Addressing the impacts of sand and dust storms in North Africa, the Middle East and Europe for air quality, aviation and solar energy: the DustClim approach to climate services

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Sand and Dust Storms (SDS) are extreme meteorological phenomena associated with high amounts of atmospheric mineral dust. SDS are an essential element of the Earth's natural biogeochemical cycles but are also partly caused by human factors including anthropogenic climate change and unsustainable land and water management; in turn, SDS contribute to climate change and air pollution. SDS have become a serious global concern in recent decades due to their significant impacts on the environment, health, agriculture, livelihoods, and the economy. The impacts are felt throughout the developed and developing world and their mitigation is aligned with several of the United Nations' Sustainable Development Goals. There has been an ever-increasing need for accurate information and predictions on SDS—particularly over desert regions such as the Sahara and in the Middle East—to support early warning systems as well as preparedness and mitigation plans, in addition to growing interest from diverse stakeholders and policymakers in the solar energy, health, environment and aviation sectors.

The ongoing ERA4CS ‘Dust Storms Assessment for the development of user-oriented Climate services in Northern Africa, the Middle East and Europe’ (DustClim) project is enhancing our knowledge of the ways SDS affect society by producing and delivering an advanced dust regional model reanalysis for N. Africa, the Middle East and Europe, based on the MONARCH chemical weather prediction system (Pérez et al. 2011; Di Tomaso et al. 2017) and satellite retrievals over dust source regions, and by developing dust-related services tailored to strategic planning, operations, and policy-making in the air quality, aviation, and solar energy sectors.

In this contribution, we will present how the resulting dust reanalysis is used as the basis to understand the mid-to-long-term impacts and implications of operating (and regulating) in risky
sand and dust environments, namely: (1) the mineral dust component of air quality and its health and regulatory implications; (2) aircraft and airport operations, maintenance and planning; (3) strategic investment and operations optimization in solar energy. We will present our development approach that integrates scientific, industrial and regulatory knowledge, addressing ‘objective threats’ in dialogue with industry partners and public stakeholders (Votsis et al. 2020). Finally, we present an overview of the developed portfolio of SDS climate services for the three aforementioned sectors.

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References

