropical Pacific Ocean. *J. Phys. Oceanogr.*, **32**, 2938–2954.

Bopp, L., C. Le Quéré, M. Heimann, A. C. Manning, and P. Monfray, 2002: Climate-induced oceanic oxygen fluxes: Implications for the contemporary carbon budget. *Global Biogeochem. Cycles*, **16**, 2, doi:10.1029/2001GB001445.

Bousquet, P., and Coauthors, 2011: Source attribution of the changes in atmospheric methane for 2006–2008. *Atmos. Chem. Phys.*, **11**, 3689–3700.

Box, J. E., and Coauthors, 2011: Greenland ice sheet. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 117–138. [Available online at http://www.arctic.noaa.gov/reportcard.]

Boyer, T. P., S. Levitus, J. I. Antonov, R. A. Locarnini, and H. E. Garcia, 2005: Linear trends in salinity for the World Ocean, 1955–1998. *Geophys. Res. Lett.*, **32**, L01604, doi:10.1029/2004GL021791

——, ——, ——, ——, A. Mishonov, H. Garcia, and S. A. Josey, 2007: Changes in freshwater content in the North

Atlantic Ocean 1955–2006. *Geophys. Res. Lett.*, **34**, L16603, doi:10.1029/2007GL030126.

——, and Coauthors, 2009: Introduction. *World Ocean Database 2009*, NOAA Atlas NESDIS 66, 216 pp.

Brasnett, B., 1999: A global analysis of snow depth for numerical weather prediction. *J. App. Meteor.*, **38**, 726–740.

Bretherton, F. P., R. E. Davis, and C. Fandry, 1976: A technique for objective analysis and design of oceanographic instruments applied to MODE-73. *Deep-Sea Res.*, **23**, 559–582.

Brocca, L., F. Melone, T. Moramarco, W. Wagner, V. Naeimi, Z. Bartalis, and S. Hasenauer, 2010: Improving runoff prediction through the assimilation of the ASCAT soil moisture product. *Hydrol. Earth System Sci.*, **14**, 1881–1893.

Brohan, P., J. J. Kennedy, I. Harris, S. F. B. Tett and P. D. Jones, 2006: Uncertainty estimates in regional and global observed temperature changes: a new dataset from 1850. *J. Geophys. Res.*, **111**, D12106, doi:10.1029/2005JD006548.

Bromwich, D. H., and S-H. Wang, 2011: [Antarctica] Net precipitation [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S164–167.

——, A. N. Rogers, P. Kallberg, R. I. Cullather, J. W. C. White, and K. J. Kreutz, 2000: ECMWF analyses and reanalyses depiction of ENSO signal in Antarctic precipitation. *J. Climate*, **13**, 1406–1420.

——, A. J. Monaghan, and Z. Guo, 2004: Modeling the ENSO modulation of Antarctic climate in the late 1990s with Polar MM5. *J. Climate*, **17**, 109–132.

——, R. L. Fogt, K. I. Hodges, J. E. Walsh, 2007: A tropospheric assessment of the ERA-40, NCEP, and JRA-25 global reanalyses in the polar regions. *J. Geophys. Res.*, **112**, D10111, doi:10.1029/2006JD007859.

——, J. P. Nicolas, and A. J. Monaghan, 2011: An assessment of precipitation changes over Antarctica and the Southern Ocean since 1989 in contemporary global reanalyses. *J. Climate*, **24**, 4189–4209.

Brown, J., O. J. Ferrians, J. A. Heginbottom, and E. S. Melnikov, 1997: Circum-Arctic map of permafrost and ground-ice conditions. National Snow and Ice Data Center, Boulder, CO, digital media. [Available online at http://nsidc.org/data/ggd318.html.]

Brown, L. C., and C. R. Duguay, 2010: The response and role of ice cover in lake-climate interactions. *Progr. Phys. Geog.*, **34**, 671–704.

Brown, R., and D. Robinson, 2011: Northern Hemisphere spring snow cover variability and change over 1922–2010 including an assessment of uncertainty. *The Cryosphere*, **5**, 219–229.

——, C. Derksen, and L. Wang, 2010: A multi-dataset analysis of variability and change in Arctic spring snow cover extent, 1967-2008. *J. Geophys. Res.*, **115**, D16111, doi:10.1029/2010JD013975.

Bruhwiler, L., and E. Dlugokencky, 2011: Carbon dioxide (CO_2) and methane (CH_4). *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 20–23. [Available online at http://www.arctic.noaa.gov/reportcard.]

Burn, C. R., and S. V. Kokelj, 2009: The environment and permafrost of the Mackenzie Delta area. *Permafrost Periglacial Processes*, **20**, 83–105.

Butchart, N., and E. E. Remsberg, 1986: The area of the stratospheric polar vortex as a diagnostic for tracer transport on an isentropic surface. *J. Atmos. Sci.,* **43**, 1319–1339.

Caldeira, K., and M. E. Wickett, 2003: Anthropogenic carbon and ocean pH. *Nature*, **425**, 365.

——, and ——, 2005: Ocean model predictions of chemistry changes from carbon dioxide emissions to the atmosphere and ocean. *J. Geophys. Res.*, **110**, C09S04, doi:10.1029/2004JC002671 .

Callaghan, T. V., F. Bergholm, T. R. Christensen, C. Jonasson, U. Kokfelt, and M. Johansson, 2010: A new climate era in the sub-Arctic: Accelerating climate changes and multiple impacts. *Geophys. Res. Lett.*, **37**, L14705, doi:10.1029/2009GL042064.

——, C. E. Tweedie, and P. J. Webber, 2011: Multi-decadal changes in tundra environments and ecosystems: Synthesis of the International Polar Year Back to the Future Project (IPY-BTF). *Ambio*, **40,** 705–716.

Camargo, S. J., K. A. Emanuel, and A. H. Sobel, 2007: Use of a genesis potential index to diagnose ENSO effects on tropical cyclone genesis. *J. Climate*, **20**, 4819–4834.

Campbell, J. W., 1995: The lognormal distribution as a model for bio-optical variability in the sea. *J. Geophys. Res.*, **100** (C7), 13237–13254.

Cappelen, J., Ed., 2011: DMI monthly climate data collection 1768–2010, Denmark, The Faroe Islands and Greenland. DMI Tech. Rep. 11–05, 54 pp. [Available online at http://www.dmi.dk/dmi/tr11-05.pdf.]

——, B. V. Jørgensen, E. V. Laursen, L. S. Stannius, and R. S. Thomsen, Eds., 2000: The observed climate of Greenland, 1958–99 – with climatological standard normals, 1961–90. DMI Tech. Rep. 00–18, 152 pp. [Available online at http://www.dmi.dk/dmi/tr00-18.pdf.]

Cavalieri, D., C. Parkinson, P. Gloersen, and H. J. Zwally, 2008: Sea ice concentrations from Nimbus-7 SMMR and DMSP SSM/I passive microwave data. National Snow and Ice Data Center, Boulder, CO, digital media. [Available at http://nsidc.org/data/nsidc-0051.html.]

Cayan, D. R., 1992: Latent and sensible heat flux anomalies over the northern oceans, driving the sea surface temperature. *J. Phys. Oceanogr.*, **22**, 859–881.

CEOS, 2012: CEOS Working Group on Climate (WGC) Terms of Reference. Committee on Earth Observation

Satellites, 2 pp. [Available online at http://www.ceos.org/images/TERMS_OF_REFERENCE_WGC.pdf.]

Chan, F., J. A. Barth, J. Lubchenco, A. Kirincich, H. Weeks, W. T. Peterson, and B. A. Menge, 2008: Emergence of anoxia in the California current large marine ecosystem. *Science*, **319**, 920.

Chan, J. C. L., 2000: Tropical cyclone activity over the western North Pacific associated with El Niño and La Niña events. *J. Climate*, **13**, 2960–2972.

Cheng, X., L. Wu, F. Hu, and Q.-C. Zeng, 2012: Parameterizations of some important characteristics of turbulent fluctuations and gusty wind disturbances in the atmospheric boundary layer. *J. Geophys. Res.*, **117**, D08113, doi:10.1029/2011JD017191.

Chidichimo, M. P., T. Kanzow, S. A. Cunningham, W. E. Johns, and J. Marotzke, 2010: The contribution of eastern-boundary density variations to the Atlantic meridional overturning circulation at 26.5°N. *Ocean Science*, **6**, 475–490.

Chipman, D. W., T. Takahashi, S. Rubin, S. C. Sutherland, and M. H. Koshlyakov, 1997: Carbon dioxide, hydrographic, and chemical data obtained during the R/V *Akademik Ioffe* cruise in the South Pacific Ocean (WOCE Section 4sP, February-April, 1992). TN ORNL/CDIAC-100, NDP-063, 38 pp. [Available online at http://cdiac.ornl.gov/oceans/ndp_063/.]

Christiansen, H. H., and Coauthors, 2010: The thermal state of permafrost in the Nordic area during IPY 2007-2009. *Permafrost Periglacial Processes*, **21**, 156–181.

Christy, J. R., R. W. Spencer, and W. B Norris, 2011: The role of remote sensing in monitoring bulk tropospheric temperatures. *Int. J. Remote Sens.,* **32**, 1–15.

Church, J. A., and Coauthors, 2011: Revisiting the Earth's sea-level and energy budgets from 1961 to 2008. *Geophys. Res. Lett.*, **38**, L18601, doi:10.1029/2011GL048794.

Cogley, J. G., and Coauthors, 2011: Glossary of glacier mass balance and related terms. IHP-VII Tech. Documents in Hydrol. No. 86, IACS Contribution No. 2, 114 pp. [Available online at http://unesdoc.unesco.org/images/0019/001925/192525e.pdf.]

Cohen, J. L., J. C. Furtado, M. A. Barlow, V. A. Alexeev, and J. E. Cherry, 2012: Arctic warming, increasing snow cover and widespread boreal winter cooling. *Environ. Res. Lett.*, **7**, 014007, doi:10.1088/1748-9326/7/1/014007.

Comiso, J., 1999: Bootstrap sea ice concentrations from NIMBUS-7 SMMR and DMSP SSM/I. National Snow and Ice Data Center, Boulder, CO, digital media. [Available online at http://nsidc.org/data/nsidc-0079.html.]

——, 2010: Variability and trends of the global sea ice cover. *Sea Ice*, 2nd ed., D. N. Thomas and G. S. Dieckmann, Eds., Wiley-Blackwell, 205–246.

Compo, G. P., and Coauthors, 2011: The twentieth century reanalysis project. *Quart. J. Roy. Meteor. Soc.*, **137**, 1–28.

Cook, A. J., and D. G. Vaughan, 2010: Overview of areal changes of the ice shelves on the Antarctic Peninsula over the past 50 years. *The Cryosphere*, **4**, 77–98.

Cook Islands Government, 2006: *Kia vai teateamamao ("Be Prepared")*, produced by Cook Islands National Environment Service, DVD.

——, 2011: An interview with Mr. George "Birdman" Matearikі. *Signs of Nature for Atiu,* produced by Emergency Management Cook Islands and Cook Islands Television, DVD.

Cummins, P. F., G. S. E. Lagerloef, and G. T. Mitchum, 2005: A regional index of northeast Pacific variability based on satellite altimeter data. *J. Geophys. Res.*, **32**, L17607, doi:10.1029/2005GL023642.

Cunningham, S. A., and Coauthors, 2007: Temporal variability of the Atlantic Meridional Overturning Circulation at 26.5°N. *Science*, **312**, 935–938.

——, and Coauthors, 2010: The present and future system for measuring the Atlantic meridional overturning circulation and heat transport. *OceanObs'09: Sustained Ocean Observations and Information for Society* (Vol. 2), J. Hall et al., Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.21.

Curry, R. G., and M. S. McCartney, 2001: Ocean gyre circulation changes associated with the North Atlantic oscillation. *J. Phys. Oceanogr.*, **31**, 3374–3400.

——, R. Dickson, and I. Yashayaev, 2003: A change in the freshwater balance of the Atlantic Ocean over the past four decades. *Nature*, **426**, 826–829.

Dai, A., 2006: Recent climatology, variability, and trends in global surface humidity. *J. Climate*, **19**, 3589–3606.

——, J. Wang, P. W. Thorne, D. E. Parker, L. Haimberger, and X. L. Wang, 2011: A new approach to homogenize daily radiosonde humidity data. *J. Climate*, **24**, 965–991.

Daniel, J. S., and Coauthors, 2011: A focus on information and options for policymakers. *Scientific Assessment of Ozone Depletion: 2010*, Global Ozone Research and Monitoring Project Rep. 52, World Meteorological Organization, 5.1–5.56.

Dare, R. A., and J. L. McBride, 2011: Sea surface temperature response to tropical cyclones. *Mon. Wea. Rev.*, **139**, 3798–3808.

Davidson, E. A., 2009: The contribution of manure and fertilizer nitrogen to atmospheric nitrous oxide since 1860. *Nature Geosci.*, **2**, 659–662.

De Jeu, R. A. M., and M. Owe, 2003: Further validation of a new methodology for surface moisture and vegetation optical depth retrieval. *Int. J. Remote Sens.*, **24**, 4559–4578.

——, R. Parinussa, Y. Liu, W. Dorigo, W. Wagner, K. Scipal, H. Dolman, and Z. Su, 2009: Trends and dynamics in

long term satellite soil moisture data sets. *Proc. Earth Observation and Water Cycle Science Symposium,* EGU Topical Conf. Series on the hydrological cycle, Frascati, Italy, ESA/ESRIN.

——, W. W. Wagner, W. A Dorigo, and Y. Y. Liu, 2011: [Global climate] Soil moisture [in "State of the Climate 2010"]. *Bull. Amer. Meteor. Soc.,* **92** (6), S52–S53.

Dee, D. P., and Coauthors, 2011a: The ERA-Interim reanalysis: configuration and performance of the data assimilation system. *Quart. J. Roy. Meteor. Soc*., **137**, 553–597.

——, and Coauthors, 2011b: [Global climate] The use of reanalysis data for monitoring the state of the climate [in "State of the Climate 2010"]. *Bull. Amer. Meteor. Soc*., **92** (6), S34–S35.

Delwart, S., and L. Bourg, 2011: Radiometric calibration of MERIS. *Proc. SPIE*, **8176**, 817613, doi:10.1117/12.895090.

Delworth, T. L., and M. E. Mann, 2000: Observed and simulated multi-decadal variability in the Northern Hemisphere. *Climate Dyn.,* **16**, 661–676.

DeMaria, M., M. Mainelli, L. K. Shay, J. A. Knaff, and J. Kaplan, 2005: Further improvement to the Statistical Hurricane Intensity Prediction Scheme (SHIPS).*Wea. Forecasting*, **20**, 531–543.

Denman, K. L., and Coauthors, 2007: Couplings between changes in the climate system and biogeochemistry. *Climate Change 2007: The Physical Science Basis*, S. Solomon et al., Eds., Cambridge University Press, 499–587.

Dery, S., and R. Brown, 2007: Recent Northern Hemisphere snow cover extent trends and implications for the snow-albedo feedback. *J. Geophys. Res*., **34**, L22504, doi:10.1029/2007GL031474.

Deser, C., and M. L. Blackmon, 1993: Surface climate variations over the North Atlantic Ocean during winter: 1900–1989. *J. Climate*, **6**, 1743–1753.

Deser, M., A. Alexander, S. P. Xie, and A. S. Phillips, 2010: Sea surface temperature variability: Patterns and mechanisms. *Ann. Rev. Marine Sci*., **2**, 115–143.

Dhomse, S., M. Weber, J. P. Burrows, I. Wohltmann, and M. Rex, 2006: On the possible cause of recent increases in NH total ozone from a statistical analysis of satellite data from 1979 to 2003. *Atmos. Chem. Phys*., **6**, 1165–1180.

Di Girolamo, L., A. Menzies, G. Zhao, K. Mueller, C. Moroney, and D. J. Diner, 2010: Multi-angle imaging spectroradiometer level 3 cloud fraction by altitude algorithm theoretical basis document. JPL Publ. D-62358, 23 pp.

Dijkstra, H. A., L. te Raa, M. Schmeits, and J. Gerrits, 2006: On the physics of the Atlantic multidecadal oscillation. *Ocean Dyn*., **56,** 36–50.

Ding, Q., E. Steig, D. Battisti, and M. Kuttel, 2011: Winter warming in West Antarctica caused by central tropical Pacific warming. *Nature Geosci*., **4**, 398–403, doi:10.1038/NGEO1129.

