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Cloud properties from AIRS

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Since May 2002 the Atmospheric Infrared Sounder (AIRS), in combination with the Advanced Microwave Sounder Unit (AMSU), onboard the NASA Aqua satellite provides measurements at very high spectral resolution of radiation emitted and scattered from the atmosphere and surface. The instrument was developed to provide atmospheric temperature and water vapour profiles at a vertical resolution of about 1 km and 2 km, respectively, but the high spectral resolution of this instrument also allows the retrieval of cloud properties (especially cirrus), aerosol and surface properties as well as the quantity of trace gazes. We present a cloud property retrieval scheme, which is based on a weighted χ^2 method using channels around the 15 micron CO_2 absorption band, to determine effective cloud emissivity and cloud pressure. The influence of channel choice, cloud detection, spatial resolution and of assumed atmospheric profiles on the retrieval are discussed. Results are compared to cloud properties from AIRS L2 products (version 4), the International Satellite Cloud Climatology Project (ISCCP) and from the Moderate Resolution Imaging Spectroradiometer (MODIS) of the same time period, as well as to the cloud climatology of TOVS (TIROS-N Operational Vertical Sounder) Path-B. The cloud properties retrieved from AIRS are very similar to those from the TOVS Path-B climatology. The Intertropical Convergence Zone is much better apparent with AIRS, TOVS and ISCCP than with MODIS data. The AIRS L2 data show in general average cloud pressures which are much lower than the other datasets. Cloud detection plays an important role in the cloud property retrieval: the tighter the cloud detection the larger the average p_{cld} and LCA, because partly cloudy spots are identified as low opaque clouds. This could probably also explain the large averages of p_{cld} from MODIS. A retrieval at coarser spatial resolution leads to a slightly larger high cloud amount. Adding more channels in the cloud property retrieval did not affect the results, probably because most of the information is

already contained in the five channels used for sounding the atmosphere. The most important factor in choosing the TIGR atmospheric profiles closest to the AIRS L2 profiles is the weight between temperature and water vapour in the proximity recognition, but again the sensitivity is smaller than for spatial resolution or cloud detection.