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Towards regionalization of climate predictions: Evaluation of the predictive skill of the NorCPM seasonal hindcasts

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In order to obtain robust predictions of climate at scales that matter to society (i.e. local to regional, sub-daily to daily), climate prediction model output must be downscaled. Downscaling approaches include dynamical, statistical or a hybrid approaches that combine the advantages of both. Prior to any downscaling, however, the modeling system in question must be evaluated for skill with respect to relevant variables and processes over regions of interest. These are mainly precipitation and temperature but one could also easily imagine the utility of other measures such as wind, humidity, radiation and other features. As we work towards strategies for regionalization of climate predictions a number of issues arise: 1) For what variables and at what time scales can we expect representation of regional scale features to add value? 2) How should the downscaling be done (i.e. what is the most appropriate approach?); 3) How should biases in the large-scale circulation be handled? In this two part presentation we first aim to answer: what is the baseline skill of the Norwegian Climate Prediction Model (NorCPM) hindcast over regions of interest and for variables of interest? Skillfull reproduction and prediction of a climate state on seasonal time scales is crucial for the subsequent regional downscaling. In this study, the predictive skill of a 9-member ensemble of seasonal hindcasts produced by the Norwegian Climate Prediction Model (NorCPM) is evaluated for 2 m air temperature and precipitation. Each hindcast is initialized 4 times a year, on 1st February, 1st May, 1st August and 1st November, and is run for 13 months. This is repeated for every year from 1985 – 2010. Observed sea surface temperature anomalies are assimilated into the system during the initialization. Perkins skill scores are used to assess the fidelity of the model simulations and how well it reproduces observed climate. These show high skill for temperature over land areas and higher than expected skill for precipitation at seasonal time scales. The predictive skill is estimated in terms of the spatial correlation coefficient with the ERA-Interim reanalysis at leads of 1 – 12 months. In general, we expect a deterioration of the skill beyond 1-2 months for temperature. Precipitation shows and even more pronounced drop have a more pronounced drop in the respective skill. The model shows promise for regionalization over much of Europe, but it is an open question whether inclusion of local processes will improve or degrade skill. The second part of the presentation focuses on the downscaling methodology. For this project we explore the potential for upstream approaches pioneered for the study of Hurricanes and related processes (e.g. vertical wind shear). Preliminary results show that adjustment of the biased large-scale flow at the lateral boundaries of a regional model, using reanalysis as a baseline, results is a more realistic representation of the North Atlantic storm track. There are potentially negative implications in such an approach and these are discussed along with its relative advantages.