Dlugokencky, E. J., and Coauthors, 2009: Observational constraints on recent increases in the atmospheric CH_4 burden. *Geophys. Res. Lett*., **36**, L18803, doi:10.1029/2009GL039780.

Dohan, K., and N. Maximenko, 2010: Monitoring ocean currents with satellite sensors. *Oceanography*, **23**, 94–103.

Domack, E., and Coauthors, 2005: Stability of the Larsen B ice shelf on the Antarctic Peninsula during the Holocene epoch. *Nature*, **436**, 681–685.

Doney, S., B. Tilbrook, S. Roy, N. Metzl, C. Le Quéré, M. Hood, R. A. Feely, and D. C. E. Bakker, 2009: Surface ocean CO_2 variability and vulnerability. *Deep-Sea Res. II*, **56**, 504–511.

Dong, S., S. L. Garzoli, M. O. Baringer, C. S. Meinen, and G. J. Goni, 2009: The Atlantic Meridional Overturning Circulation and its northward heat transport in the South Atlantic. *Geophys. Res. Lett*., **36**, L20606, doi:10.1029/2009GL039356.

Donohue, R. J., M. L. Roderick, and T. R. McVicar, 2007: On the importance of including vegetation dynamics in Budyko's hydrological model. *Hydrol. Earth Syst. Sci*., **11**, 983–995.

Dorigo, W. A., K. Scipal, R. M. Parinussa, Y. Y. Liu, W. Wagner, R. A. M. de Jeu, and V. Naeimi, 2010: Error characterisation of global active and passive microwave soil moisture datasets. *Hydrol. Earth Syst. Sci.,* **14**, 2605–2616.

Duguay, C. R., T. D. Prowse, B. R. Bonsal, R. D. Brown, M. P. Lacroix, and P. Ménard, 2006: Recent trends in Canadian lake ice cover. *Hydrolog. Processes*, **20**, 781–801.

Durack, P. J., and S. E. Wijffels, 2010: Fifty-year trends in global ocean salinities and their relationship to broad-scale warming. *J. Climate*, **23**, 4342–4362.

Durre, I., R. S. Vose, and D. B. Wuertz, 2006: Overview of the integrated global radiosonde archive. *J. Climate*, **19**, 53–68.

Dutton, E. G., and B. A. Bodhaine, 2001: Solar irradiance anomalies caused by clear-sky transmission variations above Mauna Loa 1957-1999. *J. Climate*, **14**, 3255–3262.

EDGAR, 2009: Emission Database for Global Atmospheric Research (EDGAR), release version 4.0. European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). [Available online at http://edgar.jrc.ec.europa.eu.]

Elkins, J. W., and G. S. Dutton, 2011: [Global Climate] Atmospheric composition [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc*., **92** (6), S60 –S61.

Ellis, H. T., and R. E. Pueschel, 1971: Solar radiation: Absence of trends at Mauna Loa. *Science,* **172**, 845–846.

Elmendorf, S. C., and Coauthors, 2011: Global assessment of experimental climate warming on tundra vegetation: heterogeneity over space and time. *Ecol. Lett.,* **15**, 164–175.

Elverhoi, H., 2012: Glacier length change table 1997–2011. Norwegian Water Resources and Energy Directorate. [Available online at http://www.nve.no/Global/Vann%20og%20vassdrag/Hydrologi/Bre/Nedlastinger/Length_Change_Table_1997-2011.pdf.]

Emanuel, K. A., 1988: The maximum intensity of hurricanes. *J. Atmos. Sci.*, **45**, 1143–1155.

——, 1995: Sensitivity of tropical cyclones to surface exchange coefficients and a revised steady-state model incorporating eye dynamics. *J. Atmos. Sci.*, **52**, 3969–3976.

——, 2001: The contribution of tropical cyclones to the oceans' meridional heat transport. *J. Geophys. Res.*, **106** (D14), 14771–14781.

Enfield, D. B., and D. A. Mayer, 1997: Tropical Atlantic sea surface temperature variability and its relation to El Niño-Southern Oscillation. *J. Geophys. Res.*, **102** (C1), 929–945.

——, and A. M. Mestas-Nuñez, 1999: Multi-scale variabilities in global sea surface temperatures and their relationships with tropospheric climate patterns. *J. Climate*, **12**, 2719–2733.

——, ——, and P. J. Trimble, 2001: The Atlantic Multidecadal Oscillation and its relationship to rainfall and river flows in the continental US. *Geophys. Res. Lett.*, **28**, 2077–2080.

England, M. H., and F. Huang, 2005: On the interannual variability of the Indonesian throughflow and its linkage with ENSO. *J. Climate*, **18**, 1435–1444.

Eplee, R. E., Jr., G. Meister, F. S. Patt, B. A. Franz, and C. R. McClain, 2011: Uncertainty assessment of the SeaWiFS on-orbit calibration. *Proc. SPIE*, **8153**, 815310, doi:10.1117/12.892340.

Epstein, H. E., D. A. Walker, M. K. Raynolds, U. S. Bhatt, C. J. Tucker, and J. E. Pinzon, 2012: Dynamics of aboveground phytomass of the circumpolar arctic tundra during the past three decades. *Environ. Res. Lett.,* **7**, 015506, doi:10.1088/1748-9326/7/1/015506.

Fabry, V. J., B. A. Seibel, R. A. Feely, and J. C. Orr, 2008: Impacts of ocean acidification on marine fauna and ecosystem processes. *ICES J. Marine Sci.*, **65**, 414–432.

——, J. B. McClintock, J. T. Mathis, and J. M. Grebmeier, 2009: Ocean acidification at high latitudes: The bellwether. *Oceanography*, **22**, 160–171.

Fairall, C. W., E. F. Bradley, J. E. Hare, A. A. Grachev, and J. B. Edson, 2003: Bulk parameterization on air–sea fluxes: Updates and verification for the COARE algorithm. *J. Climate*, **16**, 571–591.

Falkowski, P. G., 1984: Physiological responses of phytoplankton to natural light regimes. *J. Plankton Res.*, **6**, 295–307.

Famiglietti, J. S., and Coauthors, 2011: Satellites measure recent rates of groundwater depletion in California's Central Valley. *Geophys. Res. Lett.*, **38**, L03403, doi:10.1029/2010GL046442.

FAO, 2006: Global Forest Resources Assessment 2005. FAO Forestry Paper 147, Food and Agriculture Organization of the United Nations, Rome, 320 pp.

——, 2010: Global Forest Resources Assessment 2010. FAO Forestry Paper 163, Food and Agriculture Organization of the United Nations, Rome, 340 pp.

Feely, R. A., C. L. Sabine, J. M. Hernandez-Ayon, D. Ianson, and B. Hales, 2008: Evidence for upwelling of corrosive "acidified" water onto the continental shelf. *Science*, **320**, 1490–1492.

Fekete, B. M., and A. M. MacDonald, 2011: [Global climate] River discharge [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S46–S48.

——, R. B. Lammers, A. M. MacDonald, L. C. Bowling, and R. Lawford, 2010: [Global climate] River discharge [in "State of the Climate in 2009"]. *Bull. Amer. Meteor. Soc.,* **91** (7), S35.

Fioletov, V. E., and T. G. Shepherd, 2003: Seasonal persistence of midlatitude total ozone anomalies. *Geophys. Res. Lett.*, **30**, 1417, doi:10.1029/2002GL016739.

——, G. E. Bodeker, A. J. Miller, R. D. McPeters, and R. Stolarski, 2002: Global and zonal total ozone variations estimated from ground-based and satellite measurements: 1964–2000. *J. Geophys. Res.*, **107**, 4647, doi:10.1029/2001JD001350.

——, and Coauthors, 2008: The performance of the ground-based total ozone network assessed using satellite data. *J. Geophys. Res.*, **113**, D14313, doi:10.1029/2008JD009809.

Fischer, A., 2012, Gletscherbericht 2010/2011. Sammelbericht über die Gletschermessungen des Österreichischen Alpenvereins im Jahre 2011. Letzter Bericht: Bergauf 02/2011, Jg. 66 (136).

Fogt, R. L., and D. H. Bromwich, 2006: Decadal variability of the ENSO teleconnection to the high latitude South Pacific governed by coupling with the southern annular mode. *J. Climate*, **19**, 979–997.

——, ——, and K. M. Hines, 2011: Understanding the SAM influence on the South Pacific ENSO teleconnection. *Climate Dyn.*, **36**, 1555–1576**.**

Folland, C. K., J. Knight, H. W. Linderholm, D. Fereday, S. Ineson, and J. W. Hurrell, 2009: The summer North Atlantic oscillation: Past, present and future. *J. Climate,* **22**, 1082–1103.

Font, J., G. Lagerloef, D. Le Vine, A. Camps, and O. Zanife, 2004: The determination of surface salinity with the European SMOS space mission. *IEEE Trans. Geosci. Remote Sens.*, **42**, 2196–2205.

Forster, P., and Coauthors, 2007: Changes in atmospheric constituents and in radiative forcing. *Climate Change 2007: The Physical Science Basis,* S. Solomon et al., Eds., Cambridge University Press, 129–234.

Franz, B. A., S. W. Bailey, P. J. Werdell, and C. R. McClain, 2007: Sensor-independent approach to vicarious calibration of satellite ocean color radiometry. *Appl. Optics*, **46**, 5068–5082.

——, E. J. Kwiatkowska, G. Meister, and C. McClain, 2008: Moderate resolution imaging spectroradiometer on Terra: Limitations for ocean color applications. *J. Appl. Remote Sens.*, **2**, 023525, doi:10.1117/1.2957964.

Free, M., 2011: [Global climate] Lower stratospheric temperatures [in "State of the Climate 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S38–S39.

——, D. J. Seidel, J. K. Angell, J. R. Lanzante, I. Durre, and T. C. Peterson, 2005: Radiosonde Atmospheric Temperature Products for Assessing Climate (RATPAC): A new dataset of large-area anomaly time series. *J. Geophys. Res.*, **110**, D22101, doi:10.1029/2005JD006169.

Frey, K. E., K. R. Arrigo, and R. R. Gradinger, 2011: Arctic Ocean primary productivity. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 69–71. [Available online at http://www.arctic.noaa.gov/reportcard.]

Friedlingstein, P., and Coauthors, 2010: Update on CO_2 emissions. *Nature Geosci.*, **3**, 811–812.

Frolking, S., J. Talbot, M. C. Jones, C. C. Treat, J. B. Kauffman, E.-S. Tuittila, and N. Roulet, 2011: Peatlands in the Earth's 21st century climate system. *Environ. Rev.*, **19**, 371–396.

Ganachaud, A., and C. Wunsch, 2000: The oceanic meridional overturning circulation, mixing, bottom water formation, and heat transport. *Nature*, **408**, 453–457.

Gardner, A. S., and Coauthors, 2011: Sharply increased mass loss from glaciers and ice caps in the Canadian Arctic Archipelago. *Nature,* **473**, 357–360.

Garlich-Miller, J. L., J. G. MacCracken, J. Snyder, R. Meehan, M. Myers, J. M. Wilder, E. Lance, and A. Matz, Eds., 2011: Status review of the Pacific walrus (*Odobenus rosmarus divergens*). U.S. Fish and Wildlife Service, 155 pp. [Available online at http://alaska.fws.gov/fisheries/mmm/walrus/pdf/review_2011.pdf.]

Garzoli, S. L., and M. O. Baringer, 2007: Meridional heat transport using expandable bathythermographs. Part II: South Atlantic transport. *Deep-Sea Res. I*, **54**, 1402–1420.

—— S. Speich, A. Piola, and E. Campos, 2010: South Atlantic Meridional Overturning Circulation (SAMOC) Third workshop. *CLIVAR Exchanges*, **54** (4), 28–29.

GCOS, 2003: The second report on the adequacy of the Global Observing Systems for Climate in support of the UNFCCC. GCOS-82, WMO/TD No. 1143, 74 pp. [Available online at http://www.wmo.int/pages/prog/gcos/Publications/gcos-82_2AR.pdf.]

——, 2011: Systematic observation requirements for satellite-based data products for climate. GCOS No.154, 127 pp. [Available online at http://www.wmo.int/pages/prog/gcos/Publications/gcos-154.pdf.]

Giglio, L., J. T. Randerson, G. R. van der Werf, P. S. Kasibhatla, G. J. Collatz, D. C. Morton, and R. S. DeFries, 2010: Assessing variability and long-term trends in burned area by merging multiple satellite fire products. *Biogeosciences*, **7**, 1171–1186.

Gobron, N., A. S. Belward, B. Pinty, and W. Knorr, 2010: Monitoring biosphere vegetation 1998-2009. *Geophys. Res. Lett.*, **37**, L15402, doi:10.1029/2010GL043870.

Goldenberg, S. B., and L. J. Shapiro, 1996: Physical mechanisms for the association of El Niño and West African rainfall with Atlantic major hurricane activity. *J. Climate*, **9**, 1169–1187.

——, C. W. Landsea, A. M. Mestas-Nuñez, and W. M. Gray, 2001: The recent increase in Atlantic hurricane activity: Causes and implications. *Science*, **293**, 474–479.

Goni, G. J., and I. Wainer, 2001: Investigation of the Brazil Current front dynamics from altimeter data. *J. Geophys. Res.*, **36** (C12), 31117–31128.

——, and J. A. Trinanes, 2003: Ocean thermal structure monitoring could aid in the intensity forecast of tropical cyclones. *Eos, Trans. Amer. Geophys. Union*, **84**, 573–578.

——, and Coauthors, 2009: Applications of satellite-derived ocean measurements to tropical cyclone intensity forecasting. *Oceanography*, **22**, 176–183.

——, F. Bringas, and P. N. Di Nezio, 2011: Observed low frequency variability of the Brazil current front. *J. Geophys. Res.*, **116**, C10037, doi:10.1029/2011JC007198.

Gordon, A., and C. F. Giulivi, 2008: Sea surface salinity trends over 50 years within the subtropical North Atlantic. *Oceanography*, **21**, 20–29.

Gottschalck, J. G., and G. D. Bell, 2009: [Tropics] The Madden-Julian oscillation [in "State of the Climate in 2008"]. *Bull. Amer. Meteor. Soc.*, **89** (7), S78–S79.

Grainger, A., 2008: Difficulties in tracking the long-term global trend in tropical forest area. *Proc. Natl. Acad. Sci. USA,* **105**, 818–823.

Grantham, B. A., F. Chan, K. J. Nielsen, D. S. Fox, J. A. Barth, A. Huyer, J. Lubchenco, and B. A. Menge, 2004: Upwelling-driven nearshore hypoxia signals ecosystem and oceanographic changes in the northeast Pacific. *Nature*, **429**, 749–754.

Grebmeier, J. M., S. E. Moore, J. E. Overland, K. E. Frey, and R. R. Gradinger, 2010: Biological response to recent Pacific Arctic sea ice retreats. *Eos, Trans. Amer. Geophys. Union*, **91**, 161–162.

Gruber, N., and Coauthors, 2009: Ocean sources, sinks, and transport of atmospheric CO_2. *Global Biogeochem. Cycles*, **23**, GB1005, doi:10.1029/2008GB003349.

Guglielmin, M., and N. Cannone, 2011: A permafrost warming in a cooling Antarctica? *Climatic Change*, **111**, 177–195.

——, M. R. Balks, L. S. Adlam, and F. Baio, 2011: Permafrost thermal regime from two 30-m deep boreholes in Southern Victoria Land, Antarctica. *Permafrost Periglacial Processes*, **22**, 129–139.

Guinotte, J. M., and V. J. Fabry, 2008: Ocean acidification and its potential effects on marine ecosystems. *Year in Ecology and Conservation Biology 2008*, R. S. Ostfeld and W. H. Schlesinger, Eds., *Ann. New York Acad. Sci.*, Vol. 1134, 320–342.

Gumbricht, T., P. Wolski, and T. C. McCarthy, 2004: Forecasting the spatial extent of the annual flood in the Okavango Delta, Botswana. *J. Hydrol.*, **190**, 178–191.

Haeberli, W., J. Cihlar, and R. Barry, 2000: Glacier monitoring within the Global Climate Observing System. *Ann. Glaciol.,* **31,** 241–246.

——, and Coauthors, 2010: Mountain permafrost: Development and challenges of a young research field. *J. Glaciol.*, **56**, 1043–1058.

