PROJECT TITLE: A Fundamental Climate Data Record of SSMI, SSMIS and Future Microwave Imagers

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PROJECT OBJECTIVES:

--Development and production of a Level 1A BASE file dataset in NetCDF. This will involve orbitized Level 1 data granules containing all of the information in the original Temperature Data Record (TDR) files with the addition of value added fields such as improved spacecraft ephemeris and comprehensive metadata fields.

--Revisit quality control procedures and reconstruction of the most complete possible time series of SSM/I TDR data.

--Characterization of calibration issues for SSM/I and SSMIS. These include falloff in brightness temperatures near the edge of the scan, solar/lunar intrusions into the calibration counts, emissive SSMIS antenna and radio frequency interference such as that caused by the radar calibration (i.e., RADCAL) beacons on board F15 in August of 2006.

--Characterization of sensor specific antenna pattern function for accurate antenna to sensor brightness conversion.

--Characterization of errors in the pixel geolocation, and thus the Earth incidence angle, as a function of time resulting from changes in the spacecraft attitude.

--Characterization and resolution of intersensor biases using multiple approaches. This will include investigating the dependence of biases on the scene temperature by using techniques over both land and ocean and developing a best practice for estimating the errors in the SSM/I two-point calibration system.

--Production of an FCDR of microwave imager brightness temperatures from SSM/I and SSMIS along with processing code suitable for transition to NCDC.
--Full documentation of the procedures involved in going from the Level 1A to the FCDR dataset.

PROJECT ACCOMPLISHMENTS:
--We worked with the implementation group at NCDC to update/finalized the BASE file formats for both SSM/I and SSMIS to be CF compliant. The BASE files have been processed for the length of the data records up through the end of 2011.

--Quality control procedures have been implemented/updated for the SSMIS FCDR. Currently they are only applied to the SSM/I like channels as these are the only ones being intercalibrated to produce FCDR TBs.

--The cross-track bias corrections were updated to eliminate the end of scan falloff, but not the roll effect as this is tied to the calculated view angle. Initially, the cross-track bias correction adjusted the mean Tb values to be flat across the scan, but they shouldn’t be if there is a roll offset. We also developed a correction for the RADCAL interference in the F15 data after August of 2006. The beta version data was produced and a report written detailing the correction as well as an error estimate, which determined the corrected data is useful for some applications, but not for climate trends etc.

--We assessed various options for the antenna pattern correction for SSMIS and decided to go with a basic spillover and cross-polarization correction. This is different than the operational SDR code, which applies a scene dependent (i.e. temperature dependent) correction. We felt it was better to apply a basic APC correction and use our intercalibration analysis to solve for and implement and residual calibration differences between sensors.

--We modified the geolocation analysis to solve for spacecraft roll offsets based on the slope of the cross-track biases and then using our coastline analysis to solve for the pitch and yaw offsets. Our original analysis attempted to solve for roll, pitch, and yaw using our coastline analysis, however, we found that the roll and yaw were not independent and thus we got unreasonable results. This approach has been run and finalized for the SSM/I and related SSMIS channels and a publication detailing our geolocation analysis was submitted to TGARS.
--Five independent techniques have been implemented to develop intercalibration corrections for SSM/I including a warm scene calibration over the Amazon. The results are generally consistent with 0.5K giving us a high degree of confidence in the results. A paper detailing our multiple intercalibration approaches and the results for the SSM/I sensors was submitted to TGARS. For SSMIS four of the approaches have been implements for the SSM/I like channels. We are close to finalizing the results and releasing a beta version of the data to beta test users to solicit feedback.

--The code to produce the FCDR for SSM/I and SSMIS has all been written. A beta release of the SSM/I FCDR data was made available to select users in October of 2011 and we are planning for a beta release of the SSMIS sensors (F16, F17, and F18) within the next few weeks. We have also presented the results of our geolocation and intercalibration analysis at several conferences and meetings over the past year.

--We are currently devoting a significant amount of effort to fully documenting the data, software, and approaches. As mentioned above we submitted two manuscripts to TGARS for publication in a special issue on intercalibration. We have written a number of detailed reports on various aspects of the project and are working to fully document the code and produce ATBDs for both the SSM/I and SSMIS FCDRs. Publications describing the geolocation analysis (calculating satellite attitude) and the intercalibration have been submitted to IEEE Transactions on Geoscience and Remote Sensing.