Geophysical Research Abstracts
Vol. 13, EGU2011-10131, 2011
EGU General Assembly 2011

Dynamical and Statistical downscaling of Mediterranean climate: comparison and uncertainty assessment in the MED-CORDEX and HYMEX context

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This study presents the assessment and comparison of the two downscaling methods: Dynamic Downscaling (DD) and Statistical Downscaling (SD). Both methods are applied on a climatological study on the Mediterranean region. Hence, for the years 1989-2008, the ERA-Interim re-analyzes of mean daily values of 2-meter temperature and rainfall are dynamically downscaled using the Whether Research and Forecasting (WRF) model and statistically downscaled using the Cumulative Distribution Functions-transform model (CDF-t). In particular, the WRF model is evaluated in regards of two different horizontal resolutions (50km and 20km) and two different integrated Land Surface Models (Noah and RUC). Observations for the models evaluation are taken from the European Climate Assessment & Database (ECAD) and from the labeled hydro-meteorological stations attached to the HYdrological cycle in the Mediterranean Experiment (HYMEX).
In this study, two periods are considered: (i) from 1989 to 1998 the CDF-t model is calibrated and (ii) from 1999 to 2008 the downscaled values from the CDF-t model and the interpolated ones from the WRF model and the ERA-Interim re-analyzes are evaluated through a statistical comparison to the observations. The main diagnostic on DD and SD skill is the Kolmogorov-Smirnov test. The questions we scope to answer is on the level of uncertainties introduced by (i) both methods and (ii) from the use of gridded versus station data. The preliminary results show a sensitivity of both DD and SD to different seasons (winter and summer), and in particular for DD, to the different resolutions and parametrization. In general, downscaling on temperature shows better scores, whereas precipitation is more difficult to be reproduced from both methods. For CDF-t this is mainly because of the non standard intra-seasonal cycle. The use of observations from the HYMEX stations provides a more objective and accurate observations dataset which improves further the downscaling results.
Our motivation is to provide an assessment of the two downscaling methods in regards to their applications on regional climatological studies. This study makes part of the broader COordinated Regional climate Downscaling Experiment (CORDEX), aiming at improving our understanding of DD and SD for regional climate projections. Furthermore, the use of observations from the HYMEX project will provide some first results on regional climate from stations not assimilated. In general, with this study we aim to provide a platform of behavior of these techniques, which is not only of paramount importance for the improvement of models performance in regional or local scales, but also the first and fundamental step for future climate projections.