GLOBAL DAILY ATMOSPHERIC STATE PROFILES FROM THE ATMOSPHERIC INFRARED SOUNDER

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1. INTRODUCTION

The Atmospheric Infrared Sounder (AIRS) is a hyperspectral infrared instrument on the EOS Aqua Spacecraft, launched on May 4, 2002. AIRS has 2378 infrared channels ranging from 3.7 μm to 15.4 μm and a 13.5 km footprint. AIRS, in conjunction with the Advanced Microwave Sounding Unit (AMSU), produces temperature profiles with 1K/km accuracy on a global scale, as well as water vapor profiles, clouds, dust and trace gas amounts for CO_2, CO, SO_2, O_3 and CH_4.[1] AIRS data are used for weather forecasting and studies of global climate change. The AIRS is a "facility" instrument developed by NASA as an experimental demonstration of advanced technology for remote sensing and the benefits of high resolution infrared spectra to science investigations.

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2. CALIBRATED RADIANCE PRODUCT

The most fundamental product from AIRS are the calibrated radiances and geolocation in the Level 1B data product. The upwelling infrared spectrum contains a wealth of information about the state of the atmosphere including temperature profile, water vapor, and the trace gases mentioned above. The AIRS radiances are derived from the instrument signal (digital counts) by applying a 2 point calibration using the on-board blackbody and space views. A nonlinearity and polarization correction are also applied. The resulting calibration radiometric accuracy is better than 0.2K across the spectrum and stable to less than 10 mK/year [2].

3. SCIENCE DATA PRODUCTS

Radiative Transfer Algorithms allow one to determine the state of the atmosphere when used in conjunction with AIRS data. The AIRS Project has already performed the retrieval of temperature and water vapor profiles and trace gas amounts using a Singular Value Decomposition (SVD) retrieval algorithm. Data products are generated and stored in the AIRS Level 2 standard product [3]. Most L2 products are produced on at 45 x 45 km resolution at nadir and are "cloud cleared", with valid retrievals up to 80% cloud cover. Level 2 temperature fields agree well with NWP center predictions (ECMWF, NCEP), however comparison with water vapor and most trace gases has identified model prediction errors. This makes the AIRS very useful as a validation tool as the models develop. The AIRS L2 data products are available near-real-time weather forecast prediction and are available 3 hours from data acquisition at the GES/DISC, and in real time from the direct broadcast receiving stations. Real-time products are also used for detection of clouds, aerosols and trace gases for flight science validation campaigns.

4. USE OF AIRS FOR ATMOSPHERIC CORRECTION

Use of the AIRS data for atmospheric correction of higher spatial resolution thermal sensors including Landsat, MODIS or ASTER have not been fully explored. Difficulties arise when trying to account for the varying spatial resolution of the instruments particularly in non-uniform scenes and over land. New techniques for correcting the AIRS non-uniform response have been developed to facilitate the use of the raw data and are presented here [4]. AIRS water vapor observations

can be expected to be better than models for most places and at most altitudes. More than one application of using the AIRS water vapor data directly for atmospheric correction has been performed. Known methods will be summarized here.

5. CONCLUSIONS

AIRS has been found to be unique in its ability to detect the infrared radiative properties of dust and thin cirrus clouds. This combined with its ability to measure water vapor and trace gases make it ideal as a tool for atmospheric state determination.

11. REFERENCES

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