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Predictability of wintertime Euro-Atlantic weather regimes in medium-range forecasts

Mio Matsueda (1,2) and Tim Palmer (1)

(1) Atmospheric, Oceanic, and Planetary Physics, University of Oxford, Oxford, UK, (2) Typhoon Research Department, Meteorological Research Institute, Tsukuba, Japan

A weather regime is a persistent and/or recurrent large-scale atmospheric circulation pattern which is associated with specific weather conditions on a regional scale (e.g. zonal flow, atmospheric blocking, the North Atlantic Oscillation (NAO), and the Pacific-North American (PNA) pattern). Accurate simulations of weather regimes are important in weather and climate. The predictability of Euro-Atlantic weather regimes at medium-range timescales (up to 384hr) are investigated for winter (December-February) in the periods 2006/07-2012/13 and 1984/85-2012/13 using the THORPEX Interactive Grand Global Ensemble (TIGGE) and NOAA's second-generation global medium-range ensemble reforecast datasets, respectively. The TIGGE portals quasi-operationally provide 9 medium-range ensemble forecasts routinely operated at Numerical Weather Prediction (NWP) centres. We focus on five of the leading operational NWP centres: CMC (Canadian Meteorological Center), ECMWF (European Centre for Medium-range Weather Forecasts, UK), JMA (Japan Meteorological Agency), NCEP (National Centers for Environmental Prediction, USA), and UKMO (United Kingdom Meteorological Office). The NOAA's reforecast data has been produced with a fixed numerical model, using the 2012 version of NCEP's Global Ensemble Forecasting System (GEFS), whereas the TIGGE data has been produced with a various versions of operational numerical model. The positive and negative phases of the NAO (NAO+ and NAO-), Atlantic ridge (ATLR), and Euro-Atlantic blocking (EABL) are detected as weather regimes over the Euro-Atlantic region from the ERA-Interim data. The NWP models have common biases in the frequency of regime transitions, and therefore the models prefer NAO- and ATLR to NAO+ and EABL with lead time, compared with the ERA-Interim. The models show small skill differences regarding probabilistic regime forecasts, suggesting that the skills of regime forecasts strongly depend on atmospheric flows. The models show higher forecast skills when predicting NAO+ and NAO-. The NAO+ and NAO- forecasts have a better skill than its climatological forecasts even at a lead time of 16 days. The persistence of NAO- is the most predictable. In contrast, EABL forecasts from ATLR have the lowest skill, followed by ATLR forecasts from NAO+, ATLR, and EABL.