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Investigating the Influence of Atmospheric Blocking Morphology on Predictability

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Low-frequency variability (LFV) encompasses atmospheric and climate processes on time scales from a few weeks to decades. This includes atmospheric blockings, heat waves, cold spells, and at longer time scales long-term oscillations like the MJO, the NAO, ENSO..... Better understanding of LFV, could contribute to improved long term forecasts.

In the results described in Xavier et al, 2023, who used a reduced order atmosphere-land model (Demaeyer et al, 2020), weather patterns that involve atmospheric blocking to the west of a given topographical feature tend to have reduced predictability and show instability when contrasted with blocking occurrences situated to the east of such topographical elements. This finding aligns with actual meteorological occurrences, such as the persistence of North Pacific blocking patterns (Breedon et al., 2020; Kim and Kim, 2019). The shape and characteristics of the identified blocking events closely resemble North Pacific blocks, where a high-pressure system exists either on the western or eastern side of the underlying topography. In the physical world, these positions correspond to Asian and American continents on either side of the Pacific. Despite quasi-geostrophic models being overly simplified, using such reduced order models in this study allowed us to undertake such mathematical analysis. Thus allowing for a comparison with the real world...

In the current study, we aim to analyze these predictability differences based on the morphology of the blocking situations in the real-world scenario using the CMIP6 dataset. Blocking situations are identified using two different indices, the anomaly-based blocking index proposed by Sausen et al., 1995 and the local reversal of the meridional flow-based index proposed by Davini et al., 2012. Predictability is quantified using local dimension metrics and analogue studies in the identified blocking events. The findings are discussed from the perspective of the current literature on the predictability of blocking.

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