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An unusual Saharan dust outbreak into central Europe and heavy precipitation at the southern side of the Alps in May 2008: A TIGGE case study

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At the end of May 2008 a pronounced upper-level disturbance (ULD) penetrated from the mid-latitude North Atlantic into the Mediterranean Sea and produced a combination of severe weather events. Strong surface winds to the southeast of this trough over the northern Sahara caused widespread dust mobilization and a subsequent transport across the Mediterranean Sea and Italy into central Europe. In addition, the strong southerly flow associated with the ULD produced heavy precipitation at the windward side of the Alps. Some regions in southern Switzerland and northern Italy recorded daily averages of over 100mm over a period of 4 consecutive days.

Here we investigate the representation of this unusual case in 249 operational ensemble forecasts from 10 different meteorological centres that participate in the recently established THORPEX Interactive Grand Global Ensemble (TIGGE) project. The main objectives of this study are an assessment of the forecast quality and predictability of the synoptic and large-scale features described above.

For larger-scales and longer lead times the focus of the investigation is on the representation of the upper-level development and ULD formation during this case, in particular the region of strong southerly flow from the Sahara across the Mediterranean Sea to Europe. Two complementary error measures were applied. Beside comparisons of single and multi-model ensemble means to analysis fields, root mean square errors and ensemble spread of the different operational centres are examined to test whether the ensemble forecasts are under- or overdispersive for this synoptic situation. The second, a feature-based error measure, is applied to the PV-streamer, and structural (location, shape) and amplitude errors are evaluated for each ensemble member.

For shorter lead times the focus is on the details of the unusual weather events. For the dust analysis, this involves the assessment of the number of members of the different centres that produce wind gusts sufficient for dust mobilization (i.e. stronger than 8m/s) in the different ensemble systems. A similar analysis is made for the heavy precipitation at the southern side of the Alps that investigates the representation of the precipitation fields in relation to the UL features in the different ensemble members.

In combination the results of this case study can shed light on (i) the representation of ULD forcing in the TIGGE ensembles and (ii) on the dynamical implications of the forecast accuracy on the prediction of such severe weather events.