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Predictability of winter Pacific weather regimes and its connections with MJO on medium-range timescales

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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. Accurate simulations of weather regimes are important in weather and climate. The predictability of weather regimes over the North Pacific (20-80N, 120E-60W) at medium-range timescales (up to 384hr) are investigated for extended winters (November-March) in 2006/07-2013/14 and 1985/86-2013/14 using the The 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 (Canada), ECMWF (EU), JMA (Japan), NCEP (USA), and UKMO (UK).

Pacific trough (PATR), the positive and negative phases of PNA (PNA+ and PNA-), Pacific blocking (PABL), and Alaskan blocking (ALBL) are detected as wintertime weather regimes over the Pacific region from the ERA-Interim data. The frequency of PATR (PNA-, PABL and ALBL) is significantly increased (decreased) during El Nino months. The NWP models have common biases in the frequency of regime transitions, and therefore the models prefer PATR and PNA- to the other regimes with lead time. Verification of probabilistic Pacific regime forecasts reveals that the forecasts made by state-of-the-art models are useful up to a lead time of 15-16 days on average and that their skills are higher than those of probabilistic Euro-Atlantic regime forecasts. Probabilistic PATR and PABL forecasts show higher skills than the other probabilistic regime forecasts. Probabilistic regime forecasts initialised from PNA- show higher skills than those from the other regimes. ECMWF generally shows the best probabilistic skills, followed by UKMO. In addition, tropical-midlatitude teleconnections during the Madden-Julian Oscillation (MJO) phases can be seen to act as forcing for these regimes. We show that the probabilistic skills for these mid-latitude regimes also depend on the MJO phase at the initial time of the forecast.