Geophysical Research Abstracts
Vol. 19, EGU2017-16690-1, 2017
EGU General Assembly 2017

Introducing a moving time window in the analogue method for precipitation prediction to find better analogue situations at a sub-daily time step

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Analogue methods (AMs) predict local weather variables (predictands), such as precipitation, by means of a statistical relationship with predictors at a synoptic scale. Predictors are extracted from reanalysis datasets that often have a six hourly time step. For precipitation forecasts, the predictand often consists of daily precipitation (06h to 30h UTC), given the length of their available archives, and the unavailability of equivalent archives at a finer time step. The optimal predictors to explain these daily precipitations have been obtained in a calibration procedure with fixed times of observation (e.g. geopotential heigths Z1000 at 12h UTC and Z500 at 24h UTC). In operational forecast, a new target situation is defined by its geopotential predictors at these fixed hours, i.e. Z1000 at 12h UTC and Z500 at 24h UTC. Usually, the search for candidate situations for this given target day is usually undertaken by comparing the state of the atmosphere at the same fixed hours of the day for both the target day and the candidate analogues. However, it can be expected that the best analogy among the past synoptic situations does not occur systematically at the same time of the day and that better candidates can be found by shifting to a different hour. With this assumption, a moving time window (MTW) was introduced to allow the search for candidates at different hours of the day (e.g. Z1000 at 00, 06, 12, 18 h UTC and Z500 at 12, 18, 24, 30 h UTC respectively).

This MTW technique can only result in a better analogy in terms of the atmospheric circulation (compared to the method with fixed hours), with improved values of the analogy criterion on the entire distribution of analogue dates. A seasonal effect has also been identified, with larger improvements in winter than in summer.

However, its interest in precipitation forecast can only be evaluated with an archive of the corresponding 24h-totals, i.e. not only 6-30h UTC totals, but also 0-24h, 12-12h and 18-18h totals). This was possible to assess on a set of stations from the Swiss hourly measurement network with rather long time-series. The prediction skill was found to have improved by the MTW, and even to a greater extent after recalibrating the AM parameters. Moreover, the improvement was greater for days with heavy precipitation, which are generally related to more dynamic atmospheric situations where timing is more specific. The use of the MTW in the AM can be considered for several applications in different contexts, may it be for operational forecasting or climate-related studies.