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Exploring the potential of vegetation information for improving weather forecast performance

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The quality of weather forecasts is continuously improving for decades. However, increases in forecast skills have slowed down in recent years. This highlights the importance of exploring new avenues towards future forecast system improvements. Until now, (near) real-time information on vegetation anomalies is not used in most forecasting models. Addressing this gap, we explore the potential of the vegetation state for explaining the spatial and temporal variation in forecast accuracy globally across climate regions, seasons, and vegetation types. For this purpose, we employ re-forecasts from the European Centre of Medium-Range Weather Forecasting (ECMWF) and infer the vegetation status through the Enhanced Vegetation Index derived from the Moderate-Resolution Imaging Spectroradiometer (MODIS) satellite observations during the 2000-2019 period. In particular, we focus on land surface variables such as evaporation and temperature to study the relationship between forecast errors and vegetation anomalies.

The results show a stronger correlation between forecast errors and vegetation anomalies in semi-arid and sub-humid regions during the growing season, which highlights that vegetation information has the potential to help advance weather forecast performance. To put these results into perspective, we will further perform a multivariate analysis to determine the relative roles of vegetation, hydrology and climate in explaining weather forecast errors. Thereby, our results can inform the future development of weather forecast models and underlying data assimilation schemes.