Hahn, C. J., and S. G. Warren, 2007: A gridded climatology of clouds over land (1971–1996) and ocean (1954–1997) from surface observations worldwide. ORNL/CDIAC-153, NDP-026E, 75 pp. [Available online at http://cdiac.ornl.gov/epubs/ndp/ndp026e/ndp026e.html.]

Häkkinen, S., P. B. Rhines, and D. L. Worthen, 2011: Warm and saline events embedded in the meridional circulation of the northern North Atlantic. *J. Geophys. Res.*, **116**, C03006, doi:10.1029/2010JC006275.

Hales, B., L. Karp-Boss, A. Perlin, and P. A. Wheeler, 2006: Oxygen production and carbon sequestration in an upwelling coastal margin. *Global Biogeochem. Cycles*, **20**, GB3001, doi:10.1029/2005GB002517.

Hansen, J., R. Ruedy, M. Sato, and K. Lo, 2010: Global surface temperature change. *Rev. Geophys.*, **48**, RG4004, doi:10.1029/2010RG000345.

Harnisch, J., and A. Eisenhauer, 1998: Natural CF_4 and SF_6 on Earth. *Geophys. Res. Lett.*, **25**, 2401–2404.

——, R. Borchers, P. Fabian, H. W. Gaggeler, and U. Schotterer, 1996a: Effect of natural tetrafluoromethane. *Nature*, **384**, 32.

——, ——, ——, and M. Maiss, 1996b: Tropospheric trends for CF_4 and C_2F_6 since 1982 derived from SF_6 dated stratospheric air. *Geophys. Res. Lett.*, **23**, 1099–1102.

——, M. Frische, R. Borchers, A. Eisenhauer, and A. Jordan, 2000: Natural fluorinated organics in fluorite and rocks. *Geophys. Res. Lett.*, **27**, 1883–1886.

Hart, R. E., R. N. Maue, and M. C. Watson, 2007: Estimating local memory of tropical cyclones through MPI anomaly evolution. *Mon. Wea. Rev.*, **135**, 3990–4005.

Hauri, C., N. Gruber, G.-K. Plattner, S. Alin, R. A. Feely, B. Hales, and P. A. Wheeler, 2009: Ocean acidification in the California current system. *Oceanography*, **22**, 60–71.

Heide-Jørgensen, M. P., K.L. Laidre, L. T. Quakenbush, and J. Citta, 2012:, Northwest Passage opens for bowhead whales. *Biol. Lett.*, **8**, 270–273.

Heidinger, A. K., and M. J. Pavolonis, 2009: Gazing at cirrus clouds for 25 years through a split window, part 1: Methodology. *J. Appl. Meteor. Climatol.*, **48**, 1100–1116.

Heimbach, P., C. Wunsch, R. M. Ponte, G. Forget, C. Hill, and J. Utke, 2011: Timescales and regions of the sensitivity of the Atlantic meridional volume mean heat transport: Toward observing system design. *Deep-Sea Res. II*, **58**, 1858–1879.

Held, I. M., and B. J. Soden, 2006: Robust response of the hydrological cycle to global warming. *J. Climate*, **19**, 5686–5699.

Helfrich, S. R., D. McNamara, B.H. Ramsay, T. Baldwin, and T. Kasheta, 2007: Enhancements to, and forthcoming developments in the Interactive Multisensor Snow and Ice Mapping System (IMS). *Hydrol. Process.*, **21**, 1576–1586.

Helm, K. P., N. L. Bindoff, and J. A. Church, 2010: Changes in the global hydrological-cycle inferred from ocean salinity. *Geophys. Res. Lett.*, **37**, L18701, doi:10.1029/2010GL044222.

Hendon, H., C. Zhang, and J. Glick, 1999: Interannual variation of the Madden-Julian Oscillation during Austral Summer. *J. Climate*, **12**, 2538–2550.

Henry, O., P. Prandi, W. Llovel, A. Cazenave, S. Jevrejeva, D. Stammer, B. Meyssignac, and N. Koldunov, 2012: Tidal gauge-based sea level variations since 1950 along the Norwegian and Russian coasts of the Arctic Ocean. *J. Geophys. Res.*, in press, doi:10.1029/2011JC007706.

Hilburn, K. A., and F. J. Wentz, 2008: Intercalibrated passive microwave rain products from the unified microwave ocean retrieval algorithm (UMORA). *J. Appl. Meteor. Climatol.*, **47**, 778–794.

Ho, S.-P., Y.-H. Kuo,W. Schreiner, X. Zhou, 2010: [Global climate] Using SI-traceable global positioning system radio occultation measurements for climate monitoring [in "State of the Climate in 2009]. *Bull. Amer. Meteor. Sci.*, **91** (7), S36–S37.

Hofmann, D. J., and S. A. Montzka, 2009: Recovery of the ozone layer. *Eos, Trans. Amer. Geophys. Union*, **90**, 1–2.

——, J. H. Butler, E. J. Dlugokencky, J. W. Elkins, K. Masarie, S. A. Montzka, and P. Tans, 2006: The role of carbon dioxide in climate forcing from 1979-2004: Introduction of the Annual Greenhouse Gas Index. *Tellus,* **58B**, 614–619. [Updated annually at: http://www.esrl.noaa.gov/gmd/aggi.]

Hosoda, S., T. Suga, N. Shikama, and K. Mizuno, 2009: Global surface layer salinity change detected by Argo and its implication for hydrological cycle intensification. *J. Oceanogr.*, **65**, 579–586.

Hostetler, S. W., 1995: Hydrological and thermal response of lakes to climate: description and modelling. *Physics and Chemistry of Lakes*, A. Lerman et al., Eds., Springer-Verlag, 63–82.

Hu, Z.-Z., A. Kumar, B. Huang, Y. Xue, W. Wang, and B. Jha, 2011: Persistent atmospheric and oceanic anomalies in the North Atlantic from summer 2009 to summer 2010. *J. Climate*, **24**, 5812–5830.

Huffman, G. J., and Coauthors, 2007: The TRMM multi-satellite precipitation analysis: Quasi-global, multi-year, combined-sensor precipitation estimates at fine scale. *J. Hydrometeor.*, **8**, 38–55.

Hughes, N. A., 1984: Global cloud climatologies: A historical review. *J. Clim. Appl. Meteor.*, **23**, 724–751.

Hurrell, J. W., 1995: Decadal trends in the North Atlantic Oscillation: Regional temperatures and precipitation. *Science*, **269**, 676–679.

——, Y. Kushnir, G. Ottersen, and M. Visbeck, 2003: An overview of the North Atlantic oscillation. *The North Atlantic Oscillation: Climate Significance and Impact. Geophys. Monogr.,* Vol. 134, Amer. Geophys. Union, 1–37.

Hurst, D. F., S. J. Oltmans, H. Vömel, K. H. Rosenlof, S. M. Davis, E. A. Ray, E. G. Hall, and A. F. Jordan, 2011: Stratospheric water vapor trends over Boulder, Colorado: Analysis of the 30 year Boulder record. *J. Geophys. Res.*, **116**, D02306, doi:10.1029/2010JD015065.

IAI, 2011: Results of the 2010 anode effect survey. International Aluminium Institute, 52 pp. [Available online at http://www.world-aluminium.org/cache/fl0000441.pdf.]

IICWG, 2011: News release: National ice services caution that "Open" does not mean ice-free. International Ice Charting Working Group, 21 October 2011. [Available online at http://nsidc.org/noaa/iicwg/docs/IICWG_2011/IICWG-XII_News_Release.pdf.]

Ingleby, B., and M. Huddleston, 2007: Quality control of ocean temperature and salinity profiles - historical and real-time data. *J. Marine Sys.*, **65**, 158–175.

INPE, cited 2012: Prodes project reporting. [Available online at http://www.obt.inpe.br/prodes/prodes_1988_2011.htm.]

Isaksen, K., J. L. Sollid, P. Holmlund, and C. Harris, 2007: Recent warming of mountain permafrost in Svalbard and Scandinavia. *J. Geophys. Res.*, **112**, F02S04, doi:10.1029/2006JF000522.

——, and Coauthors, 2011: Degrading mountain permafrost in southern Norway - spatial and temporal variability of mean ground temperatures 1999–2009. *Permafrost Periglacial Processes*, **22**, 361–377.

Ishihara, K., 2006: Calculation of global surface temperature anomalies with COBE-SST. *Sokkō-jihō [Weather Service Bulletin]*, **73** Special Issue, S19–S25, (in Japanese).

Ives, M., cited 2011: Okavango Delta flood update. [Available online at http://www.eyesonafrica.net/updates/flood-update.htm]

Jackson, J. M., E. C. Carmack, F. A. McLaughlin, S. E. Allen, and R. G. Ingram, 2010: Identification, characterization, and change of the near-surface temperature maximum in the Canada Basin, 1993-2008. *J. Geophys. Res.*, **115**, C05021, doi:10.1029/2009JC005265.

——, S. E. Allen, F. A. McLaughlin, R. A. Woodgate, and E. C. Carmack, 2011: Changes in near-surface waters in the Canada Basin, Arctic Ocean, from 1993 to 2009: a basin in transition. *J. Geophys. Res.*, **116**, C10008, doi:10.1029/2011JC007069.

Jacob, T., J. Wahr, W. T. Pfeffer, and S. Swenson, 2012: Recent contributions of glaciers and ice caps to sea level rise. *Nature*, **482**, 514–518.

Jacobs, S. S., A. Jenkins, C. F. Giulivi and P. Dutrieux, 2011: Strong ocean circulation and increased melting beneath Pine Island Glacier ice shelf. *Nature Geosci.*, **4**, 519–523.

Jacobson, M. Z., and Y. J. Kaufman, 2006: Wind reduction by aerosol particles. *Geophys. Res. Lett.*, **33**, L24814, doi:10.1029/22006GL027838.

Janowiak, J. E., and P. Xie, 1999: CAMS–OPI: A global satellite-rain gauge merged product for real-time precipitation monitoring applications. *J. Climate*, **12**, 3335–3342.

Jáuregui, E., 2003: Climatology of landfalling hurricanes and tropical storms in Mexico. *Atmósfera*, **16**, 193–204.

Johnson, D. R., T. P. Boyer, H. E. Garcia, R. A. Locarnini, O. K. Baranova, and M. M. Zweng, 2009: *World Ocean Database 2009 documentation*. NODC Internal Rep. 20, 175 pp.

Johnson, F., and A. Sharma, 2010: A comparison of Australian open water body evaporation trends for current and future climates estimated from Class A evaporation pans and general circulation models. *J. Hydrometeorol.*, **11**, 105–121.

Johnson, G. C., and N. Gruber, 2007: Decadal water mass variations along 20°W in the northeastern Atlantic Ocean. *Prog. Oceanogr.*, **73**, 277–295.

——, and S. E. Wijffels, 2011: Ocean density change contributions to sea level rise. *Oceanography*, **24**, 112–121.

Jones, A., and Coauthors, 2009: Evolution of stratospheric ozone and water vapour time series studied with satellite measurements. *Atmos. Chem. Phys.*, **9**, 6055–6075.

Jones, P. D., D. H. Lister, T. J. Osborn, C. Harpham, M. Salmon, and C. P. Morice, 2012: Hemispheric and large-scale land surface air temperature variations: An extensive revision and an update to 2010. *J. Geophys. Res.*, **117**, D05127, doi:10.1029/2011JD017139.

Josey, S. A., E. C. Kent, and P. K. Taylor, 1999: New insights into the ocean heat budget closure problem from analysis of the SOC air–sea flux climatology. *J. Climate*, **12**, 2856–2880.

Jung, M., and Coauthors, 2010: Recent decline in the global land evapotranspiration trend due to limited moisture supply. *Nature*, **467**, 951–954.

Kahru, M., V. Brotas, M. Manzano-Sarabia, and B. G. Mitchell, 2010: Are phytoplankton blooms occurring earlier in the Arctic? *Global Change Biol.*, **17**, 1733–1739, doi: 10.1111/j.1365-2486.2010.02312.x.

Kaiser, J. W., A. Heil, and G. R. van der Werf, 2011: [Global climate] Biomass burning [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S72–S74.

——, and Coauthors, 2012: Biomass burning emissions estimated with a global fire assimilation system based on observed fire radiative power. *Biogeosciences*, **9**, 527–554.

Kalnay, E., and Coauthors, 1996: The NCEP/NCAR 40-year reanalysis project. *Bull. Amer. Meteor. Soc.*, **77**, 437–471.

Kanzow, T., U. Send, and M. McCartney, 2008: On the variability of the deep meridional transports in the tropical North Atlantic. *Deep-Sea Res. I*, **55**, 1601–1623.

——, and Coauthors, 2010: Seasonal variability of the Atlantic meridional overturning circulation at 26.5°N. *J. Climate*, **23**, 5678–5698.

Kaplan, A., 2011: [Global climate] Patterns and indices of climate variability [in: "State of the Climate 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S20–S25.

Kaplan, J., M. DeMaria, and J. A. Knaff, 2010: A revised tropical cyclone rapid intensification index for the Atlantic and east Pacific basins. *Wea. Forecasting*, **25**, 220–241.

Kayano, M., and V. Kousky, 1999: Intraseasonal (30-60 day) variability in the global tropics: Principal modes and their evolution. *Tellus*, **51A**, 373–386.

Kennett, J. P., K. G. Cannariato, I. L. Hendy, and R. J. Behl, 2000: Carbon isotopic evidence for methane hydrate instability during quaternary interstadials. *Science*, **288**, 128–133, doi:10.1126/science.288.5463.128.

Kent, E. C., S. D. Woodruff, and D. I. Berry, 2007: Metadata from WMO Publication No. 47 and an assessment of voluntary observing ship observation heights in ICOADS. *J. Atmos. Oceanic Tech.*, **24**, 214–234.

Key, R. M., and Coauthors, 2004: A global ocean carbon climatology: Results from GLODAP. *Global Biogeochem. Cycles*, **18**, GB4031, doi:10.1029/2004GB002247.

Khatiwala, S., F. Primeau, and T. Hall, 2009: Reconstruction of the history of anthropogenic CO_2 concentrations in the ocean. *Nature*, **462**, 346–349.

Kiladis, G. N., K. H. Straub, and P. T. Haertel, 2005: Zonal and vertical structure of the Madden–Julian oscillation. *J. Atmos. Sci.*, **62**, 2790–2809.

King, D., W. Tawhai, A. Skipper, and W. Iti, 2005: Anticipating local weather and climate outcomes using Māori environmental indicators. NIWA AKL2005-129, 15 pp. [Available online at http://www.niwa.co.nz/sites/default/files/niwa_report_akl2005-129.pdf.]

——, J. Goff, and A. Skipper, 2007: Maori environmental knowledge and natural hazards in Aotearoa - New Zealand. *J. Roy. Soc. New Zealand,* **37**, 59–73.

Kistler, R., and Coauthors, 2001: The NCEP/NCAR 50-year reanalysis: Monthly means CD-ROM and documentation. *Bull. Amer. Meteor. Soc.*, **82**, 247–267.

Klein, A. G., and J. Stroeve, 2002: Development and validation of a snow albedo algorithm for the MODIS instrument. *Ann. Glaciol.*, **34**, 45–52.

Klein, S. A., B. J. Soden, and N.-C. Lau, 1999: Remote sea surface temperature variations during ENSO: Evidence for a tropical atmospheric bridge. *J. Climate*, **12**, 917–932.

Knapp, K. R., M. C. Kruk, D. H. Levinson, H. J. Diamond, and C. J. Neumann, 2010: The International Best Track Archive for Climate Stewardship (IBTrACS). *Bull. Amer. Meteor. Soc.*, **91**, 363–376.

Knight, J. R., R. J. Allan, C. K. Folland, M. Vellinga, and M. E. Mann, 2005: A signature of persistent natural thermohaline circulation cycles in observed climate. *Geophys. Res. Lett.,* **32**, L20708, doi:10.1029/2005GL024233.

Knutti, R., and L. Tomassini, 2008: Constraints on the transient climate response from observed global temperature and ocean heat uptake. *Geophys. Res. Lett.*, **35**, L09701, doi:10.1029/2007GL032904.

Kopp, G., and J. L. Lean, 2011: A new, lower value of total solar irradiance: Evidence and climate significance. *Geophys. Res. Lett.*, **38**, L01706, doi:10.1029/2010GL045777.

——, G. Lawrence, and G. Rottman, 2005: The Total Irradiance Monitor (TIM): Science results. *Solar Physics*, **230**, 129–139.

