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Synergistic use of Imager Window observations for Cloud Clearing of Sounder Observation for INSAT-3D

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Abstract. The retrieval of atmospheric temperature and water vapor profiles from infrared Sounder are severely limited by the presence of cloud. Therefore, retrieval from infrared sounding observations is performed only over clear-sky atmospheric conditions. The probability of finding a clear-sky pixel at spatial resolution of 10 km is found to be very small globally. This study presents a quantitative analysis of the clear-sky probability that is carried out for different months over the Indian region for INSAT-3D Sounder. The probability of a clear-sky is found to be ~7 % for the field of view of 10 km corresponding to the INSAT-3D Sounder. This statistical analysis is established using MODIS cloud mask having 95 % confidence level at 1 km resolution spread in the region between 50E– 110E and 30S– 30N. This necessitates cloud clearing to remove the effect of partial clouds in the Sounder FOV to provide a clear-sky equivalent sounding retrieval.

Various methods were explored to derive the cloud-cleared radiances using supplementary information such as high resolution infrared or microwave observations. This study presents an effort to use the existing traditional method to derive optimal cloud-cleared radiances for INSAT-3D Sounder, by estimating the fractional cloud cover using collocated high resolution INSAT-3D Imager window channel observation. The final Sounder cloud-cleared radiances have been validated with the operational AIRS L2 cloud-cleared radiance products.

Nevertheless, the statistical analysis of clear-sky probability over Indian region also provides a significant insight towards the dependency of spatial resolution and the considerable field-of-regard (FOR) in obtaining the clear-sky area in the satellite observations. This, in a way, necessitates the cloud-clearing for coarser resolution sensors and at the same time, states the benefits of using very high resolution sensors. It has been observed that FOV of 1km and by choosing a reasonably good FOR can eliminate the cloudy-sky hindrances by increasing the probability of clear-sky from 5 % to 50 %.

