NWP SAF

Satellite Application Facility for Numerical Weather Prediction

Tools for improved use of hyperspectral IR observations

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NRL

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Nigel Atkinson was gracious to guide me through implementation of the AAPP bufr decoders. We successfully read the NOAA produced IASI and AQUA bufr files which are ingested at NRL. The NAVDAS read routines for AQUA AIRS/AMSU data were modified on local MetOffice systems to use the AAPP decoders and fully integrated into the NAVDAS AQUA pre-processor. They were somewhat inadvertently tested with g77, gfortran, and ifort compilers successfully. This will be ported to NRL systems upon return.

An infrared emissivity atlas was created from August 2007 means values on the UK MetOffice Unified Model (UM) grid of 640x481. The vegetation and soil databases were also regridded to this model grid. The emissivity atlas that has been completed consists of 1101 spectral data points running from 3.0 to 14.0 µm at 0.01 µm resolution. The limitation of 14.0 µm is set by the fidelity of the ASTER spectral library measurements which are used as a baseline.

The method to create the database in short consists of taking mean infrared emissivity values from the HIRS sensors. These means are retrieved for HIRS channels 08, 10, 18, and 19 corresponding to 11.11, 12.47, 4.00, and 3.76 µm respectively. An indexed emissivity map is also created which incorporates, soil type fraction, vegetation fraction, and monthly mean vegetation greenness. Optionally snow and sea-ice can also be added. These surface database values are used to reference different profiles in the ASTER spectral library and created an 'indexed emissivity' map. Linear regression coefficients are found between the HIRS wavelengths and the full spectral. The coefficients are then applied to the retrieved monthly HIRS mean emissivities to create an updated spectral map.

The FORTRAN90 code to perform this work was written and compiled on the UK MetOffice systems and is available for use. The ancillary data (surface databases at full resolution), and code to regrid them is also included.

Included are 3 figures. The Figure 01 shows locations of sample spectra which are displayed in Figure 02. While Figure 03 shows an example of the emissivity altas for 10.7 µm.

Ongoing work is to finalize a set of eigenvectors over which to project the emissivity spectra. On the last day of the visit, Ed Pavelin supplied an IDL routine he used in prior SVD of laboratory emissivity spectrum from Havemann and Taylor; and it should prove to be useful in producing the same reconstruction capability for the emissivity atlas. It is planned to just try to reconstruct snow-free land points (no ocean or sea-ice) as a starting point. This work is to be completed at NRL.

Figure 01: Locations of selected emissivity spectra samples.

