Dynamical systems proxies of atmospheric predictability and mid-latitude extremes

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Mid-latitude weather, including a wide range of extremes (e.g. storms, heatwaves, cold spells, heavy precipitation), can be linked to recurrent atmospheric circulation patterns. Identifying these patterns and characterising their physical and dynamical properties provides an important predictability pathway on meteorological timescales.

We propose a novel approach to diagnosing the predictability afforded by recurrent large-scale atmospheric patterns, which builds upon recent advances in dynamical systems theory. We use two simple dynamical systems metrics − local dimension and persistence – to: i) diagnose the properties of recurrent patterns identified in the literature, such as weather regimes and ii) identify new large-scale atmospheric flow patterns which present a coherent temporal evolution and afford a particularly good forward predictability. We provide specific examples of applications to wintertime European temperature extremes and Eastern Mediterranean weather regimes.

Key words: Dynamical Systems, Weather Extremes, Predictability, Weather Regimes