The September 2006 Update to RSS Climate Data Records

Introduction

A major update to the SSM/I and TMI datasets has been implemented.
SSM/I Version 5 (V05) has been updated to Version 6 (V06).
TMI Version 3 (V03) has been updated to Version 4 (V04).
The major objectives of the updates were to:

1. Remove spurious trends in the wind speed retrievals.
2. Implement a much-improved cloud and rain rate algorithm.
3. Achieve better consistency for all retrievals over the 8 satellite platforms (i.e, 6 SSM/I, TMI, and AMSR-E).
4. Make minor improvements in other retrievals, namely SST and vapor.

In addition to the SSM/I and TMI updates, a minor update to the AMSR-E rain rates has also been implemented. There was a small bug in the calculation of the composite maps (3-day, weekly, and monthly) that mostly affected the monthly maps. As a result, the monthly rain rates were biased low by about 0.03 mm/hr relative to the daily maps. Also, in the daily maps, extremely light rain (<0.025 mm/h) is now set to zero. This change has little effect on the mean rain rates, but does affect the aerial coverage. Since this is a minor update, we denote it as V05a, as compared to the preceding V05 dataset.

Two scientific papers (wind and rain) are in preparations that describe in detail the new wind and rain products. Drafts of the papers will be available at www.remss.com by the end of November 2006.

For all of these updates, the satellite datasets have been completely reprocessed and the new versions, in their entirety, are now available for downloading. Any users doing climate work with our wind speeds or rain rates should definitely replace their earlier versions with SSM/I V06 and TMI V04. We also suggest that the AMSR-E V05a datasets be downloaded to ensure complete consistency among the various datasets. There are no changes to the file format, so read routines do not need to be changed.

RSS considers the September 2006 Update to be a very important milestone in our production of Climate Data Records (CDR). Investigators can confidently use these new satellite datasets for detailed interannual and decadal trend studies. As always, continued funding for production and dissemination of these CDR is dependant upon you, the users, to let us know how you have used these data and their value to your research. Please make sure you provide us with information about your work, send results and/or papers to our office, and always provide your correct email when accessing the data by ftp.

Algorithm Improvements for TMI

1. The generation of a CDR for TMI is particularly challenging due to the following:

   a. The vapor-deposited aluminum (VDA) on the TMI antenna oxidized and/or cracked. As a result the antenna has an emissivity of graphite, which is 3 to 4%.
   b. The solar environment for TMI is constantly changing due to its near-equatorial orbit drifting through the diurnal cycle. Furthermore, the solar environment changes radically every month or so when a 180° yaw maneuver is completed.
   c. In September 2001, the TMI orbit was boosted from an altitude of 350 km to 400 km.
   d. There are small errors in the knowledge of the satellite roll and pitch, particularly right after the 2001 orbit boost.

   Our new calibration algorithms attempt to correct for all these effects. We found that the algorithm used to correct roll and pitch errors was introducing a small along-scan error in the SST and wind retrievals. This problem has been fixed in V04. We also found small systematic biases in the SST, wind, and vapor retrievals that were correlated with the yaw state (either 0° or 180°). Finally, we found small systematic biases in wind and vapor for the time period before the boost as compared to the time period after the boost. Both these biases have been removed in V04 products.
2. The new rain rate algorithm was implemented, as described in Item 2 above for SSM/I. As a result, the cloud water and rain rate retrievals are now very consistent across all 8 satellite platforms (i.e, 6 SSM/I, TMI, and AMSR-E).
3. TMI had been using the same type of T_A resampling as we use for AMSR-E (see Item 3 above in the SSM/I description). However, the resampling was not correctly taking into account the change in geometry that occurs when TMI goes through a 180° yaw maneuver. The resampling weights were correct for 180° yaw orientation but were incorrect for the 0° yaw orientation. This error led to a distortion near the swath edges and produced a positive bias in cloud water and rain rate at the swath edges. We have corrected this problem and now use 4 separate sets of resampling weights: yaw 0°-preboost, : yaw 180°-preboost, yaw 0°-postboost, : yaw 180°-postboost. Use of the new weights makes little impact on SST, wind speed, or columnar water vapor, but does significantly affect cloud water and rain rate.
4. The geophysical retrieval algorithm and data processing system was updated as described in item 4 above for SSM/I.