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The Meteorological Drivers of the September 2015 Severe Dust Event in the Eastern Mediterranean

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In 6–8 September 2015 one of the severest and most unusual dust events on record occurred in the Eastern Mediterranean. Five people died, hundreds were hospitalized, daily life and traffic in the region were disrupted. Surprisingly, operational dust transport models were unable to forecast the event and therefore no early warnings were given to the population.

This study details the reasons for this forecast failure and presents simulations of the event at convection-permitting resolution using the modelling system ICON-ART. The results allow for an in-depth analysis of the influence of the synoptic situation, the complex interaction of multiple driving atmospheric systems and the mineral dust radiative effect on the dust event. A comparison of the results with observations reveals the quality of the simulation results with respect to structure and timing of the dust transport. The forecast of the dust event is improved decisively, most likely due to the explicit representation of convection and a more highly resolved orography.

The event is triggered by the unusually early occurrence of an active Red Sea trough situation with an easterly axis over Mesopotamia. The connected sustained organized mesoscale convection produces multiple cold-pool outflows responsible for intense dust emissions. Complexity is added by the interaction with an intense heat low, the inland-penetrating Eastern Mediterranean sea breeze and the widespread occurrence of supercritical flow conditions and subsequent hydraulic jumps in the vicinity of the Jordan Rift Valley. The newly implemented mineral dust radiation interaction leads to systematically more intense and faster propagating cold-pool outflows.

This case study demonstrates how processes across a wide range of scales can conspire to produce one of the most severe dust events on record for this region with large impacts on the population. The results suggest that high resolution and a sophisticated treatment of convection, dust and radiation is needed for a realistic forecast and early warning.