ANALYSIS AND VALIDATION OF CLOUD AND PRECIPITATION MICROPHYSICAL PROPERTIES OF DEEP MOIST CONVECTION OVER SOUTH EASTERN SOUTH AMERICA (SESA), USING OBSERVATION AND MODELING TOOLS

Victoria Sol Galligani[1], Paola Salio[1], Catherine Prigent[2]

victoria.galligani@cima.fcen.uba.ar

[1] CIMA, UBA CONICET
[2] LERMA, CNRS

ABSTRACT

The continental region east of the Andes and covering the north and centre of Argentina, south of Brazil, Paraguay and Uruguay, usually referred to as southeastern South America (SESA), is known for its large and intense mesoscale convective systems (MCs) within which severe events develop. SESA MCSs stand out as among the strongest on earth in satellite observations. In this data sparse region, little is known of the aspects of these systems including what governs their structure, life cycle, similarities and differences with severe weather-producing systems observed elsewhere, and their predictability on weather to climate timescales. The present project aims to advance into the knowledge of such physical processes involved in the developing phase of MCSs where the convective region is particularly active and on the triggering mechanisms associated to their initiation.

The focus of present work is especially on the analysis of cloud microphysical parameterizations of the Weather Research and Forecasting (WRF) model. Cloud resolving models like WRF can be operated with different cloud microphysics schemes. Those microphysics schemes include different microphysics species and processes between those species. Extensive validations for existing schemes are needed in order to constrain and reduce uncertainties. The microphysical properties (e.g., dielectric properties, density, particle size distribution, shape, orientation) of the frozen particles specifically, have a very complex temporal and spatial variability, and lack robust parameterizations. There is a pressing need to constrain such microphysical properties in order to reduce the large uncertainties associated with frozen quantities in Numerical Weather Prediction (NWP) and cloud resolving models.

Microwave radiometry has shown a promising ability in the characterization of iced particles, as it is able to penetrate and provide insight into the vertical profiles of most clouds, in contrast to infrared and visible observations, which essentially sense cloud tops. One way to verify the good behavior of a microphysical scheme, and consequently the representativity of the cloud simulations, is to perform radiative transfer simulations with inputs, (1) the atmospheric profiles provided by the cloud model (i.e. in this work WRF simulations of deep moist convection events in particular situations of central/northern Argentina and southern Brazil) and (2) a rather accurate description of the radiative properties of each microphysical species. The radiative transfer simulations are to be carefully compared to the coincident satellite observations, at the same frequencies, geometry, and mode (active and passive). This exercise requires not only the cloud simulations to be as close as possible to the reality, i.e. good location in time and space of the studied clouds relative to the observations, but also realistic radiative properties of the clouds to reproduce the magnitude of the satellite observations.

Keywords: deep convection, radiative transfer, microwave