Kort, E. A., and Coauthors, 2011: Tropospheric distribution and variability of N_2O: Evidence for strong tropical emissions. *Geophys. Res. Lett.*, **38**, L15806, doi:10.1029/2011GL047612.

Kossin, J. P., and D. J. Vimont, 2007: A more general framework for understanding Atlantic hurricane variability and trends. *Bull. Amer. Meteor. Soc.*, **88**, 1767–1781.

——, S. J. Camargo, and M. Sitkowski, 2010: Climate modulation of North Atlantic hurricane tracks. *J. Climate*, **23**, 3057–3076.

Kouraev, A. V., S. V. Semovski, M. N. Shimaraev, N. M. Mognard, B. Légresy, and F. Remy, 2007: Observations of Lake Baikal ice from satellite altimetry and radiometry. *Remote Sens. Environ*, **108**, 240–253.

Kousky, V., and M. Kayano, 1994: Principal modes of outgoing longwave radiation and 250-mb circulation for the South American sector. *J. Climate*, **7**, 1131–1143.

Kratz, D. P., S. K. Gupta, A. C. Wilber, and V. E. Sothcott, 2010: Validation of the CERES edition 2B surface-only flux algorithms. *J. Appl. Meteor. Climatol.*, **49**, 164–180.

Kwiatkowska, E. J., B. A. Franz, G. Meister, C. R. McClain, and X. Xiong, 2008: Cross-calibration of ocean color

bands from Moderate Resolution Imaging Spectroradiometer on Terra platform. *Appl. Optics*, **47**, 6796–6810.

Lagerloef, G., and J. Font, 2010: SMOS and Aquarius/SAC-D missions: The era of space borne salinity measurements is about to begin. *Oceanography from Space*, V. Barale et al., Eds., Springer.

——, and Coauthors, 2008: The Aquarius/SAC-D mission – Designed to meet the salinity remote sensing challenge. *Oceanography*, **21**, 68–81.

——, R. Schmitt, J. Schanze, and H. Kao, 2010: The ocean and the global water cycle. *Oceanography*, **23**, 82–93.

Lamarque, J. F., and S. Solomon, 2010: Impact of changes in climate and halocarbons on recent lower stratospheric ozone and temperature trends. *J. Climate*, **23**, 2599–2611.

Lander, M. A., 1994: An exploratory analysis of the relationship between tropical storm formation in the western North Pacific and ENSO. *Mon. Wea. Rev.*, **122**, 636–651.

Landsea, C. W., and W. M. Gray, 1992: The strong association between Western Sahel monsoon rainfall and intense Atlantic hurricanes. *J. Climate*, **5**, 435–453.

——, G. D. Bell, W. M. Gray, and S. B. Goldenberg, 1998: The extremely active 1995 Atlantic hurricane season: Environmental conditions and verification of seasonal forecasts. *Mon. Wea. Rev.*, **126**, 1174–1193.

Latifovic, R., and D. Pouliot, 2007: Analysis of climate change impacts on lake ice phenology in Canada using the historical satellite data record. *Remote Sens. Environ.*, **106**, 492–508.

Lawrence, D. M., A. G. Slater, R. A. Tomas, M. M. Holland, and C. Deser, 2008: Accelerated Arctic land warming and permafrost degradation during rapid sea ice loss. *Geophys. Res. Lett.,* **35,** L11506, doi:10.1029/2008GL033985.

Le Quéré, C., and Coauthors, 2009: Trends in the sources and sinks of carbon dioxide. *Nature Geosci*., **2**, 831–836.

Le Vine, D. M., G. S. E. Lagerloef, R. Colomb, S. Yueh, and F. Pellerano, 2007: Aquarius: An instrument to monitor sea surface salinity from space. *IEEE Trans. Geosci. Remote Sens*., **45**, 2040–2050.

L'Ecuyer, T. S., N. B. Wood, T. Haladay, G. L. Stephens, and P. W. Stackhouse, 2008: Impact of clouds on atmospheric heating based on the R04 CloudSat fluxes and heating rates data set. *J. Geophys. Res*., **113**, D00A15, doi:10.1029/2008JD009951.

Lee, H., C. K. Shum, K. H. Tseng, J. Y. Guo, amd C. Y. Kuo, 2011: Present-day lake level variation from ENVISAT Altimetry over the northeastern Qinghai-Tibetan Plateau: Links with precipitation and temperature. *J. Terrestrial Atmos. Ocean Sci*., **22**, 169–175.

Lefale, P. F., 2003: Seasons in Samoa. *Water Atmos*., **11**, 10–11. [Available online at http://www.niwa.co.nz/publications/wa/vol11-no2-june-2003/seasons-in-samoa.]

——, 2010: *Ua Afa le Aso* Stormy weather today: Traditional ecological knowledge of weather and climate. The Samoa experience. *Climatic Change*, **100**, 317–335.

Lefsky, M. A., 2010: A global forest canopy height map from the Moderate Resolution Imaging Spectroradiometer and the Geoscience Laser Altimeter System. *Geophys. Res. Lett.,* **37**, L15401, doi:10.1029/2010GL043622.

Leuliette, E. W., and R. Scharroo, 2010: Integrating Jason-2 into a multiple-altimeter climate data record. *Marine Geodesy*, **33**, 504–517.

——, and J. K. Willis, 2011: Balancing the sea level budget. *Oceanography*, **24** (2), 122–129.

Levitus, S., J. I. Antonov, T. P. Boyer, R. A. Locarnini, H. E. Garcia, and A. V. Mishonov, 2009: Global ocean heat content 1955–2007 in light of recently revealed instrumentation problems. *Geophys. Res. Lett*., **36**, L07608, doi:10.1029/2008GL037155.

——, ——, ——, J. Reagan, and C. Schmid, 2011 : [Global oceans] Subsurface salinity [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc*., **92** (6), S88–S92.

L'Heureux, M. L., D. Collins, and Z. Hu, 2012: Linear trends in sea surface temperature of the tropical Pacific Ocean and implications for the El Niño-Southern Oscillation. *Climate Dyn*., in press, doi:10.1007/s00382-012-1331-2.

Li, W. K. W., F. A. McLaughlin, C. Lovejoy, and E. C. Carmack, 2009: Smallest algae thrive as the Arctic Ocean freshens. *Science*, **326**, 539.

Liebmann, B., and C. A. Smith, 1996: Description of a complete (interpolated) outgoing longwave radiation dataset. *Bull. Amer. Meteor. Soc*., **77**, 1275–1277.

Lin, I.-I., C. C. Wu, I.-F. Pun, and D.-S. Ko, 2008: Upper-ocean thermal structure and the western North Pacific category 5 typhoons. Part I: Ocean features and the category 5 typhoons' intensification. *Mon. Wea. Rev*., **136**, 3288–3306.

——, C.-H. Chen, I.-F. Pun, W. T. Liu, and C.-C. Wu, 2009a: Warm ocean anomaly, air sea fluxes, and the rapid intensification of Tropical Cyclone Nargis. *Geophy. Res. Lett*., **36**, L03817, doi: 10.1029/2008GL035815.

——, I.-F. Pun, and C.-C. Wu, 2009b: Upper ocean thermal structure and the western North Pacific category-5 typhoons. Part II: Dependence on translation speed. *Mon. Wea. Rev.*, **137**, 3744–3757.

Liu, H., L. Wang, and K. Jezek, 2005: Wavelet-based edge detection approach to derivation of snow-melt onset, duration and extent from satellite passive microwave measurements. *Int. J. Remote Sens*., **26**, 4639–4660.

——, ——, and ——, 2006: Spatiotemporal variations of snowmelt in Antarctica derived from satellite SMMR and SSM/I data (1978-2004). *J. Geophys. Res.*, **111**, F01003, doi:10.1029/2005JF000318.

Liu, Y., J. R. Key, and X. Wang, 2009: Influence of changes in sea ice concentration and cloud cover on recent Arc-

tic surface temperature trends. *Geophys. Res. Lett.,* **36**, L20710, doi:10.1029/2009GL040708.

——, ——, Z. Liu, X. Wang, and S. J. Vavrus, 2012: A cloudier Arctic expected with diminishing sea ice. *Geophys. Res. Lett.*, **39**, L05705, doi:10.1029/2012GL051251.

Liu, Y. Y., R. A. M. de Jeu, A. I. J. M. van Dijk, and M. Owe, 2007: TRMM-TMI satellite observed soil moisture and vegetation density (1998-2005) show strong connection with El Nino in eastern Australia. *Geophys. Res. Lett.*, **34**, L15401, doi:10.1029/2007GL030311.

——, A. I. J. M. van Dijk, R. A. M. de Jeu, and T. R. H. Holmes, 2009: An analysis of spatiotemporal variations of soil and vegetation moisture from a 29-year satellite-derived data set over mainland Australia. *Water Resour. Res.*, **45**, W07405, doi:10.1029/2008wr007187.

——, and Coauthors, 2011: Developing an improved soil moisture dataset by blending passive and active microwave satellite-based retrievals. *Hydrol. Earth Syst. Sci.*, **15**, 425–436.

Llovel, W., S. Guinehut, and A. Cazenave, 2009: Regional and interannual variability in sea level over 2002–2009 based on satellite altimetry, Argo float data and GRACE ocean mass. *Ocean Dyn.*, **60**, 1193–1204.

Loeb, N. G., S. Kato, W. Su, T. Wong, F. Rose, D. R. Doelling, and J. Norris, 2012: Advances in understanding top-of-atmosphere radiation variability from satellite observations. *Surv. Geophys.*, in press, doi:10.1007/s10712-012-9175-1.

Lohmann, U., and J. Feichter, 2005: Global indirect aerosol effects: A review. *Atmos. Chem. Phys.*, **5**, 715–737.

Lu, J., and T. L. Delworth, 2005: Oceanic forcing of the late 20th century Sahel drought. *Geophys. Res. Lett.*, **32**, L22706, doi:10.1029/2005GL023316.

Lumpkin, R., and S. Garzoli, 2010: Interannual to decadal changes in the southwestern Atlantic's surface circulation. *J. Geophys. Res.*, **116**, C01014, doi:10.1029/2010JC006285.

Luo, J.-J., S. Behera, Y. Masumoto, H. Sakuma, and T. Yamagata, 2008: Successful prediction of the consecutive IOD in 2006 and 2007. *Geophys. Res. Lett.*, **35**, L14S02, doi:10.1029/2007GL032793.

——, R. Zhang, S. K. Behera, Y. Masumoto, F.-F. Jin, R. Lukas, and T. Yamagata, 2010: Interaction between El Niño and extreme Indian Ocean dipole. *J. Climate*, **23**, 726–742.

Lyman, J. M., 2011: Estimating global energy flow from the global upper ocean. *Surv. Geophys.*, in press, doi:10.1007/s10712-011-9167-6.

——, and G. C. Johnson, 2008: Estimating global upper ocean heat content despite irregular sampling. *J. Climate*, **21**, 5629–5641.

——, S. A. Good, V. V. Gouretski, M. Ishii, G. C. Johnson, M. D. Palmer, D. A. Smith, and J. K. Willis, 2010: Robust warming of the global upper ocean. *Nature*, **465**, 334–337.

Lyon, B., and S. J. Camargo, 2009: The seasonally-varying influence of ENSO on rainfall and tropical cyclone activity in the Philippines. *Climate Dyn.*, **32**, 125–141.

—— ,and D. G. DeWitt, 2012: A recent abrupt decline in the East Africa Long Rains. *Geophys. Res. Lett.*, **39**, L02702, doi:10.1029/2011GL050337.

Ma, Z., and Coauthors, 2012: Regional drought-induced reduction in the biomass carbon sink of Canada's boreal forests. *Proc. Natl. Acad. Sci. USA*, in press, doi:10.1073/pnas.1111576109.

MacCallum, S. N., and C. J. Merchant, 2012: Surface water temperature observations of large lakes by optimal estimation. *Can. J. Remote Sens.*, **38**, 25–45, doi:10.5589/m12-010.

Madden, R., and P. Julian, 1971: Detection of a 40-50 day oscillation in the zonal wind in the tropical Pacific. *J. Atmos. Sci.*, **28**, 702–708.

——, and ——, 1972: Description of global-scale circulation cells in the tropics with a 40-50 day period. *J. Atmos. Sci.*, **29**, 1109–1123.

——, and ——, 1994: Observations of the 40-50 day tropical oscillation: A review. *Mon. Wea. Rev.*, **122**, 814–837.

Mäder, J. A., J. Staehelin, T. Peter, D. Brunner, H. E. Rieder, and W. A. Stahel, 2010: Evidence for the effectiveness of the Montreal Protocol to protect the ozone layer. *Atmos. Chem. Phys.*, **10**, 19005–19029.

Maes, C., K. Ando, T. Delcroix, W. S. Kessler, M. J. McPhaden, and D. Roemmich, 2006: Observed correlation of surface salinity, temperature and barrier layer at the eastern edge of the western Pacific warm pool. *Geophys. Res. Lett.*, **33**, L06601, doi:10.1029/2005GL024772.

Mainelli, M., M. DeMaria, L. Shay, and G. Goni, 2008: Application of oceanic heat content estimation to operational forecasting of recent Atlantic category 5 hurricanes. *Wea. Forecasting*, **23**, 3–16.

Malhi, Y., and Coauthors, 2002: An international network to monitor the structure, composition and dynamics of Amazonian forests (RAINFOR). *J. Vegetation Sci.* **13**, 439–450.

Maloney, E. D., and D. L. Hartmann, 2001: The Madden–Julian oscillation, barotropic dynamics, and North Pacific tropical cyclone formation. Part I: Observations. *J. Atmos. Sci.*, **58**, 2545–2558.

Manney, G. L., and Coauthors, 2011: Unprecedented Arctic ozone loss in 2011. *Nature,* **478**, 469–475.

Mantua, N. J., S. R. Hare, Y. Zhang, J. M. Wallace, and R. C. Francis, 1997: A Pacific interdecadal climate oscillation with impacts on salmon production. *Bull. Amer. Meteor. Soc.*, **78**, 1069–1079.

Marshall, G. J., 2003: Trends in the southern annular mode from observations and reanalyses. *J. Climate*, **16**, 4134–4143.

——, 2007: Short communication: Half-century seasonal relationships etween the Southern Annular Mode and Antarctic temperatures. *Int. J. Climatol.*, **27**, 373–383, doi:10.1002/joc.1407.

Martinson, D. G., 2011: Antarctic circumpolar current's role in the Antarctic ice system: An overview. *Palaeogeogr., Paleoclimatol., Palaeoecol.*, **335–336**, 71–74, doi:10.1016/j.palaeo.2011.04.007.

Maslanik, J., and J. Stroeve, 1999: Near-real time DMSP SSM/I daily polar gridded sea ice concentrations. National Snow and Ice Data Center, Boulder, CO, digital media. [Available online at http://nsidc.org/data/nsidc-0081.html.]

——, C. Fowler, J. Stroeve, S. Drobot, J. Zwally, D. Yi, and W. Emery, 2007: A younger, thinner Arctic ice cover: Increased potential for rapid, extensive sea-ice loss. *Geophys. Res. Lett.*, **34**, L24501, doi:10.1029/2007GL032043.

——, J. Stroeve, C. Fowler, and W. Emery, 2011: Distribution and trends in Arctic sea ice age through spring 2011. *Geophys. Res. Lett.*, **38**, L13502, doi:10.1029/2011GL047735.

Massom, R. A., S. E. Stammerjohn, W. Lefebvre, S. A. Harangozo, N. Adams, T. A. Scambos, M. J. Pook, and C. Fowler, 2008: West Antarctic Peninsula sea ice in 2005: Extreme ice compaction and ice edge retreat due to strong anomaly with respect to climate. *J. Geophys. Res.*, **113**, C02S20, doi:10.1029/2007JC004239.

Matear, R. J., and A. C. Hirst, 2003: Long-term changes in dissolved oxygen concentrations in the ocean caused by protracted global warming. *Global Biogeochem. Cycles,* **17**, 1125, doi:10.1029/2002GB001997.

Mathis, J. T., J. N. Cross, and N. R. Bates, 2011: Coupling primary production and terrestrial runoff to ocean acidification and carbonate mineral suppression in the eastern Bering Sea. *J. Geophys. Res.*, **116**, C02030, doi:10.1029/2010JC006453.

Matsuo, K., and K. Heki, 2010: Time-variable ice loss in Asian high mountains from satellite gravimetry. *Earth Planet. Sci. Lett.,* **290**, 30–36.