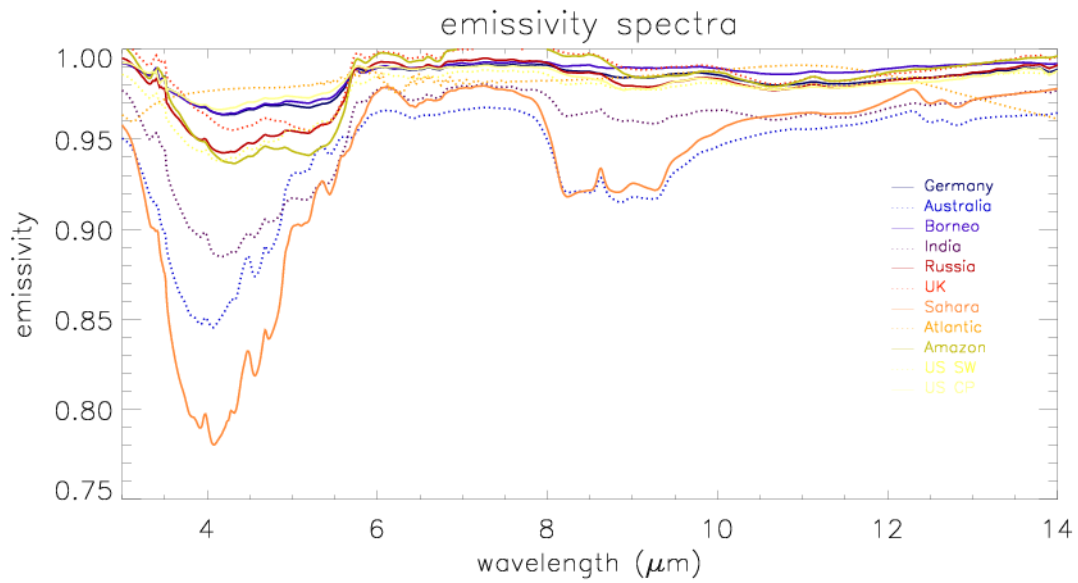Figure 02: Single point samples of 11 spectra from the August emissivity atlas.
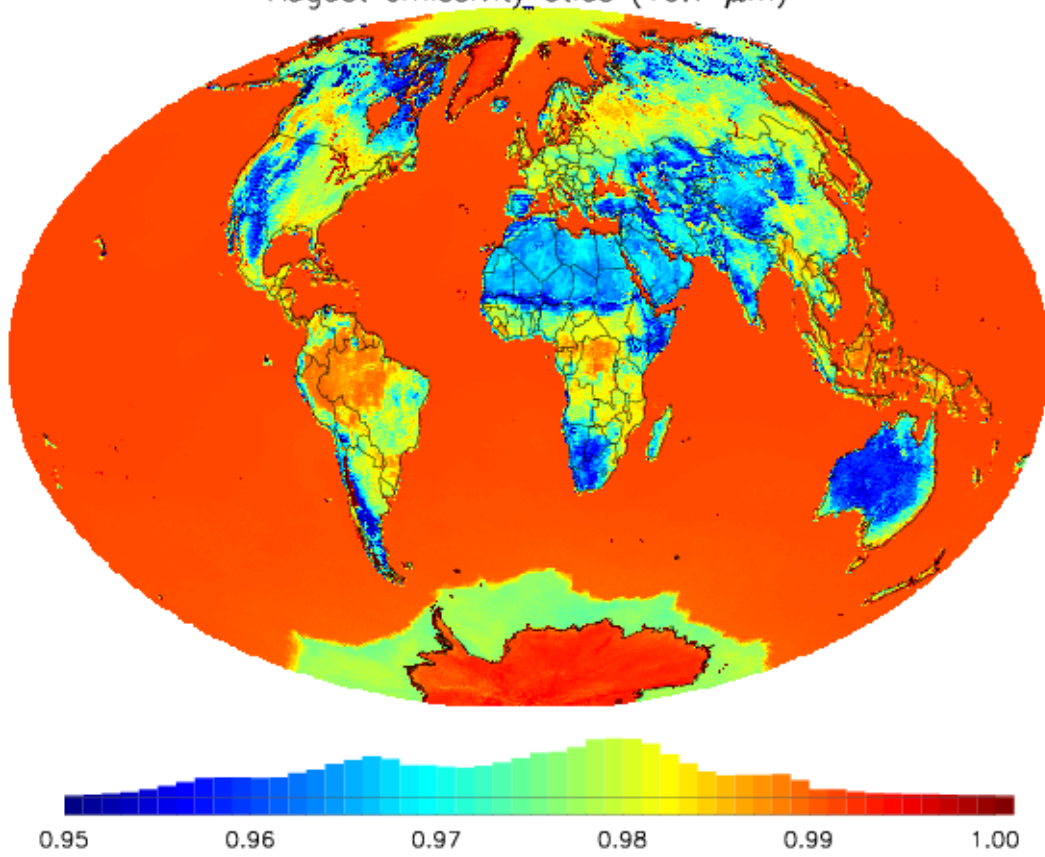
Figure 03: A single spectra point (index 771) corresponding to the 10.7 µm wavelength emissivity from the atlas.