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Cloud-filtering of AIRS data

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The Atmospheric Infrared Sounder (AIRS) on the Earth Observing System (EOS) Aqua satellite was launch in May 2002 into polar orbit and has been producing 4 million spectra of the globe each day since September 2002. In order to retain the maximum radiometric accuracy and gaussian noise characteristics of the AIRS data, all effects of cloud contamination have to be eliminated from the calibrated radiances. This can be done by either eliminating the effects of clouds ("cloud-clearing") using the combination of infrared and microwave measurements or by rejecting cloud contaminated data ("cloud-filtering"). Cloud contaminated data have historically been rejected by the combination of spatial coherence and spectral tests. In this paper we discuss cloud-filtering optimized for the high spectral resolution of the AIRS data. This allows a very accurate assessment of the degree of cloud contamination of a spectrum in a single spectrum, potentially avoiding the spatial coherence test.

We use the number of 3K outliers of the sea surface temperature deduced from the AIRS data relative to the NCEP RTG.SST as the figure of merit of the success in eliminating cloud contaminated data. The number of spectra accepted by these tests is a function of the acceptable outlier rate. If 1:100 outliers are acceptable, then no spatial coherence test is required and 20% of the data from day and night ocean within +/-50 degree latitude pass the cloud screening test. 2% of the data pass the cloud-screening tests, if a tight spatial coherence test and spectral tests are used, resulting in outlier rates of less then 1:10,000. Closer analysis of the cloud-filtered spectra reveals the presence of an unaccounted for atmospheric absorption component, which causes a cold bias of about 0.3K. In addition, about 10% of the data are contaminated by significant amounts of thin cirrus, which does not impact the surface temperature retrieval accuracy, but causes a cold bias of more than 0.4K in the 9 to 12 micron window channels. This may impact the retrieval of Ozone and CO_2 from the AIRS data.

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