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Statistical forecasting of monthly winter precipitation in Western Iberia

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A multi-linear regression model has been built with the aim of forecasting monthly winter precipitation in Western Iberia and particularly in Portugal. Precipitation data from several Portuguese meteorological stations in the period 1951-2003 have been used as predictands. Several meteorological variables obtained all over the world from the NCEP Reanalysis data set were assessed as potential predictors. This was done by computing their correlation with Portuguese precipitation using time lags between 1 and 6 months. The regions with the highest statistically significant correlations were selected and the predictors' values on the maximum correlation points were included in the multi-linear regression model. This model uses a cross validation methodology, with the training period being the whole period minus the forecast year.

The skill of our model was assessed through objective comparisons with simpler benchmark models, namely against climatology and persistence. Two sets of results have been obtained. The first uses as predictors the previous month precipitation, a time index and the 2nd PC of the North-Atlantic and European 1000 hPa geopotential height, which corresponds essentially to the NAO pattern. The second set of predictors includes those used in the first set and additionally a few more, dependent on the month: a) for December, the 1-month lag surface temperature (tmpsfc) in the Golf of Mexico and the 3-month lag tmpsfc in Central Asia and water equivalent snow depth (weasd) in Western North America; b) for January, 1-month lag specific humidity at 2m height (spfh2m) and tmpsfc in Northern Asia and 2-month lag spfh2m in Northwestern Africa; c) for February, 1-month lag spfh2m and tmpsfc in the Alaska region together with the 2-month lag spfh2m and tmpsfc in the North Atlantic. It is worth noticing that the second set of predictors improved significantly the model scores, namely the correlation coefficient (COR) and the climatology mean square error skill score (MSSS) in comparison with the first set, particularly for the Northwestern Iberia

region. With the first set of predictors, COR and MSSS values between forecasted and observed precipitation in Northwestern Iberia are: 1) COR=0.06, MSSS= -0.06 in December; 2) COR=0.18, MSSS=0.00 in January; and 3) COR=0.36, MSSS=0.11 in February. With the second set, the scores in Northwestern Iberia reach: 1) COR=0.55, MSSS=0.29 in December; 2) COR=0.67, MSSS=0.45 in January; and 3) COR=0.61, MSSS=0.45 in February, being all statistically significant.

Due to the promising results obtained here in hindcast mode, it is planned to expand the procedure in order to obtain real forecasts of monthly precipitation in selected Portuguese stations.