Geophysical Research Abstracts, Vol. 8, 10186, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10186

Precipitation retrieval and analysis of severe storm events based on Cloud Dynamics and Radiation Database (CDRD) approach

A. Mugnai (1), F. Baordo (1), J. Hoch (2), C.M. Medaglia (1), A. Metha (3), E.A. Smith (3), and G.J. Tripoli (2)

(1) Istituto di Scienze dell'Atmosfera e del Clima, CNR, Roma, Italy; (2) Dept. of Atmospheric and Oceanic Sciences, University of Wisconsin, Madison, Wisconsin, USA; (3) Goddard Space Flight Center, NASA, Greenbelt, Maryland, USA.

(a.mugnai@isac.cnr.it / Phone: +39 06 4993.4575)

Visible/infrared measurements from geostationary (GEO) satellite platforms enable following storm development at the relevant space and time scales, but have limited applicability for quantitative precipitation measurement. Alternatively, passive microwave (MW) observations from low Earth orbiting (LEO) satellites provide more direct and reliable measurements of precipitation and cloud internal structure, but do not properly address the fundamental space-time scales of precipitation and storm evolution. Active MW sensors, that is space radars, can provide more accurate and detailed precipitation measurements, however – as evident from TRMM Precipitation Radar (PR) measurements – with even lower space and time coverage than provided by passive MW radiometers. Finally, space-based lightning measurements provide information useful for convection detection, but again at LEO-based space-time scales.

In this study, we develop a unified precipitation retrieval and analysis framework that combines all available multisensor (both GEO- and LEO-based) satellite observations in conjunction with atmospheric simulations produced by a cloud resolving model (CRM). This unified framework is designed to take advantage of the respective strengths of the different data sources in combination with the CRM in monitoring and nowcasting hazardous, flood-producing storms that intermittently strike the basins of the Mediterranean Sea and Caribbean Sea - Gulf of Mexico.

At the outset of the study, we develop the foundations of a new approach for precipitation retrieval, which is based on extending the Cloud-Radiation Database (CRD) method used by most physically-based MW algorithms, particularly Bayesian algorithms. This is accomplished by a more general implementation of the CRD method, one that incorporates an extensive mix of the CRM's dynamical, thermodynamical and microphysical variables and more inclusive measurement simulation vis-à-vis all relevant space sensors useful for the retrieval application. We call this the Cloud Dynamics and Radiation Database (CDRD) approach, and demonstrate that this approach: (a) reduces retrieval uncertainty by increasing the number of constraints; and (b) improves retrieval performance stemming from the considerable predictability of the dynamical, thermodynamical and microphysical properties of many precipitating storm systems.