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Intercomparison and evaluation of cumulus parameterization schemes of the regional model BRAMS over South America

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Occurrence of rain is usually a major concern of society related to weather and climate. In numerical prediction with horizontal resolution coarser than 10 km, the occurrence of precipitation is treated by cumulus parameterization. Several cumulus parameterization schemes have been developed based on observational data and in the understanding of how several atmospheric scales interact. The cumulus parameterization scheme currently implemented in the model Brazilian developments on the regional Atmospheric Modelling System (BRAMS) consists of disturbances around the classical closures of Grell, Arakawa and Schubert, Kain and Fritsch, low-level Omega and moisture convergence. As a result, we have precipitation forecasts that can be combined in several ways, generating a numerical representation of precipitation and atmospheric rates of heating and moistening. In this version, only a specific closure or a simple average among the members is available. A detailed study of the skill of the forecasts using different closures has not been made, which makes it difficult to choose which scheme must be used in the model. The aim of this study is to develop an intercomparison between the different assumptions in the cumulus parameterization scheme and to evaluate the performance of the regional model BRAMS in simulating the convective precipitation for the period December 2004 to February 2006 over South America. As this study is preliminary, only December 2004 was assessed. We used the horizontal resolution of 25 km and vertical resolution of 30 levels. Simulations were conducted every 24 hours for each day of December. The classical closures used were Grell, Arakawa and Schubert, Kain and Fritsch, low-level Omega, moisture convergence and the ensemble closure (given by simple average among members). We used satellite precipitation estimated from the project Tropical Rainfall Measuring Mission (TRMM) to compare the precipitation forecasts over South America. Comparisons were also held in some Brazilian cities, using rain gauge data obtained from the National Institute of Meteorology (INMET). The results show the better skill of the ensemble closure compared to the other closures. Moreover, it appears that the moisture convergence and low-level Omega closures underestimate the observed precipitation over South America. Such assessments encourage studies aimed at improving the performance of these closures, with the aim of producing better products for weather and climate studies using the model BRAMS.