McCabe, G., M. Palecki, and J. Betancourt, 2004: Pacific and Atlantic Ocean influences on multidecadal drought frequency in the United States. *Proc. Natl. Acad. Sci. USA*, **101**, 4136–4141.

McCarthy, J., and Coauthors, 2004: Patterns in the Okavango Wetland in Botswana, between 1972 and 2000. *Ambio,* **7**, 453–457.

McClain, C. R., 2009: A decade of satellite ocean color observations. *Ann. Rev. Marine Sci.*, **1**, 19–42.

——, G. C. Feldman, and S. B. Hooker, 2004: An overview of the SeaWiFS project and strategies for producing a climate research quality global ocean bio-optical time series. *Deep-Sea Res. II*, **51**, 5–42.

McGuire, D. A., and Coauthors, 2009: Sensitivity of the carbon cycle in the Arctic to climate change. *Ecol. Monogr.*, **79**, 523–555.

McKinley, G. A., A. R. Fay, T. Takahashi, and N. Metzl, 2011: Convergence of atmospheric and North Atlantic carbon dioxide trends on multidecadal timescales. *Nature Geosci.*, **4**, 606–610.

McTaggart-Cowan, R., G. D. Deane, L. F. Bosart, C. A. Davis, and T. J. Galarneau, 2008: Climatology of tropical cyclogenesis in the North Atlantic (1948–2004). *Mon. Wea. Rev.*, **136**, 1284–1304.

McVicar, T. R., T. G. Van Niel, L. T. Li, M. L. Roderick, D. P. Rayner, L. Ricciardulli, and R. J. Donohue, 2008: Wind speed climatology and trends for Australia, 1975-2006: Capturing the stilling phenomenon and comparison with near-surface reanalysis output. *Geophys. Res. Lett.*, **35**, L20403, doi:10.1029/2008GL035627.

——, and Coauthors, 2012: Global review and synthesis of trends in observed terrestrial near-surface wind speeds: Implications for evaporation. *J. Hydrol.*, **416/417**, 182–205.

Mears, C. A., and F. J. Wentz, 2009: Construction of the RSS V3.2 lower tropospheric temperature records from the MSU and AMSU microwave sounders. *J. Atmos. Oceanic Tech.*, **26**, 1492–1509.

Meier, M. F., M. B. Dyurgerov, U. K. Rick, S. O'Neel, W. T. Pfeffer, R. S. Anderson, S. P. Anderson, and A. F. Glazovsky, 2007: Glaciers dominate eustatic sea level rise in the 21st century. *Science,* **317**, 1064–1067.

Meijers, A. J. S., N. L. Bindoff, and S. R. Rintoul, 2011: Frontal movements and property fluxes: Contributions to heat and freshwater trends in the Southern Ocean. *J. Geophys. Res.*, **116**, C08024, doi:10.1029/2010JC006832.

Meinen, C. S., M. O. Baringer, and R. F. Garcia, 2010: Florida current transport variability: An analysis of annual and longer-periods. *Deep-Sea Res. I*, **57**, 835–846.

Meister, G., B. A. Franz, E. J. Kwiatkowska, and C. R. McClain, 2012: Corrections to the calibration of MODIS Aqua ocean color bands derived from SeaWiFS data. *IEEE Trans. Geosci. Remote Sens.*, **50**, 310–319.

Mekis, E., and L. Vincent, 2011: An overview of the second generation adjusted daily precipitation dataset for trend analysis in Canada. *Atmos.-Ocean*, **49**, 163–177.

Mekonnen, A., C. D. Thorncroft, A. R. Aiyyer, and G. N. Kiladis, 2008: Convectively coupled Kelvin waves over tropical Africa during the boreal summer: Structure and variability. *J. Climate*, **21**, 6649–6667.

Menéndez, M., and P. Woodworth, 2010: Changes in extreme high water levels based on a quasi-global tide-gauge data set. *J. Geophys. Res.*, **115**, C10011, doi:10.1029/2009JC005997.

Meredith, M. P., and J. C. King, 2005: Rapid climate change in the ocean west of the Antarctic Peninsula during the

second half of the 20th century. *Geophys. Res. Lett.*, **32**, L19604, doi:10.1029/2005GL024042.

Merrifield, M. A., 2011: A shift in western tropical Pacific sea level trends during the 1990s. *J. Climate*, **24**, 4126–4138.

——, and M. E. Maltrud, 2011: Regional sea level trends due to a Pacific trade wind intensification. *Geophys. Res. Lett.*, **38**, L21605, doi:10.1029/2011GL049576.

Miller, B. R., and Coauthors, 2010: HFC-23 (CHF_3) emission trend response to HCFC-22 ($CHClF_2$) production and recent HFC-23 emission abatement measures. *Atmos. Chem. Phys.*, **10**, 7875–7890.

Mo, K. C., and V. E. Kousky, 1993: Further analysis of the relationship between circulation anomaly anomaly patterns and tropical convection. *J. Geophys. Res.*, **98** (D3), 5103–5113.

Mokhov, I. L., and M. E. Schlesinger, 1994: Analysis of global cloudiness 2. Comparison of ground-based and satellite-based cloud climatologies. *J. Geophys. Res.*, **99** (D8), 17045–17065.

Montzka, S. A., and Coauthors, 2011: Ozone-depleting substances (ODSs) and related chemicals. *Scientific Assessment of Ozone Depletion: 2010*, Global Ozone Research and Monitoring Project Rep. 52, World Meteorological Organization, 1.1–1.108.

Mooers, C. N. K., C. S. Meinen, M. O. Baringer, I. Bang, R. Rhodes, C. N. Barron, and F. Bub, 2005: Florida current response to cold front passages: Comparison of NOAA cable and Navy model volume transports. *Eos, Trans. Amer. Geophys. Union*, **86**, 269, 272–273.

Mostafaeipour, A., 2010: Feasibility study of harnessing wind energy for turbine installation in province of Yazd in Iran. *Renew. Sustain. Energy Rev.*, **14**, 93–111.

Mote, T. L., 2007: Greenland surface melt tends 1973-2007: Evidence of a large increase in 2007. *Geophys. Res. Lett.*, **34**, L22507, doi:10.1029/2007GL031976.

Mounier, F., G. N. Kiladis, and S. Janicot, 2007: Analysis of the dominant mode of convectively coupled Kelvin waves in the West African monsoon. *J. Climate*, **20**, 1487–1503.

Mühle, J., and Coauthors, 2010: Perfluorocarbons in the global atmosphere: Tetrafluoromethane, hexafluoroethane, and octafluoropropane. *Atmos. Chem. Phys.*, **10**, 5145–5164.

Mullan, A. B., 2011: [Tropics] Intertropical convergence zones [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S134–S136.

Müller, R., J.-U. Grooß, C. Lemmen, D. Heinze, M. Dameris, and G. Bodeker, 2008: Simple measures of ozone depletion in the polar stratosphere. *Atmos. Chem. Phys.*, **8**, 251–264.

Münnich, M., and J. D. Neelin, 2005: Seasonal influence of ENSO on the Atlantic ITCZ and equatorial South America. *Geophys. Res. Lett.*, **32**, L21709, doi:10.1029/2005GL023900.

Muñoz, E., C. Wang, and D. Enfield, 2010: The Intra-Americas springtime sea surface temperature anomaly dipole as fingerprint of remote influences. *J. Climate*, **23**, 43–56.

Murata, A., Y. Kumamoto, S. Watanabe, and M. Fukasawa, 2007: Decadal increases of anthropogenic CO_2 in the South Pacific subtropical ocean along 32°S. *J. Geophys. Res.*, **112**, C05033, doi:10.1029/2005JC003405.

Murphy, B. F., and B. Timbal, 2008: A review of recent climate variability and climate change in southeastern Australia. *Int. J. Climatol.*, **28**, 859–879.

Narama, C., A. Kääb, M. Duishonakunov, and K. Abdrakhmatov, 2010: Spatial variability of recent glacier area changes in the Tien Shan Mountains, Central Asia, using Corona (~1970), Landsat (~2000) and ALOS (~2007) satellite data. *Global Planet. Change*, **71**, 42–54.

National Ice Center, 2008: IMS daily Northern Hemisphere snow and ice analysis at 4 km and 24 km resolution. National Snow and Ice Data Center, Boulder, CO, digital media. [Available online at http://nsidc.org/data/g02156.html.]

Nerem, R., D. Chambers, E. Leuliette, G. Mitchum, and B. Giese, 1999: Variations in global mean sea level associated with the 1997–1998 ENSO event: Implications for measuring long-term sea level change. *Geophys. Res. Lett.*, **26**, 3005–3008.

——, ——, C. Choe, and G. Mitchum, 2010: Estimating mean sea level change from the TOPEX and Jason altimeter missions. *Marine Geodesy*, **33**, 435–446.

Neumann, C. J., B. R. Jarvinen, C. J. McAdie, and J. D. Elms, 1993: *Tropical Cyclones of the North Atlantic Ocean, 1871-1992.* NOAA National Climatic Data Center, 193 pp.

Newman, P. A., J. S. Daniel, D. W. Waugh, and E. R. Nash, 2007: A new formulation of equivalent effective stratospheric chlorine (EESC). *Atmos. Chem. Phys.*, **7**, 4537–4552.

Nicolas, J. P., and D. H. Bromwich, 2011: Precipitation changes in high southern latitudes from global reanalyses: A cautionary tale. *Surv. Geophys.*, **32**, 475–494.

Niiler, P. P., R. E. Davis, and H. J. White, 1987: Water-following characteristics of a mixed layer drifter. *Deep-Sea Res. A*, **34**, 1867–1881.

——, N. A. Maximenko, G. G. Panteleev, T. Yamagata, and D. B. Olson, 2003: Near-surface dynamical structure of the Kuroshio Extension. *J. Geophys. Res.*, **108**, 3193, doi:10.1029/2002JC001461.

NIWA, 2011: *NIWA Year in Review 2011.* National Institute of Water and Atmosphere Research, 53 pp. [Available online at http://www.niwa.co.nz/about-niwa/annual-reports/2011-year-in-review.]

Njoku, E. G., T. J. Jackson, V. Lakshmi, T. K. Chan, and S. V. Nghiem, 2003: Soil moisture retrieval from AMSR-E. *IEEE Trans. Geosci. Remote Sens.*, **41**, 215–229.

NOAA, 2004: *The NOAA-NASA Pathfinder Program*. University Corporation for Atmospheric Research, 22 pp.

Nobre, P., and J. Shukla, 1996: Variations of sea surface temperature, wind stress and rainfall over the tropical Atlantic and South America. *J. Climate*, **9**, 2464–2479.

Novelli, P. C., K. A. Masarie, P. M. Lang, B. D. Hall, R. C. Myers, and J. W. Elkins, 2003: Reanalysis of tropospheric CO trends: Effects of the 1997–1998 wildfires. *J. Geophys. Res.,* **108,** 4464, doi:10.1029/2002JD003031.

NRC, 2004: *Climate Data Records from Environmental Satellites.* National Academies Press, 150 pp.

——, 2011: *Assessing Requirements for Sustained Ocean Color Research and Operations*. National Academies Press, 100 pp.

O'Connor, F. M., and Coauthors, 2010: Possible role of wetlands, permafrost, and methane hydrates in the methane cycle under future climate change: A review. *Rev. Geophys.*, **48**, RG4005, doi:10.1029/2010RG000326.

Oerlemans, J., 1994: Quantifying global warming from the retreat of glaciers. *Science*, **264,** 243–245.

Olsen, A., A. M. Omar, E. Jeansson, L. G. Anderson, and R. G. J. Bellerby, 2010: Nordic seas transit time distributions and anthropogenic CO_2. *J. Geophys. Res.*, **115**, C05005, doi:10.1029/2009JC005488.

O'Malley, R. T., M. J. Behrenfeld, D. A. Siegel, and S. Maritorena, 2010: [Global oceans] Global ocean phytoplankton [in "State of the Climate in 2009"]. *Bull. Amer. Meteor. Soc.*, **91** (7), S75–S78.

Onogi, K., and Coauthors, 2007: The JRA-25 reanalysis. *J. Meteor. Soc. Japan,* **85,** 369–432.

Orr, A., D. Cresswell, G. J. Marshall, J. C. R. Hunt, J. Sommeria, C-G. Wang, and M. Light, 2004: A 'low-level' explanation for the recent large warming trend over the western Antarctic Peninsula involving blocked winds and changes in zonal circulation. *Geophys. Res. Lett.*, **31**, L06204, doi:10.1029/2003GL019160.

——, G. J. Marshall, J. C. R. Hunt, J. Sommeria, C-G. Wang, N. P. M. van Lipzig, D. Cresswell, and J. C. King, 2008: Characteristics of summer airflow over the Antarctic Peninsula in response to recent strengthening of westerly circumpolar winds. *J. Atmos. Sci.*, **65**, 1396–1412.

Orr, J. C., and Coauthors, 2005: Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. *Nature*, **437**, 681–686.

Osterkamp, T. E., 2008: Thermal state of permafrost in Alaska during the fourth quarter of the twentieth century (plenary paper). *Proc. Ninth Int. Conf. on Permafrost*, Fairbanks, AK, Vol. 2, D. L. Kane and K. M Hinkel, Eds., Institute of Northern Engineering, University of Alaska, Fairbanks, 1333–1338.

Overland, J. E., U. Bhatt, J. Key, Y. Liu, J. Walsh, and M. Wang, 2011a: Temperature and clouds. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 11–19. [Available online at http://www.arctic.noaa.gov/reportcard.]

——, K. R. Wood, and M. Wang, 2011b: Warm Arctic-cold continents: Impacts of the newly open Arctic Sea. *Polar Res.* **30**, 15787, doi:10.3402/polar.v30i0.15787.

Owe, M., R. A. M. De Jeu, and T. R. H. Holmes, 2008: Multisensor historical climatology of satellite-derived global land surface moisture. *J. Geophys. Res.,* **113**, F01002, doi:10.1029/2007JF000769.

Palmer, M. D., and P. Brohan, 2011: Estimating sampling uncertainty in fixed-depth and fixed-isotherm estimates of ocean warming. *Int. J. Climatol.*, **31**, 980–986.

——, K. Haines, S. F. B. Tett, and T. J. Ansell, 2007: Isolating the signal of ocean global warming. *Geophys. Res. Lett.*, **34**, L23610, doi:10.1029/2007GL031712.

Pan, Y., and Coauthors, 2011: A large and persistent carbon sink in the world's forests. *Science,* **333**, 988–993.

Park, G-H., K. Lee, P. Tishchenko, D. Min, M. J. Warner, L. D. Talley, D. Kang, and K. Kim, 2006: Large accumulation of anthropogenic CO_2 in the East (Japan) Sea and its significant impact on carbonate chemistry. *Global Biogeochem. Cycles*, **20**, GB4013, doi:10.1029/2005GB002676.

——, and Coauthors, 2010: Variability of global net sea-air CO_2 fluxes over the last three decades using empirical relationships. *Tellus*, **62B**, 352–368.

Pelto, M. S., 2010: Forecasting temperate alpine glacier survival from accumulation zone observations. *The Cryosphere,* **4**, 67–75.

——, 2011: North Cascade Glacier Climate Project 2011 field season report. [Available online at http://glacierchange.wordpress.com/2011/08/28/north-cascade-glacier-climate-project-2011-field-season-report/.]

Peng, C., and Coauthors, 2011: A drought-induced pervasive increase in tree mortality across Canada's boreal forests. *Nature Climate Change*, **1**, 467–471.

PERMOS, 2010: Permafrost in Switzerland 2006/2007 and 2007/2008. Glaciological Report (Permafrost) 8/9, Cryospheric Commission of the Swiss Academy of Sciences, 68 pp. [Available online at http://www.permos.ch/downloads/permos06-08.pdf.]

Perovich, D., W. Meier, J. Maslanik, and J. Richter-Menge, 2011: Sea ice. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 42–54. [Available online at http://www.arctic.noaa.gov/reportcard.]

Peters, G. P., G. Marland, C. Le Quere, T. Boden, J .G. Canadell, and M. Raupauch, 2012: Rapid growth in CO_2 emissions after the 2008-2009 global financial crisis. *Nature Climate Change*, **2**, 2–4.

Peterson, T. C., and R. S. Vose, 1997: An overview of the Global Historical Climatology Network temperature database. *Bull. Amer. Meteor. Soc.*, **78**, 2837–2849.

