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European Decadal Climate Variability and its Prediction

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The Atlantic Multi-Decadal Variability (AMV) pattern is a leading mode of decadal climate variability with teleconnections and climate impacts in the North-Atlantic sector. A skill of AMV predictions thus offers the potential of skilful climate predictions also for the regions surrounding the Atlantic.
The German MiKlip project develops a decadal prediction system and has generated several generations of initialised hindcasts using MPI-ESM as the global prediction system. The MiKlip efforts include a module on regional downscaling, which generates hindcast ensembles over Europe by downscaling the global simulations applying the regional climate model (RCM) COSMO-CLM (CCLM). These regional hindcasts are analysed with respect to skill and the added value compared to the global ensemble. A robust skill pattern is found over Europe. The attribution to natural variability or climate trend varies between different regions within Europe. A systematic added value is found for the accuracy (measured e.g. by MSESS) and reliability (measured e.g. by CRPSS), by reducing regional biases and improving the representation of the probability density distributions. The temporal correlation is mostly maintained from the global system. A predictive skill was also found for further climate indictors beyond mean temperature, for instance for heat related summertime extremes.
The MiKlip hindcast period covers the phase 1960 – 2016. This period is shorter than the period of the AMV of ca. 65 – 70 years. Partly the AMV is in phase with the climate trend. Therefore, this period is too short for a robust attribution of the skill. To overcome this problem, the analysis period has been extended to 1900 – 2010 using 20th century re-analysis (NOAA-ESRL 20CR and ERA20C) as forcing. The temporal evolutions of several indicators of climate extremes are correlated to the AMV index. For instance, the average precipitation intensity and the number of heavy precipitation day depict maxima for the last AMV+ phase from the 1930th to the 1950th as well as for the recent positive AMV phase starting in the 1990th.