Characterization of Infrared Imager/Sounder and Infrared/Microwave Sounder Synergistic Cloud-Cleared Infrared Radiances

H.-L. Huang[1], Li Guan[1], Kevin Baggett[1], Jun Li[1], Chian-Yi Liu[1], Xuebao Wu[1], Timothy J. Schmit[2], and W. Paul Menzel[2]

[1] Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison

[2] Office of Research and Applications, NOAA/NESDIS

Satellite infrared sounders, such as AIRS, CrIS, and IASI, have relatively large fields of view that the probability of an entirely cloud-free observation is characteristically low. The direct assimilation of cloudy radiances and cloudy sounding retrievals is currently prohibitive due to the difficulty in accurate modeling and treatment of the cloud signal part of the measurements. Efforts have only just begun to model the microphysical complexity of clouds and their radiative responses, Still under development is the parameterization of cloud properties that will deliver much needed improvements in the speed and accuracy of forward radiative transfer models. In the interim, indirect use of cloud contaminated radiances by way of cloud-cleared radiances has since received great attention to improve both the spatial and spectral yields of useful satellite infrared radiances and sounding products.

Two classes of cloud-clearing retrieval approaches for IR radiances developed so far involve the synergistic use of 1) collocated infrared and microwave measurements, and 2) collocated infrared imaging and sounding measurements. For example, the NASA Earth Observing System (EOS) is currently demonstrating the AIRS/AMSU and AIRS/MODIS cloud-clearing algorithms. These algorithms are to be adopted by NPP/NPOESS as that will have similar measurements available from the instrument suites CrIS/ATMS and CrIS/VIIRS.

In this paper we will evaluate the characteristics of these cloud-cleared radiances and their potential for improvements of numerical weather prediction and cloudy sounding applications. Preliminary results have shown that these two approaches, though quite different in character, and processing methodology, are both effective and have certain unique characteristics and deficiencies. Where microwave measurements are unavailable, the synergistic imaging/sounding approach to cloud-clearing is the only reliable indirect use of cloud contaminated infrared measurements. This is the case for the U.S. Geostationary Operational Environmental Satellite (GOES) next generation system (GOES-R) that will carry only the infrared imager ABI (Advanced Baseline Imager) and infrared sounder HES (Hyperspectral Environmental Suite).

INTERNATIONAL ATOVS WORKING GROUP

Proceedings of the Fourteenth International TOVS Study Conference

Beijing, China
25-31 May 2005