——, R. Vautard, T. R. McVicar, J.-N. Thépaut, and P. Berrisford, 2011a: [Global climate] Surface winds over land [in "State of Climate 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S57.

——, K. M. Willett, and P. W. Thorne, 2011b: Observed changes in surface atmospheric energy over land. *Geophys. Res. Lett.*, **38**, L16707, doi:10.1029/2011GL048442.

——, P. A. Stott, and S. Herring, Eds., 2012: Explaining extreme events of 2011 from a climate perspective. *Bull. Amer. Meteor. Soc.*, **93**, 1041–1067, doi:10.1175/BAMS-D-12-00021.1

Phillips, M., E. Zenklusen, M. Kern-Lütschg, and M. Lehning, 2009: Rapid degradation of ground ice in a ventilated talus slope: Flüela Pass, Swiss Alps. *Permafrost Periglacial Processes*, **20**, 1–14.

Pinty, B., I. Andredakis, M. Clerici, T. Kaminski, M. Taberner, M. M. Verstraete, N. Gobron, and J.-L. Widlowski, 2011a: Exploiting the MODIS albedos with the Twostream Inversion Package (JRC-TIP) Part I: Effective leaf area index, vegetation and soil properties. *J. Geophys. Res.*, **116**, D09105, doi:10.1029/2010JD015372.

——, ——, ——, ——, ——, ——, ——, and ——, 2011b: Fractions of transmitted and absorbed fluxes in the vegetation and soil layers. *J. Geophys. Res.*, **116**, D09106, doi:10.1029/2010JD015373.

Pitts, M. C., L. R. Poole, and L. W. Thomason, 2009: CALIPSO polar stratospheric cloud observations: second-generation detection algorithm and composition discrimination. *Atmos. Chem. Phys.*, **9**, 7577–7589, doi:10.5194/acp-9-7577-2009.

Popova, V. V., and A. B. Shmakin, 2009: The influence of seasonal climatic parameters on the permafrost thermal regime, West Siberia, Russia. *Permafrost Periglacial Processes*, **20**, 41–56.

Power, S., T. Casey, C. Folland, A. Colman, and V. Mehta, 1999: Inter-decadal modulation of the impact of ENSO on Australia. *Climate Dyn.*, **15**, 319–324.

Prinn, R. G., and Coauthors, 2000: A history of chemically and radiatively important gases in air deduced from ALE/GAGE/AGAGE. *J. Geophys. Res.,* **105** (D14), 17751–17792, doi:10.1029/2000JD900141.

——, and Coauthors, 2005: Evidence for variability of atmospheric hydroxyl radicals over the past quarter century. *Geophys. Res. Lett.*, **32**, L07809, doi:10.1029/2004GL022228.

Pritchard, H. D., and D. G. Vaughan, 2007: Widespread acceleration of tidewater glaciers on the Antarcitc Peninsula. *J. Geophys. Res.*, **112,** F03S29, doi:10.1029/2006JF000597.

Privette, J., J. Bates, T. Karl, B. Barkstrom, D. Markham, and E. Kearns, 2009: NOAA's approach to providing CDRs within a new interagency initiative. *Proc. 5th Symp. Future National Operational Environmental Satellite Systems*, Phoenix, AZ, Amer. Meteor. Soc., Paper J13.2. [Available online at http://ams.confex.com/ams/pdfpapers/149762.pdf.]

Proshutinsky, A. Y., and M. A. Johnson. 1997: Two circulation regimes of the wind-driven Arctic Ocean. *J. Geophys. Res.*, **102** (C9), 12493–12514.

——, and M. Johnson, 2011: Arctic Ocean Oscillation Index (AOO): interannual and decadal changes of the Arctic climate. *Geophysical Research Abstracts,* Vol. 13, Abstract EGU2011-7850.

——, I. M. Ashik, E. N. Dvorkin, S. Hakkinen, R. A. Krishfield, and W. R. Peltier, 2004: Secular sea level change in the Russian sector of the Arctic Ocean. *J. Geophys. Res.*, **109**, C03042, doi:10.1029/2003JC002007.

——, and Coauthors, 2009: Beaufort Gyre freshwater reservoir: State and variability from observations. *J. Geophys. Res.*, **114**, C00A10, doi:10.1029/2008JC005104.

——, and Coauthors, 2011a: Ocean. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 42–54. [Available online at http://www.arctic.noaa.gov/reportcard.]

——, and Coauthors, 2011b: [The Arctic] Ocean [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.,* **92** (6), S145–S148.

Pryor, S. C., and Coauthors, 2009: Wind speed trends over the contiguous United States. *J. Geophys. Res.*, **114**, D14105, doi:10.1029/2008JD011416.

Purkey, S. G., and G. C. Johnson, 2010: Warming of global abyssal and deep Southern Ocean waters between the 1990s and 2000s: Contributions to global heat and sea level rise budgets. *J. Climate*, **23**, 6336–6351.

Ramanathan, V., and G. Carmichael, 2008: Global and regional climate changes due to black carbon. *Nature Geosci.,* **1**, 221–227.

Randel, W. J., and A. M. Thompson, 2011: Interannual variability and trends in tropical ozone derived from SAGE II satellite data and SHADOZ ozonesondes. *J. Geophys. Res.*, **116**, D07303, doi:10.1029/2010JD015195.

Raphael, M. N., 2004: A zonal wave 3 index for the Southern Hemisphere. *Geophys. Res. Lett.,* **31**, L23212, doi:10.1029/2004GL020365.

Rast, M., and J.-L. Bezy, 1999: The ESA Medium Resolution Imaging Spectrometer MERIS: A review of the instrument and its mission. *Int. J. Remote Sens.*, **20**, 1681–1702.

Ravishankara, A. R., J. S. Daniel, and R. W. Portmann, 2009: Nitrous oxide (N_2O): The dominant ozone-depleting substance emitted in the 21st century. *Science*, **316**, 123–125.

Rayner, D., and Coauthors, 2010: Monitoring the Atlantic meridional overturning circulation. *Deep-Sea Res. II*, **58**, 1744–1753.

Rayner, N. A., D. E. Parker, E. B. Horton, C. K. Folland, L. V. Alexander, D. P. Rowell, E. C. Kent, and A. Kaplan, 2003: Global analyses of sea surface temperature, sea ice, and night marine air temperature since the late nineteenth century. *J. Geophys. Res.*, **108**, 4407, doi:10.1029/2002JD002670.

——, P. Brohan, D. E. Parker, C. K. Folland, J. J. Kennedy, M. Vanicek, T. Ansell, and S. F. B. Tett, 2006: Improved analyses of changes and uncertainties in sea surface temperature measured in situ since the mid-nineteenth century: The HadSST2 data set. *J. Climate*, **19**, 446–469.

Raynolds, M. K., D. A. Walker, H. E. Epstein, J. E. Pinzon, and C. J. Tucker, 2012: A new estimate of tundra-biome phytomass from trans-Arctic field data and AVHRR NDVI. *Remote Sens. Lett.,* **3,** 403–411.

Reed, R. J., D. C. Norquist, and E. E. Recker, 1977: The structure and properties of African wave disturbances as observed during Phase III of GATE. *Mon. Wea. Rev.*, **105**, 317–333.

Ren, L., and S. Riser, 2010: Observations of decadal-scale salinity changes in the thermocline of the North Pacific Ocean. *Deep-Sea Res. II*, **57**, 1161–1170.

Rex, M., R. J. Salawitch, P. von der Gathen, N. R. P. Harris, M. P. Chipperfield, and B. Naujokat, 2004: Arctic ozone loss and climate change. *Geophys. Res. Lett.*, **31**, L04116, doi:10.1029/2003GL018844.

Reynolds, R. W., and D. B. Chelton, 2010: Comparisons of daily sea surface temperature analyses for 2007–08. *J. Climate*, **23**, 3545–3562.

——, N. A. Rayner, T. M. Smith, D. C. Stokes, and W. Wang, 2002: An improved in situ and satellite SST analysis for climate. *J. Climate*, **15**, 1609–1625.

Rienecker, M. M., and Coauthors, 2011: MERRA: NASA's Modern-Era Retrospective Analysis for Research and Applications. *J. Climate*, **24**, 3624–3648.

Rigby, M., and Coauthors, 2008: Renewed growth of atmospheric methane. *Geophys. Res. Lett.*, **35**, L22805, doi:10.1029/2008GL036037.

Rintoul, S. R., and Coauthors, 2010: Deep circulation and meridional overturning: Recent progress and a strategy for sustained observations. *Proc. OceanObs'09: Sustained Ocean Observations and Information for Society* (Vol. 1), Venice, Italy, J. Hall et al. Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.pp.32.

Rio, M.-H., and F. Hernandez, 2004: A mean dynamic topography computed over the world ocean from altimetry, in situ measurements, and a geoid model. *J. Geophys. Res.*, **109**, C12032, doi:10/1029/2003JC002226.

Rodell, M., and J. S. Famiglietti, 2001: An analysis of terrestrial water storage variations in Illinois with implications for the Gravity Recovery and Climate Experiment (GRACE). *Water Resour. Res.*, **37**, 1327–1340.

——, I. Velicogna, and J. S. Famiglietti, 2009: Satellite-based estimates of groundwater depletion in India. *Nature*, **460**, 999–1002.

——, J. S. Famiglietti, D. P. Chambers, and J. Wahr, 2011: [Global climate] Contributions of GRACE to climate monitoring [in "State of the Climate 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S50–S51.

Roderick, M. L., L. D. Rotstayn, G. D. Farquhar, and M. T. Hobbins, 2007: On the attribution of changing pan evaporation. *Geophys. Res. Lett.*, **34**, L17403, doi:10.1029/2007GL031166.

——, M. T. Hobbins, and G. D. Farquhar, 2009: Pan evaporation trends and the terrestrial water balance II. Energy balance and interpretation. *Geography Compass*, **3**, 761–780.

Roemmich, D., and J. Gilson, 2009: The 2004–2008 mean and annual cycle of temperature, salinity, and steric height in the global ocean from the Argo Program. *Progr. Oceanogr.*, **82**, 81–100.

——, and Coauthors, 2009: The Argo Program: Observing the global oceans with profiling floats. *Oceanography*, **22**, 34–43.

Romanovsky, V. E., and Coauthors, 2010a: Thermal state of permafrost in Russia. *Permafrost Periglacial Processs*, **21**, 136–155.

——, S. L. Smith, and H. H. Christiansen, 2010b: Permafrost thermal state in the polar Northern Hemisphere during the International Polar Year 2007-2009: A synthesis. *Permafrost Periglacial Processes*, **21**, 106–116.

——, ——, ——, N. I. Shiklomanov, D. S. Drozdov, N. G. Oberman, A. L. Kholodov, and S. S. Marchenko, 2011: Permafrost. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 139–147. [Available online at http://www.arctic.noaa.gov/reportcard.]

Ropelewski, C. F., and M. S. Halpert, 1987: Global and regional scale precipitation patterns associated with El Nino/Southern Oscillation. *Mon. Wea. Rev.*, **115**, 1606–1626.

——, and ——, 1989: Precipitation patterns associated with the high index phase of the Southern Oscillation. *J. Climate*, **2**, 268–284.

Roundy, P. E., and G. N. Kiladis, 2006: Observed relationships between oceanic Kelvin waves and atmospheric forcing. *J. Climate*, **19**, 5253–5272.

Rykaczewski, R. R., and J. P. Dunne, 2010: Enhanced nutrient supply to the California current ecosystem with global warming and increased stratification in an earth system model. *Geophys. Res. Lett.*, **37**, L21606, doi:10.1029/2010GL045019.

Saatchi, S. S., and Coauthors, 2011: Benchmark map of forest carbon stocks in tropical regions across three continents. *Proc. Natl. Acad. Sci. USA,* **108**, 9899–9904.

Sabine, C. L., and Coauthors, 2004: The ocean sink for anthropogenic CO_2. *Science*, **305**, 367–371.

——, R. A. Feely, F. J. Millero, A. G. Dickson, C. Langdon, S. Mecking, and D. Greeley 2008: Decadal changes in Pacific carbon. *J. Geophys. Res.*, **113**, C07021, doi:10.1029/2007JC004577.

Saha, S., and Coauthors, 2010: The NCEP climate forecast system reanalysis. *Bull. Amer. Meteor. Soc.*, **91**, 1015–1057.

Saji, N. H., and T. Yamagata, 2003a: Structure of SST and surface wind variability during Indian Ocean dipole mode events: COADS observations. *J. Climate*, **16**, 2735–2751.

——, and ——, 2003b: Possible impacts of Indian Ocean dipole mode events on global climate. *Climate Res.*, **25**, 151–169.

——, B. N. Goswami, P. N. Vinayachandran, and T. Yamagata, 1999: A dipole mode in the tropical Indian Ocean. *Nature,* **401**, 360–363.

Salby, M., E. Titova, and L. Deschamps, 2011: Rebound of Antarctic ozone. *Geophys. Res. Lett.*, **38**, L09702, doi:10.1029/2011GL047266.

Sarmiento, S., and A. Palanisami, 2011: Coherence between atmospheric teleconnections and Mackenzie River Basin lake levels. *J. Great Lakes Res.*, **37**, 642–649.

Scambos, T. A., C. Hulbe, and M. Fahnestock, 2003: Climate-induced ice shelf disintegration in the Antarctic Peninsula. *Antarctic Peninsula Climate Variability: Historical and Paleoenvironmental Perspectives*, E. Domack et al., Eds., Antarctic Research Series, Vol. 79, Amer. Geophys. Union, 79–92.

Schaaf, C. B., and Coauthors, 2002: First operational BRDF, albedo and nadir reflectance products from MODIS. *Remote Sens. Environ.*, **83**, 135–148.

Schanze, J. J., R. W. Schmitt, and L. L. Yu, 2010: The global oceanic freshwater cycle: A state-of-the-art quantification. *J. Marine Res.*, **68**, 569–595.

Schmitt, R., 2008: Salinity and the global water cycle. *Oceanography*, **21**, 12–19.

Schneider, A., T. Tanhua, A. Körtzinger, and D. W. R. Wallace, 2010: High anthropogenic carbon content in the eastern Mediterranean. *J. Geophys. Res.*, **115**, C12050, doi:10.1029/2010JC006171.

Schneider, P., and S. J. Hook, 2010: Space observations of inland water bodies show rapid surface warming since 1985. *Geophys. Res. Lett.*, **37**, L22405, doi:10.1029/2010GL045059.

Schneider, U., A. Becker, A. Meyer-Christoffer, M. Ziese, and B. Rudolf, 2011: Global precipitation analysis products of the GPCC. Global Precipitation Climatology Centre (GPCC), Deutscher Wetterdienst. [Available online at http://www.gpcc.dwd.de/.]

Schreck, C. J., J. P. Kossin, and P. A. Hennon, 2012: Global tropical cyclone climatology using IBTrACS. *30th Conf. Hurricanes and Tropical Meteorology*, Ponte Vedra Beach, FL, Amer. Meteor. Soc., 1B.4. [Available on line at http://ams.confex.com/ams/30Hurricane/webprogram/Paper204685.html.]

Seidel, D. J., N. P. Gillett, J. R. Lanzante, K. P. Shile, and P. W. Thorne, 2011: Stratospheric temperature trends: Our evolving understanding. *WIRES: Climate Change*, **2**, 592–616.

Seiler, W., and P. J. Crutzen, 1980: Estimates of gross and net fluxes of carbon between the biosphere and the atmosphere from biomass burning. *Climatic Change*, **2**, 207–247.

Send, U., M. Lankhorst, and T. Kanzow, 2011: Observation of decadal change in the Atlantic meridional overturning circulation using 10 years of continuous transport data. *Geophys. Res. Lett.*, **38**, L24606, doi:10.1029/2011GL049801.

Seneviratne, S. I., T. Corti, E. L. Davin, M. Hirschi, E. B. Jaeger, I. Lehner, B. Orlowsky, and A. J. Teuling, 2010: Investigating soil moisture-climate interactions in a changing climate: A review. *Earth-Science Rev.*, **99**, 125–161.

SERVIR, 2011: Severe precipitation deficit in Dominican Republic, Jan – Mar 2011. Accessed 18 May 2012. [Available online at http://servirglobal.net/Global/Articles/tabid/86/Article/959/Default.aspx.]

Severinghaus, J. P., T. Sowers, E. J. Brook, R. B. Alley, and M. L. Bender, 1998: Timing of abrupt climate change at the end of the Younger Dryas interval from thermally fractionated gases in polar ice. *Nature*, **391**, 141–146.

