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The strong role of external forcing in seasonal forecasts of European summer temperatures

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Since the 1980s, external forcing from increasing greenhouse gases and declining aerosols has had a large effect on European summer temperatures. The forcing therefore provides an important source of predictive skill, even for timescales as short as seasonal forecasts. However, the relative importance of forcing for seasonal forecasts has thus far not been quantified, particularly for skill on regional scales. In this study, we investigate forcing-induced skill by comparing the skill of the operational multi-model ensemble of seasonal predictions from the Copernicus climate change service (C3S) archive to that of an uninitialized ensemble of CMIP6 projections for European summers for the period 1993-2016.

We show that for some regions, such as northern Europe, the forced trend provides the primary source of 2m temperature skill in current seasonal forecast models at 2-4 month lead-times. Over some parts of northern Europe, summer correlation skill is actually higher in uninitialized predictions and in runs with long lead-times than at short lead-times suggesting that there may be problems with the initialization. Conversely, 2m temperature in the Mediterranean region is generally well predicted by seasonal forecast models out to 4-6 months due to a combination of dynamical skill and a strong forced trend.

We argue that the strong warming trends mean that even uninitialized predictions contain useful information for seasonal forecasts of European summer temperatures. However, the ability of current models to capture summer circulation patterns requires further investigation as it is still unclear whether the models are deficient in this regard or whether the summer is inherently unpredictable.