ECMWF/KNMI contribution to GLACE2

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The Seasonal Prediction System of ECMWF has participated with 2 different versions to the GLACE2 experiment. In one version (label *KNMI*) SST was prescribed as provided, in another (label *ECMWF*) SST was provided by the Ocean-Atmosphere coupled system. Results shown here focus on co-varying patterns of soil moisture, temperature and MSLP in Europe. Also, European ROC scores are presented for temperature and precipitation.

System description

The forecasts are carried out using the cycle 33R1 version of ECMWF Seasonal prediction system, at a T159L62 resolution. The LSM HTESSEL uses a revised hydrology and soil moisture treatment.

Two sets of ensemble simulations are used. **Series 1** uses initial soil moisture derived from the GSWP2 project. **Series 2** uses soil moisture from a free climate model integration. In the KNMI set-up different soil moisture values are used for each ensemble member. In the ECMWF set-up initial soil moisture is similar for each member. T_{2m} and precipitation observations are from the E-Obs dataset created within ENSEMBLES. All data are averaged in 15-day bins.

Pattern correlations

For the European domain a Maximum Covariance Analysis (MCA) was carried out between ΔW_{1m} and ΔT_{2m}, where Δ = series 1 – series 2 (Fig A), and W_{1m} is initial soil moisture in the top 1 m. The correlation between ΔW_{1m} and ΔT_{2m} is very local, demonstrated by the basically identical patterns.

An MCA between ΔW_{1m} and ΔMSLP(1-15days) reveals the existence of a quickly responding surface heat low to low soil moisture (Fig B). However, considering MSLP at longer lead times a trade-off with high pressure conditions leading to low moisture conditions appears to remove the surface heat low signal (Fig C).

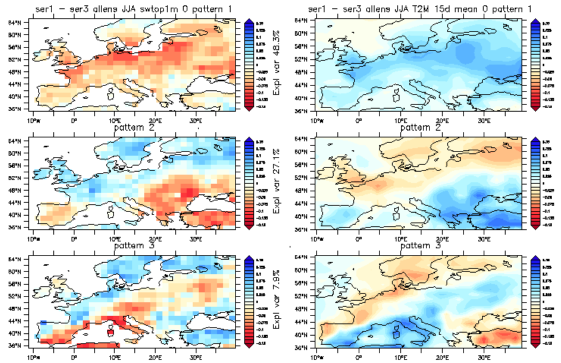

Figure A. *MCA for ΔW_{1m} (init) and ΔT_{2m} (1-15days) for all JJA startdates. Only the three leading patterns are shown.*

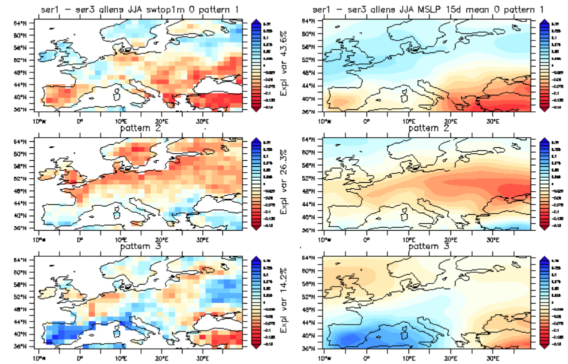

Figure B. *As fig A, for ΔW_{1m} (init) and ΔMSLP (1-15days).*

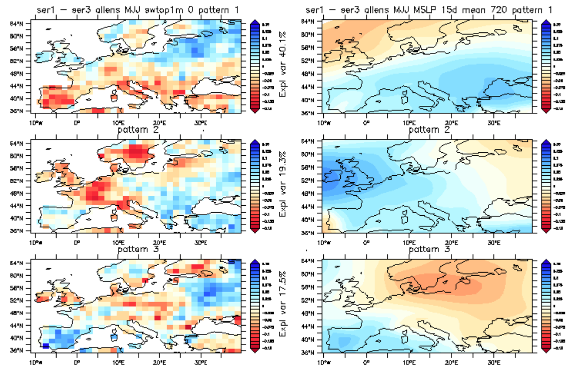

Figure C. *As fig B, for ΔW_{1m} (init) and ΔMSLP (31-45days).*

ROC scores

Shown are probabilistic ROC scores using 6 GLACE2 models combined into one super-ensemble (KNMI, ECMWF, FSU, 2 NCAR versions and NCEP). Results after conditional sampling on anomalous initial soil moisture in 2 subregions (MED and WEUR) are also shown (Fig D and E).

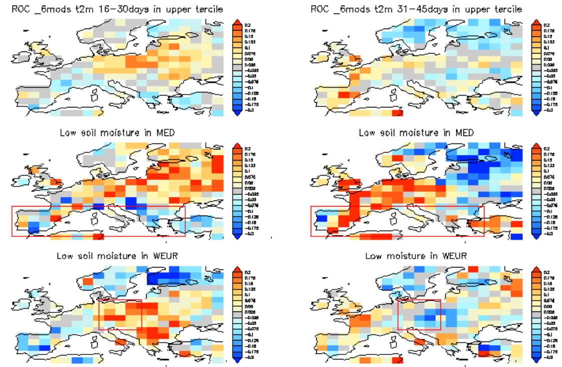

Figure D. *ROC score difference (series 1 – series 2) for JJA temperature in upper tercile. 2nd and 3rd row show only dates with soil moisture in Mediterranean or W-Europe to be in the lowest tercile.*

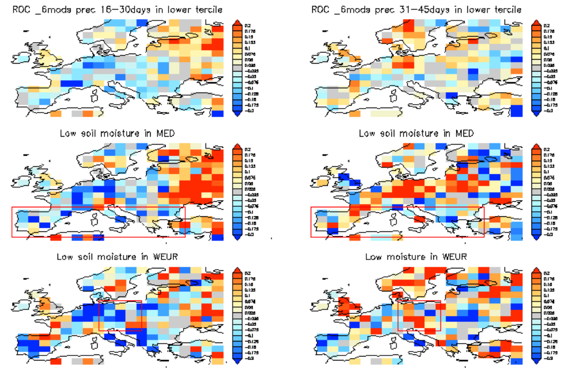

Figure D. *As Fig D for precipitation in lowest tercile.*

Conclusions

Remote effects of soil moisture anomalies in Europe are not strong. However, conditional sampling of anomalous soil moisture conditions may improve forecasts of extreme temperature up to 45 days, also in remote areas.

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