Shahgedanova, M., G. Nosenko, T. Khromova, and A. Muraveyev, 2010: Glacier shrinkage and climatic change inthe Russian Altai from the mid-20th century: An assessment using remote sensing and PRECIS regional climate model. *J. Geophys. Res.*, **115**, D16107, doi:10.1029/2009JD012976.

Sharp, M., and G. Wolken, 2011a: [The Arctic] Glaciers outside Greenland [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S155–S156.

——, and ——, 2011b: Glaciers and ice caps (outside Greenland). *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 110–116. [Available online at http://www.arctic.noaa.gov/reportcard.]

——, D. O. Burgess, J. G. Cogley, M. Ecclestone, C. Labine, and G. J. Wolken, 2011: Extreme melt on Canada's Arctic ice caps in the 21st century. *Geophys. Res. Lett.*, **38**, L11501, doi:10.1029/2011GL047381.

Shay, L. K., G. J. Goni, and P. G. Black, 2000: Effects of a warm oceanic feature on Hurricane Opal. *Mon. Wea. Rev.*, **128,** 1366–1383.

Shiklomanov, N. I., D. A. Streletskiy, F. E. Nelson, R. D. Hollister, V. E. Romanovsky, C. E. Tweedie, J. G. Bockheim, and J. Brown, 2010: Decadal variations of active-layer thickness in moisture-controlled landscapes, Barrow, Alaska. *J. Geophys. Res.*, **115**, G00I04, doi:10.1029/2009JG001248.

Siegel, D. A., and B. A. Franz, 2010: Oceanography: A century of phytoplankton change. *Nature*, **466**, 569–570.

——, S. Maritorena, N. B. Nelson, and M. J. Behrenfeld, 2005: Independence and interdependencies of global ocean color properties: Reassessing the bio-optical assumption. *J. Geophys. Res.*, **110**, C07011, doi:10.1029/2004JC002527.

——, M. J. Behrenfeld, S. Maritorena, R. T. O'Malley, and E. Fields, 2011: [Global oceans] Global ocean phytoplankton [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S105–S108.

Simmons, A., 2010: Monitoring atmospheric composition and climate. *ECMWF Newsletter*, **123**, 10–13.

——, K. M. Willett, P. D. Jones, P. W. Thorne, and D. Dee, 2010: Low-frequency variations in surface atmospheric humidity, temperature and precipitation: inferences from reanalyses and monthly gridded observational datasets. *J. Geophys. Res.*, **115**, D01110, doi:10.1029/2009JD012442.

Sinclair, M. R., 2002: Extratropical transition of Southwest Pacific tropical cyclones. Part I: Climatology and mean structure changes. *Mon. Wea. Rev.*, **130**, 590–609.

Singh, O. P., T. M. Ali Khan, and S. Rahman, 2000: Changes in the frequency of tropical cyclones over the North Indian Ocean. *Meteor. Atmos. Phys.*, **75**, 11–20.

Sinnhuber, B. M., G. Stiller, R. Ruhnke, T. von Clarmann, S. Kellmann, and J. Aschmann, 2011: Arctic winter 2010/2011 at the brink of an ozone hole. *Geophys. Res. Lett.*, **38**, L24814, doi:10.1029/2011GL049784.

Smith, S. L., S. A. Wolfe, D. W. Riseborough, and F. M. Nixon, 2009: Active-layer characteristics and summer climatic indices, Mackenzie Valley, Northwest Territories, Canada. *Permafrost Periglacial Processes*, **20**, 201–220.

——, V. E. Romanovsky, A. G. Lewkowicz, C. R. Burn, M. Allard, G. D. Clow, K. Yoshikawa, and J. Throop, 2010: Thermal state of permafrost in North America: A contribution to the International Polar Year. *Permafrost Periglacial Processes*, **21**, 117–135.

Smith, T. M., and R. W. Reynolds, 1998: A high-resolution global sea surface temperature climatology for the 1961–90 base period. *J. Climate*, **11**, 3320–3323.

——, and ——, 2005: A global merged land air and sea surface temperature reconstruction based on historical observations (1880-1997). *J. Climate*, **18**, 2021–2036.

——, ——, T. C. Peterson, and J. Lawrimore, 2008: Improvements to NOAA's historical merged land-ocean surface temperature analysis (1880-2006). *J. Climate*, **21**, 2283–2296.

Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., 2007: *Climate Change 2007: The Physical Science Basis.* Cambridge University Press, 996 pp.

——, J. S. Daniel, R. R. Neely III, J. P. Vernier, E. G. Dutton, and L. W. Thomason, 2011: The persistently variable "background" stratospheric aerosol layer and global climate change. *Science,* **333**, 866–870.

SPARC, 2010: SPARC Report on the evaluation of chemistry climate models. SPARC Report No. 5, WCRP-132, WMO/TD-No. 1526, 426 pp. [Available online at http://www.sparc-climate.org/publications/sparc-reports/sparc-report-no5/.]

Stackhouse, P. W., Jr., D. P. Kratz, G. R. McGarragh, S. K. Gupta, and E. B. Geier, 2006: Fast Longwave and Shortwave Radiative Flux (FLASHFlux) products from CERES and MODIS measurements. *Proc. 12th Conf. Atmospheric Radiation*. Madison, WI, Amer. Meteor. Soc., P1.10. [Avilable online at http://ams.confex.com/ams/pdfpapers/113479.pdf.]

Stammerjohn, S. E., D. G. Martinson, R. C. Smith, X. Yuan, and D. Rind, 2008: Trends in Antarctic annual sea ice retreat and advance and their relation to El Niño–Southern Oscillation and southern annular mode variability. *J. Geophys. Res.*, **113**, C03S90, doi:10.1029/2007JC004269.

——, R. Massom, D. Rind, and D. Martinson, 2012: Regions of rapid sea ice change: An inter-hemispheric seasonal comparison. *Geophys. Res. Lett.*, **39**, L06501, doi:10.1029/2012GL050874.

Steele, M., J. Morison, W. Ermold, I. Rigor, M. Ortmeyer, and K. Shimada, 2004: Circulation of summer Pacific halocline water in the Arctic Ocean. *J. Geophys. Res.*, **109**, C02027, doi:10.1029/2003JC002009.

——, W. Ermold, and J. Zhang, 2008: Arctic Ocean surface warming trends over the past 100 years. *Geophys. Res. Lett.*, **35**, L02614, doi:10.1029/2007GL031651.

——, J. Zhang, and W. Ermold, 2010: Mechanisms of summertime upper Arctic Ocean warming and the effect on sea ice melt. *J. Geophys. Res.*, **115**, C11004, doi:10.1029/2009JC005849.

Steig, E. J., Q. Ding, D. S. Battisti, and A. Jenkins, 2012: Tropical forcing of circumplolar deep water inflow and outlet glacier thinning in the Amundsen Sea Embayment, West Antarctica. *Ann. Glaciol.*, **53**, 19–28, doi:10.3189/2012AoGG0A110.

Steinacher, M., F. Joos, T. L. Frölicker, G.-K. Plattner, and S. C. Doney, 2009: Imminent ocean acidification in the Arctic projected with the NCAR global coupled carbon cycle-climate model. *Biogeosciences*, **6**, 515–533.

Steinbrecht, W., and Coauthors, 2009: Ozone and temperature trends in the upper stratosphere at five stations of the network for the detection of atmospheric composition change. *Int. J. Remote Sens.*, **30**, 3875–3886.

——, U. Köhler, H. Claude, M. Weber, J. P. Burrows, and R. J. van der A, 2011: Very high ozone columns at northern mid-latitudes in 2010. *Geophys. Res. Lett.*, **38**, L06803, doi:10.1029/2010GL046634.

Stephenson, T. S., A. A. Chen, and M. A. Taylor, 2007: Toward the development of prediction models for the primary Caribbean Dry Season. *Theoret. Appl. Climatol.*, **92**, 87–101.

Stolarski, R. S., and S. Frith, 2006: Search for evidence of trend slow-down in the long-term TOMS/SBUV total ozone data record: the importance of instrument drift uncertainty and fingerprint detection. *Atmos. Chem. Phys.*, **6**, 4057–4065.

Stramma, L., G. C. Johnson, J. Sprintall, and V. Mohrholz, 2008: Expanding oxygen-minimum zones in the tropical oceans. *Science*, **320**, 655–658.

Streletskiy, D. A, N. I. Shiklomanov, F. E. Nelson, and A. E. Klene, 2008: 13 Years of observations at Alaskan CALM sites: Long-term active layer and ground surface temperature trends. *Proc. Ninth Int. Conf. on Permafrost*, Fairbanks, AK, Vol. 2, D. L. Kane and K. M. Hinkel, Eds., Institute of Northern Engineering, University of Alaska Fairbanks, 1727–1732.

Sutton, R. T., and D. L. R. Hodson, 2007: Climate response to basin-scale warming and cooling of the North Atlantic Ocean. *J. Climate*, **20**, 891–907.

Sverdrup, H. U., 1955: The place of physical oceanography in oceanographic research. *J. Marine Res.*, **14**, 287–294.

Sweet, W., C. Zervas, and S. Gill, 2009: Elevated east coast sea level anomaly: June – July 2009. NOAA Tech. Rep. NOS CO-OPS 051, 30 pp.

Takahashi, T., and Coauthors, 2009: Climatological mean and decadal change in surface ocean pCO_2, and net sea-air CO_2 flux over the global oceans. *Deep-Sea Res. II*, **56**, 554–577.

——, S. C. Sutherland, and A. Kozyr, 2011: Global ocean surface water partial pressure of CO_2 database: Measurements performed during 1957-2010 (Version 2010). ORNL/CDIAC-159, NDP-088(V2010). Carbon Dioxide Information Analysis Center, Oak Ridge, TN, digital media. [Available online at doi:10.3334/CDIAC/otg.ndp088(V2010).]

Takala, M., K. Luojus, J. Pulliainen, C. Derksen, J. Lemmetyinen, J.-P. Kärnä, and J. Koskinen, 2011: Estimating northern hemisphere snow water equivalent for climate research through assimilation of space-borne radiometer data and ground-based measurements. *Remote Sens. Environ.*, **115**, 3517–3529.

Tanhua, T., E. P. Jones, E. Jeansson, S. Jutterstrom, W. M. Smethie Jr., D. W. R. Wallace, and L. G. Anderson, 2009: Ventilation of the Arctic Ocean: Mean ages and inventories of anthropogenic CO_2 and CFC-11. *J. Geophys. Res.*, **114**, C01002, doi:10.1029/2008JC004868.

Tapley, B. D., S. Bettadpur, J. C. Ries, P. F. Thompson, and M. M. Watkins, 2004: GRACE measurements of mass variability in the Earth system. *Science*, **305**, 503–505.

Tarnocai, C., J. G. Canadell, E. A. G. Schuur, P. Kuhry, G. Mazhitova, and S. Zimov, 2009: Soil organic carbon pools in the northern circumpolar permafrost region. *Global Biogeochem. Cycles*, **23**, GB2023, doi:10.1029/2008GB003327.

Taylor, A. H., and J. A. Stephens, 1998: The North Atlantic Oscillation and latitude of the Gulf Stream. *Tellus*, **40A**, 134–142.

Tedesco, M., 2007: Snowmelt detection over the Greenland ice sheet from SSM/I brightness temperature daily variations. *Geophys. Res. Lett.*, **34**, L02504, doi:10.1029/2006GL028466.

——, 2009: Assessment and development of snowmelt retrieval algorithms over Antarctica from K-band spaceborne brightness temperature (1979-2008). *Remote Sens. Environ.*, **113**, 979–997.

——, and A. J. Monaghan, 2009: An updated Antarctic melt record through 2009 and its linkages to high-latitude and tropical climate variability. *Geophys. Res. Lett.*, **36**, L18502, doi:10.1029/2009GL039186.

——, X. Fettweis, M. R. van den Broeke, R. S. W. van de Wal, C. J. P. P. Smeets, W. J. van de Berg, M. C. Serreze, and J. E. Box, 2011: The role of albedo and accumulation in the 2010 melting record in Greenland. *Environ. Res. Lett.*, **6**, 014005, doi:10.1088/1748-9326/6/1/014005.

Thompson, D. W. J., and S. Solomon, 2002: Interpretation of recent Southern Hemisphere climate change. *Science*, **296**, 895–899, doi:10.1126/science.1069270.

Thorne, P. W., and Coauthors, 2005: Revisiting radiosonde upper-air temperatures from 1958 to 2002. *J. Geophys. Res.*, **110**, D18105, doi:10.1029/2004JD005753.

——, and Coauthors, 2011: Guiding the creation of a comprehensive surface temperature resource for twenty-first-century climate science. *Bull. Amer. Meteor. Soc.*, **92**, ES40–ES47.

Timokhov, L., and F. Tanis, Eds., 1997: Environmental Working Group Joint U.S.-Russian Atlas of the Arctic Ocean–Winter Period. Environmental Research Institute of Michigan in association with the National Snow and Ice Data Center, Arctic Climatology Project, CD-ROM.

——, and ——, Eds., 1998: Environmental Working Group Joint U.S.-Russian Atlas of the Arctic Ocean–Summer Period. Environmental Research Institute of Michigan in association with the National Snow and Ice Data Center, Arctic Climatology Project, CD-ROM.

Tiwari, V. M., J. Wahr, and S. Swenson, 2009: Dwindling groundwater resources in northern India, from satellite gravity observations. *Geophys. Res. Lett.*, **36**, L18401, doi:10.1029/2009GL039401.

Torinesi, O., M. Fily, and C. Genthon, 2003: Variability and trends of the summer melt period of Antarctic ice margins since 1980 from microwave sensors. *J. Climate,* **16,** 1047–1060.

Trenberth, K. E., J. T. Fasullo, and J. T. Kiehl, 2009: Earth's global energy budget. *Bull. Amer. Meteor. Soc.*, **90**, 311–323.

Trigo, R. M., I. M. Trigo, C. C. DaCamara, and T. J. Osborn, 2004: Climate impact of the European winter blocking episodes from the NCEP/NCAR Reanalyses. *Climate Dyn.*, **23**, 17–28.

Turner, J., and Coauthors, 2005: Antarctic climate change during the last 50 years. *Int. J. Climatol.*, **25**, 279–294.

——, and Coauthors, 2009: Non-annular atmospheric circulation change induced by stratospheric ozone depletion and its role in the recent increase of Antarctic sea ice extent. *Geophys. Res. Lett.*, **36,** L08502, doi:10.1029/2009GL037524.

Van de Wal, R. S. W., W. Greuell, M. R. van den Broeke, C. H. Reijmer, and J. Oerlemans, 2005: Surface mass-balance observations and automatic weather station data along a transect near Kangerlussuaq, West Greenland. *Ann. Glaciol.*, **42**, 311–316.

Van den Broeke, M., 2005: Strong surface melting preceded collapse of Antarctic Peninsula ice shelf. *Geophys. Res. Lett.*, **32**, 12815, doi:10.1029/2005gl023247.

——, and N. P. M. van Lipzig, 2004: Changes in Antarctic temperature, wind and precipitation in response to the Antarctic Oscillation. *Ann. Glaciol.*, **39**, 119–126.

——, W. J. van de Berg, E. van Meijgaard, and C. H. Reijmer, 2006: Identification of Antarctic ablation areas using a regional atmospheric climate model. *J. Geophys. Res.*, **111**, D18110, doi:10.1029/2006JD007127.

Van der Werf, G. R., and Coauthors, 2010: Global fire emissions and the contribution of deforestation, savanna, forest, agricultural, and peat fires (1997–2009). *Atmos. Chem. Phys.*, **10**, 11707–11735.

Vaughan, D. G., G. J. Marshall, W. M. Connolley, J. C. King, and R. Mulvaney, 2001: Devil in the detail. *Science*, **293**, 1777–1779.

——, and Coauthors, 2003: Recent rapid regional climate warming on the Antarctic Peninsula. *Climatic Change*, **60**, 243–274.

Vautard, R., J. Cattiaux, P. Yiou, J.-N Thépaut, and P. Ciais, 2010: Northern Hemisphere atmospheric stilling partly attributed to an increase in surface roughness. *Nature Geosci.*, **3**, 756–761.

Vavrus, S. J., U. S. Bhatt, and V. A. Alexeev, 2011: Factors influencing simulated changes in future Arctic cloudiness. *J. Climate*, **24**, 4817–4830.

