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Sensitivity study of Boundary layer cloud modelling using WRF

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In this work, a detailed study of the ability of limited area numerical models to characterize boundary layer clouds is performed. Particularly, a sensitivity study was carried out to evaluate the WRF model simulations in reproducing the properties of marine stratocumulus clouds in the North Atlantic subsidence regime. To this end, a wide set of experiments was designed to analyze both, the physical parameterizations implemented in the model to simulate the different processes, such as PBL, microphysics and radiation schemes, and the model configuration, that is, initial and boundary conditions, vertical resolution, vertical nesting,...

Simulations were conducted for some case studies where different stratocumulus scenarios were found (season, optical depth, cloud cover,...) and a region located to the North of the Canary Islands was selected to compare model results with observational data retrieved from satellite sensors. In particular, data from the A-Train satellite constellation have been used (multispectral radiation from MODIS sensor, radar data from CloudSat platform and the attenuated backscatter from Calipso lidar instrument). From these measurements, information such as the cloud vertical structure or cloud radiative properties were derived and used to evaluate the strengths and weakness of the different parameterizations to model these kind of clouds.

As the numerical model provides simulated physical variables at the surface level and at different vertical model levels, model outputs cannot be directly compared to satellite data, being necessary the use of postprocessing techniques to perform this comparison. In this work, the nu-WRF (Peters-Lidard et al., 2015) GSDSU package has been used to convert WRF outputs to physical magnitudes that can be compared to satellite measurements.