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Ozone pollution over the Arabian Gulf - impact of meteorological condition

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The Middle East and particularly the Arabian Gulf region are characterised by highly favourable conditions for O_3 formation in summer. We investigated the impact of meteorological conditions on O_3 formation using the WRF-chem model. The dispersion of air pollutants strongly depends, on local wind patterns, in particular the persistent low-level north-westerly flow known as the summer Shamal, and the land-sea breeze circulation system.
A general finding from our simulations is that extreme pollution events with O_3 mixing ratios exceeding 150 nmol/mol can occur regularly over the Arabian Gulf, however, their location and magnitude can vary widely. O_3 mixing ratios are highest when the outflow of the regions with major anthropogenic emissions along the coastline is further advected over the Gulf where pollution plumes are captured in the shallow and stable marine boundary layer allowing little ventilation. The sea-breeze circulation often causes onshore advection of the pollution in the afternoon, affecting the densely populated coastal regions along the western shoreline of the Gulf. When the pollution is transported deeper over land, O_3 mixing ratios are generally lower due to rapid dilution of precursor gases in the very deep convective boundary layer over the desert.