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Contribution – Using clusters in the atmosphere's circulation to improve predictions of European wind speeds

DS applications and challenges in Medicine, Natural Sciences, and Engineering

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Abstract

The weather that we experience is largely attributable to regimes in the atmosphere's circulation. In particular, these regimes are closely linked to the occurrence of more extreme weather events, such as cold snaps in winter and heat waves in summer. To investigate regime behaviour over Europe, we apply principal component analysis to an archive of historical weather fields, before implementing a *k*-means clustering approach on the transformed fields. In doing so, we identify four atmospheric regimes. We study the effect these regimes have on European wind speeds, and utilise the regimes as predictors within statistical post-processing methods, which are designed to remove systematic errors that manifest in dynamical weather models. In an application to wind speed forecasts, we demonstrate that this regime-dependent approach is capable of producing forecasts that are more accurate than those generated using dynamical weather models, and also those issued by contemporary statistical post-processing methods. The framework is particularly beneficial during regimes associated with more extreme wind speeds, suggesting these regime-dependent post-processing models can be used to enhance predictions made for high-impact weather events.