

EMULATE Project Summary

Studies of the influence of atmospheric circulation on surface climate variables are limited by data availability. The instrumental database is short and it is often difficult to discern if relationships are stationary or whether subtle changes are occurring. Europe has the longest of all instrumental climate records as the first instruments were developed here in the late 17th century. Although earlier projects have highlighted some of these records others wait to be digitised and homogenised. EMULATE seeks to extend continent-wide analyses back to the mid-19th century, providing 150 years of gridded daily pressure data to analyse. Homogeneity issues and digital availability, both of which we will address, are the principal constraints on analyses of European circulation patterns and their influence on surface climate variations. Many analyses begin in the mid-20th century when with some effort and care they could begin in the mid-19th century.

EMULATE proposes to create daily gridded fields of mean-sea-level pressure (MSLP) over the extratropical North Atlantic and Europe (25°N to 70°N; 70°W to 50°E on a 5° by 5° grid spacing), 1850 to date. The data will be used to develop time series of characteristic atmospheric circulation patterns for each season, sampled on sub-monthly time scales. The database will be assessed for quality and standard errors quantified for each time step and grid-point location. Variations and trends in these patterns, and associated temperature and precipitation patterns, will be related to those evident in large-scale sea surface temperatures (SSTs) and other possible oceanic fluctuations including those of the thermohaline circulation, with the aid of atmosphere only and coupled atmosphere and ocean models. Variations in the incidence of extremes of temperature and precipitation (including drought) across Europe will be related to fluctuations and trends in the atmospheric circulation patterns on daily to multi-decadal timescales and, for temperature, to SST and possible anthropogenic factors. With the new datasets and patterns, relationships can be investigated for much longer periods than currently available.

The longer daily MSLP record will enable the assessment of the relative importance of anthropogenic factors to be more reliably determined. Relationships found (and their variability) will be compared with results from the Hadley Centre atmosphere-only and coupled climate models. The project will define an array of extreme events over the last 150 years across Europe and determine the importance of atmospheric circulation changes, SST and external forcing factors. This will enable the probable impacts of anthropogenic factors on extreme events to be determined over Europe.