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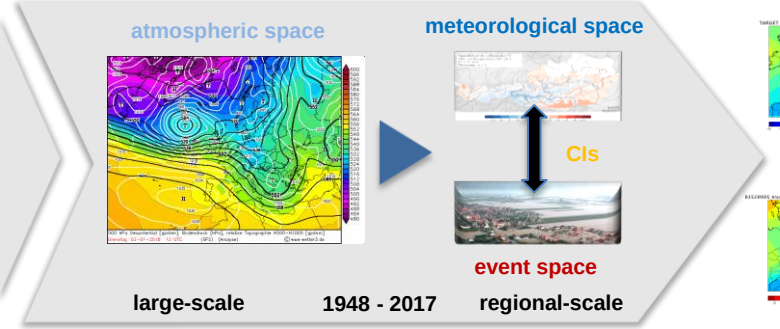
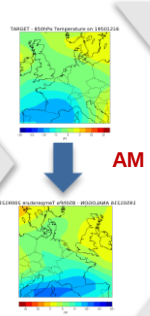
Motivation

Together with two other studies (X5.385, X5.386) this investigation contributes to a strategy supporting disaster protection and damage relief organizations to maintain high levels of civil protection under climate change. Here, our goal is the simulation of local-scale, potential damage events (floods, landslides, heatwaves & droughts) from large-scale atmospheric processes by the Analogue Method (AM). Thereby we otimize the AM approach by varying (i) the geographic sector within which atmospheric processes are considered, (ii) distance measures quantifying 'similarity, (iii) sequences concernied prior the event and (iv) the dimension used to capture the atmospheric signal.





Analogue Method (AM)

For each selected day and its atmospheric pattern that occurred in a pool the AM fetches another day-pattern from that pool that matches the selected one best. The 'sense' in which these pattern are close is defined by a distance measure – like the Eucliedan norm (two vectors are identical when the Euclidean norm of its difference-vector vanishes).

? **can we optimize AM's performance?**

atmospheric space
NCEP Reanalysis
spatial res: 2.5° x 2.5°
daily SLP, T850, RH700, GP500

met. space (see X5.385)
event space (see X5.386)

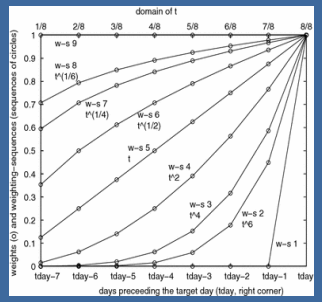
optimization in four dimensions

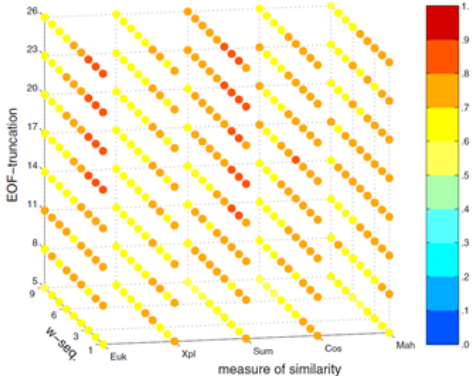
AM selects for each target day the closest match available from a pool. The larger the pool the better chance to find a god correlation. Here we are glad to have 70 years of daily data available.
In order to optimize the modelling of regional-scale weather events potentially triggering damage events we vary (i) the geographic window depicting the atmosphere, (ii) the way to quantify similarity between atmospheric pattern, (iii) the length of atmospheric processes (in days) considered and (iv) the space dimension used to picture atmospheric processes.

Mansberger[1] A., Matulla[2] C., Schmid[3] F.

Identifying best performing settings of the Analog Method (Empirical-Statistical Downscaling) linking large-scale atmospheric processes to regional-scale floodings, landslides and heat wave events in the European Alps

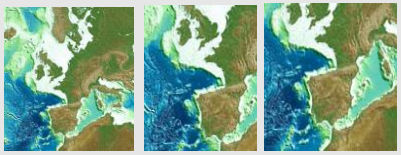
(iii) atmospheric sequences – the question is 'how important is the development of the atmosphere until the target day is reached?' the shows on its abscissa in the very right the 'target day' and towards its left days before, which are weighted according to 'weighting-sequence' as shown on the ordinate.



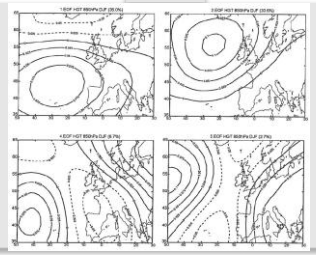


red color indicates best performance (highest correlation) depending on (ii), (iii) and (iv) when considering precipitation totals

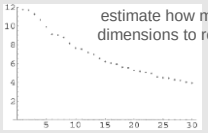
(i) the geographic sector within which atmospheric processes are considered



etc.



(iv) dimension of space capturing atmospheric processes.



(ii) similarity measures determine the 'match' of atmospheric pattern. The 'nearest' pattern to the pattern of the target day is its analogue.

$$\|\mathbf{z}\|_1 = \sum_{i=1}^{n} |z_i| \qquad \|\mathbf{z}\|_w = \left(\sum_{i=1}^{n} p_i z_i^2 \right)^{\frac{1}{2}} \qquad -\cos(\angle(\mathbf{x},\mathbf{y})) = -\frac{\sum_{i=1}^{n} x_i y_i}{\|\mathbf{x}\|_2 \|\mathbf{y}\|_2}$$

etc.