Velicogna, I., and J. Wahr, 2006: Measurements of time-variable gravity show mass loss in Antarctica. *Science*, **311**, 1754–1756.

Vernier, J.-P., and Coauthors, 2011: Major influences of tropical volcanic eruptions on the stratospheric aerosol layer during the last decade. *Geophys. Res. Lett.* **38**, LI12807, doi:10.1029/2011GL047563.

Vieira, G., and Coauthors, 2010: Thermal state of permafrost and active-layer monitoring in the Antarctic: advances during the International Polar Year 2007-09. *Permafrost Periglacial Processes*, **21**, 182–197.

Vimont, D. J., and J. P. Kossin, 2007: The Atlantic Meridional Mode and hurricane activity. *Geophys. Res. Lett.*, **34**, L07709, doi:10.1029/2007GL029683.

Visbeck, M. H., J. W. Hurrell, L. Polvani, and H M. Cullen, 2001: The North Atlantic oscillation: Past, present, and future. *Proc. Natl. Acad. Sci. USA*, **98**, 12876–12877.

Viviroli, D., H. H. Durr, B. Messerli, M. Meybeck, and R. Weingartner, 2007: Mountains of the world, water towers for humanity: typology, mapping, and global significance. *Water Resour. Res.*, **43**, W07447, doi:10.1029/2006WR005653.

Vongraven, D., and E. Richardson, 2011: Biodiversity – Status and trends of polar bears. *Arctic Report Card*, J. Richter-Menge, M. O. Jeffries, and J. E. Overland, Eds., NOAA Rep., 75–78. [Available online at http://www.arctic.noaa.gov/reportcard.]

Vörösmarty, C. J., C. A. Federer, and A. L. Schloss, 1998: Potential evaporation functions compared on US watersheds: Possible implications for global-scale water balance and terrestrial ecosystem modeling. *J. Hydrol.*, **207**, 147–169.

Wagner W., K. Scipal, C. Pathe, D. Gerten, W. Lucht, and B. Rudolf, 2003: Evaluation of the agreement between the first global remotely sensed soil moisture data with model and precipitation data. *J. Geophys. Res.*, **108**, 4611, doi:10/1029/2003JD003663.

Waliser, D. E., and C. Gautier, 1993: A satellite-derived climatology of the ITCZ. *J. Climate*, **6**, 2162–2174.

Wan, Z. M., 2008: New refinements and validation of the MODIS land-surface temperature/emissivity products. *Remote Sens. Environ.*, **112**, 59–74.

——, Y. L. Zhang, Q. C. Zhang, and Z. L. Li, 2002: Validation of the land-surface temperature products retrieved from Terra Moderate Resolution Imaging Spectroradiometer data. *Remote Sens. Environ.*, **83**, 163–180.

Wang, C., and S.-K. Lee, 2009: Co-variability of tropical cyclones in the North Atlantic and the eastern North Pacific. *Geophy. Res. Lett.*, **36**, L24702, doi:10.1029/2009GL041469.

——, D. B. Enfield, S.-K. Lee, and C. W. Landsea, 2006: Influences of the Atlantic warm pool on Western Hemisphere summer rainfall and Atlantic hurricanes. *J. Climate,* **19**, 3011–3028.

——, S.-K. Lee, and D. B. Enfield, 2007: Impact of the Atlantic warm pool on the summer climate of the Western Hemisphere. *J. Climate*, **20**, 5021–5040.

——, ——, and ——, 2008a: Atlantic warm pool acting as a link between Atlantic multidecadal oscillation and Atlantic tropical cyclone activity. *Geochem. Geophys. Geosyst.*, **9**, Q05V03, doi:10.1029/2007GC001809.

——, ——, and ——, 2008b: Climate response to anomalously large and small Atlantic warm pools during the summer. *J. Climate*, **21**, 2437–2450.

——, S. Dong, and E. Munoz, 2010: Seawater density variations in the North Atlantic and the Atlantic meridional overturning circulation. *Climate Dyn.*, **34**, 953–968.

——, H. Liu, S.-K. Lee, and R. Atlas, 2011: Impact of the Atlantic warm pool on United States landfalling hurricanes. *Geophys. Res. Lett.*, **38**, L19702, doi:10.1029/2011GL049265.

——, S. Dong, A. T. Evan, G. R. Foltz, and S.-K. Lee, 2012: Multidecadal co-variability of North Atlantic sea surface temperature, African dust, Sahel rainfall and Atlantic hurricanes. *J. Climate*, in press., doi:10.1175/JCLI-D-11-00413.1.

Wang, J., L. Zhang, A. Dai, T. Van Hove, and J. Van Baelen, 2007: A near-global, 8-year, 2-hourly atmospheric precipitable water dataset from ground-based GPS measurements. *J. Geophys. Res.,* **112**, D11107, doi:10.1029/2006JD007529.

Wang, L., and H. Liu, 2011: [Antarctica] 2009/10 seasonal melt extent and duration [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S167.

Wang, L., C.-Z. Zou, and H. Qian, 2012: Construction of stratospheric temperature data records from stratospheric sounding units. *J. Climate*, **25**, 2931–2946.

Wang, X., and J. Key, 2003: Recent trends in Arctic surface, cloud, and radiation properties from space. *Science,* **299**, 1725–1728.

——, and ——, 2005: Arctic surface, cloud, and radiation properties based on the AVHRR Polar Pathfinder data set. Part II: Recent trends. *J. Climate,* **18**, 2575–2593.

Wanninkhof, R., S. Doney, J. L. Bullister, N. M. Levine, M. J. Warner, and N. Gruber, 2010: Detecting anthropogenic CO_2 changes in the interior Atlantic Ocean between 1989 and 2005. *J Geophys. Res.* **115**, C11028, doi:11029/12010JC006251.

Wassmann, P., 2011: Arctic marine ecosystems in an era of rapid climate change. *Progr. Oceanogr.,* **90**, 1–17.

Weber, M., L. N. Lamsal, and J. P. Burrows, 2007: Improved SCIAMACHY WFDOAS total ozone retrieval: Steps towards homogenizing long-term total ozone datasets from GOME, SCIAMACHY, and GOME2. *Proc. Envisat Symposium 2007*, ESA SP-636, Montreux, Switzerland, European Space Agency, 5 pp. [Available online at http://envisat.esa.int/envisatsymposium/proceedings/posters/3P4/463281we.pdf]

——, S. Dikty, J. P. Burrows, H. Garny, M. Dameris, A. Kubin, J. Abalichin, and U. Langematz, 2011: The Brewer-Dobson circulation and total ozone from seasonal to decadal time scales. *Atmos. Chem. Phys.*, **11**, 11221–11235.

Wentz, F. J., 1997:, A well calibrated ocean algorithm for special sensor microwave / imager. *J. Geophys. Res.*, **102** (C4), 8703–8718.

——, L. Ricciardulli, K. A. Hilburn, and C. A. Mears, 2007: How much more rain will global warming bring? *Science*, **317**, 233–235.

WGMS, 2011: *Glacier Mass Balance Bulletin No. 11 (2008–2009).* World Glacier Monitoring Service, Zurich, Switzerland, 102 pp.

Wheeler, M. C., and G. N. Kiladis, 1999: Convectively coupled equatorial waves: Analysis of clouds and temperature in the wavenumber-frequency domain. *J. Atmos. Sci.*, **56**, 374–399.

——, and K. M. Weickmann, 2001: Real-time monitoring and prediction of modes of coherent synoptic to intra-seasonal tropical variability. *Mon. Wea. Rev.*, **129**, 2677–2694.

——, and H. H. Hendon, 2004: An all-season real-time multivariate MJO index: Development of an index for monitoring and prediction. *Mon. Wea. Rev.*, **132**, 1917–1932.

WHO, 2002: *Global Solar UV Index: A Practical Guide*. World Health Organization, 28 pp. [Available online at: http://www.who.int/uv/publications/en/GlobalUVI.pdf.]

Wielicki, B. A., and Coauthors, 1998: Clouds and the Earth's Radiant Energy System (CERES): Algorithm overview. *IEEE Trans. Geosci. Remote Sens.,* **36**, 1127–1141.

Wijffels, S. E, J. Willis, C. M. Domingues, P. Barker, N. J. White, A. Gronell, K. Ridgway, and J. A. Church, 2008: Changing expendable bathythermograph fall-rates and their impact on estimates of thermosteric sea level rise. *J. Climate*, **21**, 5657–5672.

Willett, K. M., P. D. Jones, N. P. Gillett, and P. W. Thorne, 2008: Recent changes in surface humidity: Development of the HadCRUH dataset. *J. Climate*, **21**, 5364–83.

Williams, C. A., G. J. Collatz, J. Masek, and S. N. Goward, 2012: Carbon consequences of forest disturbance and recovery across the conterminous United States. *Global Biogeochem. Cycles*, **26**, GB1005, doi:10.1029/2010GB003947.

Willis, J. K., 2010: Can in situ floats and satellite altimeters detect long-term changes in Atlantic Ocean overturning? *Geophys. Res. Lett.*, **37**, L06602, doi:10.1029/2010GL042372.

——, and L.-L. Fu, 2008: Combining altimeter and subsurface float data to estimate the time-averaged circulation in the upper ocean. *J. Geophys. Res.*, **113**, C12017, doi:10.1029/2007JC004690.

——, D. Roemmich, and B. Cornuelle, 2004: Interannual variability in upper ocean heat content, temperature, and thermosteric expansion on global scales. *J. Geophys. Res.*, **109**, C12036, doi:10.1029/2003JC002260.

Wisser, D., B. M. Fekete, C. J. Vörösmarty, and A. H. Schumann, 2010a: Reconstructing 20th century global hydrography: A contribution to the Global Terrestrial Network- Hydrology (GTN-H). *Hydrol. Earth Syst. Sci.*, **14**, 1–24.

——, S. E. Frolking, E. M. Douglas, B. M. Fekete, A. H. Schumann, and C. J. Vörösmarty, 2010b: The significance of local water resources captured in small reservoirs for crop production: A global-scale analysis. *J. Hydrol.*, **384**, 264–275.

WMO, 2009: Implementation Plan for the Sustained and Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM), Version 1.3. World Meteorological Organization, 28 pp. [Available online at http://www.wmo.int/pages/prog/sat/documents/SCOPE-CM_Implementation-Plan.doc.]

——, 2011: Scientific Assessment of Ozone Depletion: 2010. Global Ozone Research and Monitoring Project-Report No. 52, World Meteorological Organization, 516 pp.

Wolski, P., and M. M. Hudson, 2008: Alternative futures of the Okavango Delta simulated by a suite of global climate and hydro-ecological models. *Water SA,* **34**, 605–610.

Woodruff, S. D., and Coauthors, 2011: ICOADS release 2.5: Extensions and enhancements to the surface marine meteorological archive. *Int. J. Climatol.*, **31**, 951–967.

Wooster, M. J., G. Roberts, G. L. W. Perry, and Y. J. Kaufman, 2005: Retrieval of biomass combustion rates and totals from fire radiative power observations: FRP derivation and calibration relationships between biomass consumption and fire radiative energy release. *J. Geophys. Res.*, **110**, D24311, doi:10/1029/2005JD006318.

World Glacier Monitoring Service, 2011: Glacier mass balance data 2009/2010. [Available online at http://www.geo.uzh.ch/microsite/wgms/mbb/sum09.html.]

Worton, D. R., and Coauthors, 2007: Atmospheric trends and radiative forcings of CF_4 and C_2F_6 inferred from firn air. *Environ. Sci. Technol.*, **41**, 2184–2189.

Wunsch, C., and P. Heimbach, 2009: The global zonally integrated ocean circulation, 1992–2006: Seasonal and decadal variability. *J. Phys. Oceanogr.*, **39**, 351–368.

Wylie, D. P., D. L. Jackson, W. P. Menzel, and J. J. Bates, 2005: Global cloud cover trends inferred from two decades of HIRS observations. *J. Climate*, **18**, 3021–3031.

Wyrtki, K., 1981: An estimate of equatorial upwelling in the Pacific. *J. Phys. Oceanogr.*, **11**, 1205–1214.

Xie, P., and P. A. Arkin, 1997: Global precipitation: A 17-Year monthly analysis based on gauge observations, satellite estimates and numerical model outputs. *Bull. Amer. Meteor. Soc.*, **78**, 2539–2558.

Xiong, X., J. Sun, X. Xie, W. L. Barnes, and V. V. Salomonson, 2010: On- orbit calibration and performance of Aqua MODIS reflective solar bands. *IEEE Trans. Geosci. Remote Sens.*, **48**, 535–546.

Xue, Y., R. W. Reynolds, V. Banzon, T. Smith, and N. Rayner, 2011: [Global oceans] Sea surface temperature [in "State of the Climate in 2010"]. *Bull. Amer. Meteor. Soc.*, **92** (6), S78–S81.

Yoder, J., C. R. McClain, G. C. Feldman, and W. E. Esaias, 1993: Annual cycles of phytoplankton chlorophyll concentrations in the global ocean: A satellite view. *Global Biogeochem. Cycles*, **7**, 181–193.

Yu, L., 2011: A global relationship between the ocean water cycle and near-surface salinity. *J. Geophys. Res.*, **116**, C10025, doi:10.1029/2010JC006937.

——, and R. A. Weller, 2007: Objectively Analyzed air-sea heat Fluxes (OAFlux) for the global ocean. *Bull. Amer. Meteor. Soc.*, **88**, 527–539.

——, J. Xin, and R. A. Weller, 2008: Multidecade global flux datasets from the Objectively Analyzed Air-sea Fluxes (OAFlux) Project: Latent and sensible heat fluxes, ocean evaporation, and related surface meteorological variables. OAFlux Project Tech. Rep. OA-2008-01, 64 pp.

Yueh, S. H., and J. Chaubell, 2012: Sea surface salinity and wind retrieval using combined passive and active L-band microwave observations. *IEEE Trans. Geosci. Remote Sens.*, **50**, 1022–1032.

——, S. Dinardo, A. G. Fore, and F. K. Lee, 2010: Passive and active L-band microwave observations and modeling of ocean surface winds. *IEEE Trans. Geosci. Remote Sens.*, **48**, 3087–3100.

Zebiak, S. E., 1989: Oceanic heat content variability and El Niño cycles. *J. Phys. Oceanogr.*, **19**, 475–486.

Zenklusen Mutter, E., J. Blanchet, and M. Phillips, 2010: Analysis of ground temperature trends in Alpine permafrost using generalized least squares. *J. Geophys. Res.*, **115**, F04009, doi:10/1029/2009JF001648.

Zhang, C., 2005: Madden-Julian oscillation. *Rev. Geophys.*, **43**, 1–36.

——, and J. Gottschalck, 2002: SST Anomalies of ENSO and the Madden Julian oscillation in the equatorial Pacific. *J. Climate*, **15**, 2429–2445.

Zhang, G. J., and M. J. McPhaden, 1995: The relationship between sea surface temperature and latent heat flux in the equatorial Pacific. *J. Climate*, **8**, 589–605.

Zhang, G. Q., J. H. Xie, S. Q. Duan, M. Z. Tian, and D. H. Yi, 2011: Water level variation of Lake Qinghai from satellite and in situ measurements under climate change. *J. Appl. Remote Sens.*, **5**, 053532, doi:10.1117/1.3601363.

Zhang, R., T. L. Delworth, and I. Held, 2007: Can the Atlantic Ocean drive the observed multidecadal variability in Northern Hemisphere mean temperature? *Geophys. Res. Lett.*, **34**, L02709, doi:10.1029/2006GL028683.

Zhang, X., F. W. Zwiers, G. C. Hagerl, F. H. Lambert, N. P. Gillet, S. Solomon, P. A. Stott, and T. Nozawa, 2007: Detection of human influences on twentieth-century precipitation trends. *Nature,* **448**, 461–465.

Zhao, L., Q. Wu, S. S. Marchenko, and N. Sharkhuu, 2010: Thermal state of permafrost and active layer in Central Asia during the International Polar Year. *Permafrost Periglacial Processes*, **21**, 198–207.

Zhou, X., M. Geller, and M. Zhang, 2001: Tropical cold point tropopause characteristics derived from ECMWF reanalyses and soundings. *J. Climate*, **14**, 1823–1838.

Zwally, H. J., and S. Fiegles, 1994: Extent and duration of Antarctic surface melting. *J. Glaciol.*, **40**, 463–476.

Libraries: Please file with the *Bulletin of the American Meteorological Society*, Vol. 93, Issue 7