

Retrieval of Rainfall from Satellite Microwave Radiances

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ABSTRACT

Radiation from the earth's surface (whether from the land or from the ocean) gets attenuated and scattered because of the constituents present in the atmosphere. Hence, microwave radiation measured at the top of the atmosphere with the help of a satellite, frequently referred to as the "signature" of the atmosphere, can be used to infer the constituents of the atmosphere. By this we mean among other parameters, precipitating water, precipitating ice, cloud ice and cloud liquid water content. The determination of the radiant intensity once we know all these parameters is called the "forward problem" of atmospheric radiation and the retrieval of these parameters once the radiant intensity is known is called the "inverse problem". The retrieval problem is of great practical interest, as precipitation from oceans has to be necessarily remotely sensed. More importantly, precipitation is also a crucial input in many climate models. The solutions of both the forward and inverse problems are challenging, with the inverse problem giving us additional difficulties, consequent upon its high dimensionality and the attendant ill-posedness. In this lecture, we look at both the problems and see how the rainfall parameters could be retrieved using state of the art optimization techniques. We apply the "suite of algorithms" that has been developed to the case of FANOOS - a tropical cyclone that crossed the Bay of Bengal in December 2005. Finally, the possibility of using advanced algorithms like Principal Component Analysis (PCA) enabled Artificial Neural Networks to handle the high dimensionality is also explored.