Pathfinder Sea Surface Temperature Climate Data Record

Sheekela Baker-Yeboah[1,2], Korak Saha[1,2], Dexin Zhang[1,3], and Kenneth S. Casey[1]

[1]NCEI-MD, [2]University of Maryland CICS, [3]Science and Technology Corporation

Pathfinder SST CDR Description

Global sea surface temperature (SST) fields are important in understanding ocean and climate variability. The NOAA National Centers for Environmental Information (NCEI) develops and maintains a high resolution, long-term, climate data record (CDR) of global satellite SST. Since 1981 fields of SST values have been collected using Advanced Very High Resolution Radiometer (AVHRR) instruments aboard polar-orbiting satellites of the NOAA series. The AVHRR Oceans Pathfinder SST algorithm is based on the Non-Linear SST algorithm using the modernized NASA SeaWiFS Data Analysis System (SeaDAS). Coefficients were generated using regression analyses with co-located *in situ* and satellite measurements.

All previous versions of Pathfinder included L3C products. Pathfinder Version 5.3 includes

- L2P, L3U, and L3C products **(Figure 1.A through C)** and SST values of all quality levels, giving the user more pixels to work with (**Figure 2**);
- Processing done using cloud computation in Amazon Web Service (**Figure 3**) under NOAA cloud pilot project;
- Better identified and flagged anomalous hot-spots at land-water boundaries;
- Updated land mask (based on Global Lakes and Wetlands Database) and sea ice data over the Antarctic ice shelves masked as ice;
- Improved handling of sun glint areas;
- Consistent cloud tree tests for NOAA07 and NOAA-19 with respect to other sensors;
- Revised attributes of global variables in the netCDF files in a more consistent netCDF format with CF/ACDD conventions that remain consistent with Group for High Resolution SST (GHRSST) GDS2 requirements.

Pathfinder SST CDR Images

Figure 1. Pathfinder SST CDR products: (A) level 2P and L3U (B) products from large orbit files will be available to users in the release of version 5.3; (C) Level 3C provided as in all previous versions.

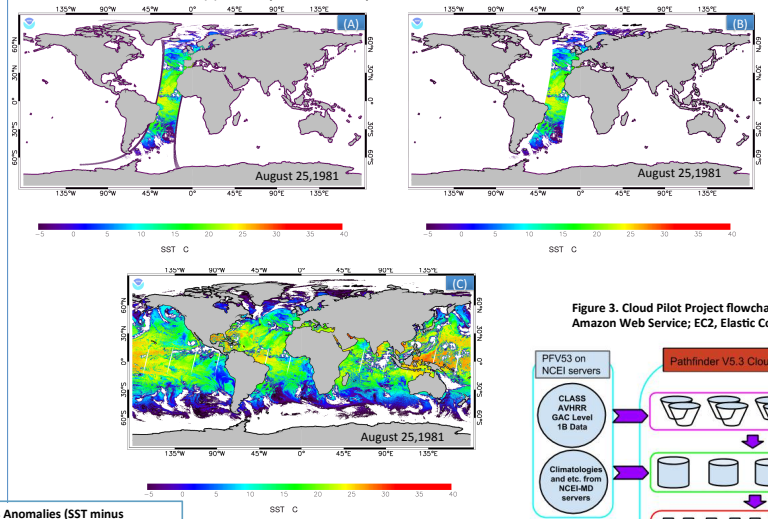


Figure 2. More data product files available to user (L2P, L3U, L3C) and more data pixels in version 5.3.

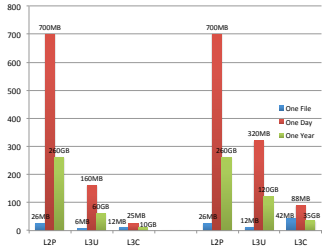
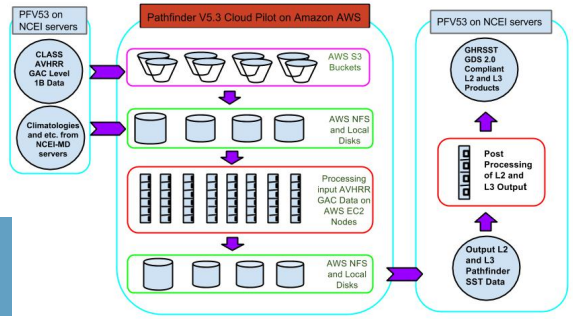


Figure 3. Cloud Pilot Project flowchart for Pathfinder SST version 5.3. (Acronyms: AWS, Amazon Web Service; EC2, Elastic Compute Cloud; S3, Simple Storage Service.)



Current Applications of the Pathfinder SST CDR

The Pathfinder SST CDR is recognized and utilized by users as an authoritative source of SST and contributes to the international effort on quality controlled SST field through GHRSST. This CDR is a primary source of information for numerous regional and global marine resource efforts, e.g., local habitat characterization, coral reef stress monitoring by Coral Reef Temperature Anomaly Database (CoRTAD, **Figure 4**), and El Niño events. NCEI provide long-term preservation and access to data and metadata for data discovery: enhanced access to data, supporting functions such as on-line visualization and subsampling. Additional applications include

- Input to produce a collection of sea surface temperature (SST) and related thermal stress metrics, developed specifically for coral reef ecosystem applications (the full suite of CoRTAD)
- Input source of AVHRR data for the Danish Meteorological Institute L4 reanalysis (**Figure 5**)
- AVHRR input to MGDSST (level 4) developed by Japanese Meteorological agency (JMA) reanalysis dataset (1982--current)
- Used in the Italian National Research Council (CNR) Reanalysis over the Mediterranean region.
- Acts as a reference climatology to OSTIA SST by UK Met office
- Used in reanalysis for NOAA OISST developed by NCEI.

Figure 4. CoRTAD Version 5 Thermal Stress Anomalies (SST minus Maximum of Weekly Mean Climatological SST) during an El Niño event.

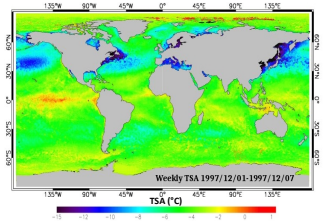
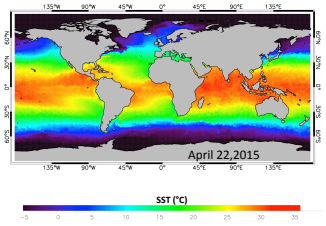


Figure 5. GHRSST-Danish Meteorological Institute OI level 4 global SST field.



ACKNOWLEDGMENTS

We gratefully acknowledge the many contributions of Robert Evans and others who continue to work with him on the pathfinder coefficients and other valuable input to this CDR.

Future Improvements of Pathfinder SST CDR and Anticipated Applications

The Pathfinder SST CDR products are improved with scientific quality assessments through rich inventory analysis and in situ data matchups. Future improvements include

- Improve the scientific quality of the data through a rigorous Rich Inventory analysis and developing match up database with in-situ SST
- Update of the CDR on a Quarterly basis
- Apply Climate Data Assessment Framework (CDAF) based on the GHRSST community standards
- Investigate how to improve the pathfinder "dt_analysis",
- Improved quality assessment: compare Pathfinder version 5.3 with a different CDR, e.g., ARC, and explore uncertainties in the SST based on FIDUCEO (Fidelity and Uncertainty in Climate data Records from Earth Observation) project.
- Populate the SSES_bias and SSES_standard_deviation variables for pathfinder v6 to make it 100% GDS2 compliant
- Mint DOIs for the new Pathfinder 5.3 once it is archived.