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Decomposing daily temperature variability into intraseasonal, interannual and cycle-induced variability

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Changes in the frequency of temperature extremes may be associated with both changes in mean and variability. We analyse changes in daily variability in 10 regional climate models of the PRUDENCE multi-model scenario experiment that is driven by the IPCC SRES A2 greenhouse gas scenario for control (1961–1990) and scenario (2071–2100) conditions.

We present a method to decompose daily summer temperature variability in the three components: (1) interannual temperature variability, (2) intraseasonal variability, and (3) variability induced by the seasonal temperature cycle within the summer.

Over the transitional climate zone between the Mediterranean to the south and the Baltic Sea to the north and depending upon the model, the total variability (standard deviation of daily temperature) increases by 20–40%. These changes are found to be due to increases in all three variability components. The interannual variability increases by 30–95%, the cycle-induced variability by 35–105%, and the intraseasonal variability by 10–30%. As a result of these changes, the relative importance of interannual and cycle-induced variability grows at the expense of intraseasonal variability. Variability changes in northern and southern Europe are much smaller.

The processes driving the changes in variability are different for the three components but generally relate to enhanced land-atmosphere coupling and/or increased variability of surface net radiation. The contribution of these two processes differs substantially

between models.