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Dynamical phenomena: implications for extreme event attribution

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Atmospheric modes of variability relevant for extreme temperature and precipitation events are evaluated in models currently being used for extreme event attribution. A multi-thousand initial condition ensemble of the global circulation model HadAM3P is compared with both the multi-model ensemble from the Coupled Model Intercomparison Project, Phase 5 (CMIP-5) and the CMIP-5 atmosphere-only counterparts (AMIP-5). The analysis focuses on mid Northern Latitudes (primarily Europe) during winter, and is compared with ERA-Interim reanalysis. The tri-modal Atlantic Eddy-driven jet distribution is remarkably well captured in HadAM3P, but not so in CMIP-5 or AMIP-5. The well known underestimation of blocking in the Atlantic region is apparent in CMIP-5 and AMIP-5, and to a lesser extent in HadAM3P. Pacific blocking features are well produced in all modeling initiatives. Blocking duration is generally biased towards models reproducing too many short-lived events. Associated storm tracks are too zonal over the Atlantic in the CMIP-5 ensemble, but well simulated in HadAM3P with the exception of being too weak over Western Europe. In all cases, the CMIP-5 and AMIP-5 performances were almost identical, suggesting that the atmospheric modes considered here are not strongly coupled to SSTs, and perhaps other model characteristics such as resolution are more important. It is recommended that only models capable of producing the necessary dynamical phenomena be used for event attribution analyses.