The Analogue Method for Precipitation Forecasting: Finding Better Analogue Situations at a Sub-Daily Time Step

The Analogue Method (AM) aims at forecasting local weather variables (predictands), such as precipitations, by means of a statistical relationship with predictors at a synoptic scale. The analogy is generally assessed in the first place on the geopotential field by mean of a comparison of the gradients, in order to sample the days with a similar atmospheric circulation.

The search for candidate situations, for a given target day, is usually undertaken by comparing the state of the atmosphere at fixed hours of the day, for both the target day and the candidate analogues. The constraint being the use of daily time series, due to the length of available archives they provide, and the unavailability of equivalent archives at a finer time step. However, it is unlikely that the best analogy happens at the very same hour, but it may occur at a different time of the day. In order to assess the potential of finding better analogues at a different hour, a sliding time window (STW) has been introduced on a reduced archive of hourly precipitation totals.

The STW resulted in a better analogy in terms of the atmospheric circulation, with improved values of the analogy criteria on the whole distribution of analogue dates. The improvement was found to grow with the analogue ranks due to an accumulation of more similar situations in the selection. Moreover, the improvement is even more important for days with heavy precipitation events, which are generally related to more dynamic atmospheric situations, where timing is more specific.

A seasonal effect has also been identified, with larger improvements in winter than in summer, supposedly due to the stronger effect of the diurnal cycle in summer, which favors predictors at the same hour for target and analogues.

The impact of the STW on the prediction performance has been assessed by means of a sub-daily precipitation series transformed into moving 24~h-totals at a 6-hourly time step. This resulted in an improvement of the prediction skills, which were even larger after recalibrating the AM parameters.

However, attempts to reconstruct longer precipitation series of running 24~h-totals by means of simple methods failed. It emphasized the need to use time series with an appropriate chronology. These should be available in a near future, either by means of growing observed archives, or by the establishment of precipitation reanalyses through regional modeling. Then, the use of a STW in the AM should be considered for any application, especially when the prediction quality of extreme events is important.