Session: C4 Poster: TH213A

HyMeX - Evaluation of dynamical and statistical methods for downscaling of extreme precipitation and surface temperature in the Mediterranean region in the frame of HyMeX and MED-CORDEX

Emmanouil Flaounas[†]; Philippe Drobinski; Mathieu Vrac; Sophie Bastin; Karine BÈranger; Marco Borga; Jean-Christophe Calvet; Guy Delrieu; Cindy Lebeaupin; Efrat Morin; Hiba Omrani; Gianni Tartari; Roberta Toffolon
[†] CNRS / IPSL / LMD / Ecole Polytechnique, France
Leading author: flaounas@lmd.polytechnique.fr

Although the performance of Atmospheric Global Circulation Models (AGCM) and the quality of re-analyzes have shown significant improvement in late years, their coarse horizontal resolution is often inadequate for climate studies on regional, or even local scales. For this reason, downscaling methods are developed. They are constituted by two distinct approaches: the Dynamical and the Statistical Downscaling (DD and SD, respectively). In this study we focus on both DD and SD of daily surface temperatures and rainfall in the Mediterranean region. For this reason we use two models: the Weather Research and Forecasting (WRF), forced by the ERA-Interim reanalyzes for DD and the CDF-t model for SD (initials stand for "Cumulative Distribution Function-transform"). Our purpose is twofold: (i) We aim at evaluating the WRF and CDF-t models capacity to reproduce properly the average and the extremes of surface temperature and precipitation in the region and (ii) using an ensemble of four WRF simulations we aim at the assessment of the WRF model to reconstitute these fields in regards to two different integrated Land Surface Models (LSM), two different horizontal resolutions: of 50 km and 20 km and the most recently developed coupling of the WRF model with the oceanic NEMO model. For the models evaluation, observations are taken from the European Climate Assessment & Dataset (ECA&D) and from the labeled hydro-meteorological stations, attached to the HYdrological cycle in the Mediterranean EXperiment (HYMEX). In our analysis 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 with the observations. Numerous diagnostics are available. In general, the WRF model outputs on temperature are shown to be particularly sensitive to the choice of the integrated LSM, whereas a finer horizontal resolution improves the model performance, depending on the region. The CDF-t model applied to all WRF simulations and the re-analyzes shows great results approaching, with limited bias, the observations. Similarly, average and extreme precipitation are better represented by CDF-t with, however, a tendency of overall underestimation in the region, regardless the model used, notably in summer. Our motivation is to provide an assessment of the two downscaling methods in regards to their applications on regional climatological studies. This study makes also part of the broader COordinated Regional climate Downscaling EXperiment (CORDEX), aiming at improving our understanding of DD and SD for regional climate projections. In general, with this study we aim at providing a platform of behavior of these techniques, which is not only of paramount importance for the improvement of models at regional or local scales, but also a fundamental step for future climate projections.