

Modeling the life cycle of fog in the Namib desert with COSMO-PAFOG

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Fog and low stratus clouds are a typical feature in coastal deserts. In the hyper-arid Namib Desert at the southwestern African coast, fog is an important source of water for ecosystems. The knowledge of the spatial and temporal patterns of fog in the Namib-region contributes to a deeper understanding of fog processes and fog-related ecosystems and thus is of great ecological and socio-economic interest.

The central aim of our study is to understand processes controlling the spatial and temporal development of coastal desert fog in the Namib by means of numerical simulations. Low stratus clouds form at the top of the marine boundary layer over the cold Benguela Current. These low clouds are advected overland by meso-scale circulations. The interaction of turbulent mixing with microphysical and advection processes in the formation, maintenance and dissipation of fog and low clouds in the Namib Desert imposes high requirements on the corresponding parametrizations.

Numerical simulations are performed with an extension of the regional weather prediction model COSMO (Consortium for Small-scale Modeling) which is adapted for the application in the Namib region. To account for microphysical processes involved in fog formation, the microphysical parametrization of the one-dimensional fog forecast model PAFOG (PArameterized FOG) has been implemented into COSMO. The resulting fog forecast model COSMO-PAFOG is run with kilometer-scale horizontal resolution.

In our study, individual case studies are analyzed with respect to their spatial extent as well as the dynamic, thermodynamic and microphysical processes yielding fog formation and dissipation. The model results are evaluated by satellite and ground observations obtained during the field campaign in September 2017 within the framework of the NaFoLiCA (Namib Fog Life Cycle Analysis) project.