Mechanisms behind the precipitation increase in Norway

Kjersti Konstali and Asgeir Sorteberg
Geophysical Institute, University of Bergen, Bergen, Norway

We use a dataset with observations of daily precipitation from 55 homogeneity tested stations in Norway over the period 1900-2019 available from MET-Norway. These observations show that precipitation in Norway has increased monotonically by 19% since 1900. Notably, over half of the overall increase was recorded within the decade of 1980-1990. To examine possible mechanisms behind the precipitation increase, we use a diagnostic model to separate the effects of changes in vertical velocity, temperature and relative humidity. We use vertical velocity, near-surface temperature and relative humidity from two reanalysis products, ECMWF’s ERA-20C and NOAA’s 20th Century Reanalysis. The model-based precipitation estimates capture the interannual variability as well as the long-term trend, but the absolute magnitude of precipitation is underestimated. Within our model, we find that the variability in vertical velocity chiefly determines the interannual variability and long-term trends. In fact, the trend in vertical velocities contributes with more than 75% of the total modelled trend in precipitation between 1900-2019, and more than 60% of the anomalies between 1980-1990. However, over the last decades (1979 to 2019), changes in temperature and relative humidity are the main contributors to the trend. Thus, different physical processes shape the trend at different times. We hypothesize that the strong precipitation increase in the 1980's is linked to an unusual high number of low pressure systems reaching Norway from the North-Atlantic. In recent decades, direct effects of global warming (rising temperatures and hence increased water vapour content) are thought to be the main cause of the positive trend in precipitation over Norway.