Modeling the dust cycle from sand dunes to haboobs

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The dust cycle is a rather complicated mechanism depending on various factors. The most important factors affecting dust production is soil characteristics (soil composi-tion, physical and chemical properties, water content, temperature etc). The most known production mechanism at small scale is the saltation-bombardment. This mechanism is able to accurately predict uptake of dust particles up to about 10 μm. Larger dust particles are heavier and fall relatively fast due to the gravitational influ-ence. The other controlling factors of dust uptake and transport are wind speed (to be above a threshold) and turbulence. Weather conditions affecting dust produc-tion/transport/deposition are of multi-scale ranging from small surface inhomoge-neities to mesoscale and large-scale systems. While the typical dust transport mech-anism is related to wind conditions near the surface, larger scale systems play an important role on dust production. Such systems are associated with mesoscale phenomena typical of the specific regions. Usually they are associated with deep convection and strong downdrafts and are known as haboobs. Density currents are formed in the surface with strong winds and turbulence. Density currents can be considered as dust sources by themselves due to high productivity of dust.

In this presentation we will discuss characteristics of the dust production mechanisms at multiscale over the Arabian Peninsula by utilizing the RAMS/ICLAMS multiscale model. A series of simulations at small-scale have been performed and mitigation actions will be explored.