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Seasonal mean temperature, precipitation and wind speed in Europe from an ensemble of 16 transient RCM simulations for 1961-2100

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In this study we investigate possible changes in seasonal mean temperature, precipitation and wind speed on a regional scale over Europe from recent (1961-1990) to future (2011-2040, 2041-2070, 2071-2100) time periods. We use an ensemble of 16 regional climate model (RCA3) integrations driven by several coupled atmosphere ocean general circulation models (AOGCMs), emission scenarios and different initial conditions. This set of simulations allows us to investigate different sources of uncertainty in future climate change. For the recent past climate (1961-1990) the results show that the ensemble mean in general performs better than the downscaling of individual AOGCMs for most areas. The results show that biases in individual simulations in the 1961-1990 period are strongly related to errors in the large-scale circulation in the AOGCMs. In accordance with earlier work the results show that the main uncertainties by the end of the century are related to the choice of AOGCM and emission scenario. Contributing to the uncertainty in choice of AOGCM is their representation of changes in the large-scale circulation. Differences in large-scale circulation between different time periods in the simulations is a manifestation of natural variability and our results show that this variability can obscure the climate change signal in some areas and seasons for the nearest few decades. Significant increases in seasonal mean temperature and precipitation in line with earlier studies are seen in the results. This includes the strongest warming in northeastern Europe in winter and in southern Europe during summer. For precipitation increases are simulated for northern Europe year round while decreases are simulated for southernmost Europe. In between these areas is a transition zone where changes are more uncertain. For wind speed the spread between the simulations is very large and no strong coherent climate change signal is seen although most simulations tend to simulate generally lower wind speed with exceptions in the northern seas and in parts of the Mediterranean in summer.