

Regional modeling of the Saharan dust storm life cycle

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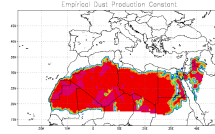
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How does DREAM model work?

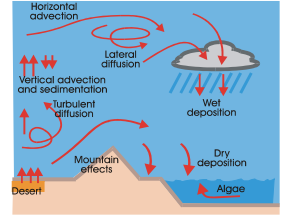
DREAM simulates all phases of the dust cycle – dust production, turbulent mixing, long-range transport and deposition. DREAM employs Euler-type approach. It includes 4 particle size categories. USGS global 1km vegetation data is used to define desert sources

TYPE	R (μm)
Clay	0.73
Silt – small	6.1
Silt – large	18
Sand	38

Particle categories



Saharan sources



Simulated dust phases

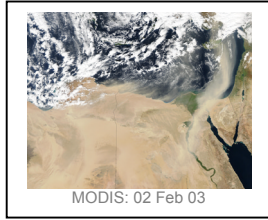
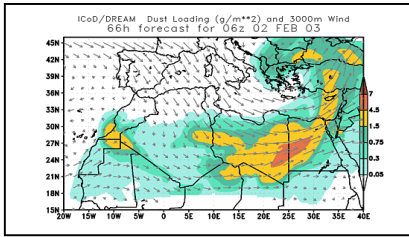
Dust concentration equation

$$\frac{\partial C}{\partial t} + \frac{\partial}{\partial x}(uC) + \frac{\partial}{\partial y}(vC) + \frac{\partial}{\partial z}(w-v_{gk})C_k - \nabla \cdot (K_H \nabla C_k) - \frac{\partial}{\partial z} \left(K_z \frac{\partial C_k}{\partial z} \right) + \left(\frac{\partial C_k}{\partial t} \right)_{SRC} - \left(\frac{\partial C_k}{\partial t} \right)_{SNK}$$

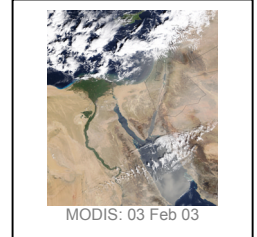
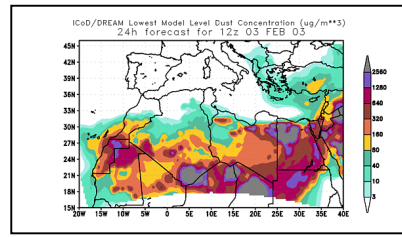
Operational dust forecasts

ICoD daily produces dust forecasts over the European and Mediterranean areas, once per day. Forecasting parameters are: dust load, surface dust concentration, dry and wet concentration, shown as horizontal maps, vertical cross sections and vertical concentration profiles.

The most recent dust storm (2 and 3 February 2003) originating from the Eastern Sahara has strongly affected Egypt, Israel and Cyprus. Both, MODIS satellite and DREAM model images indicate the mesoscale nature of the storm.



MODIS: 02 Feb 03

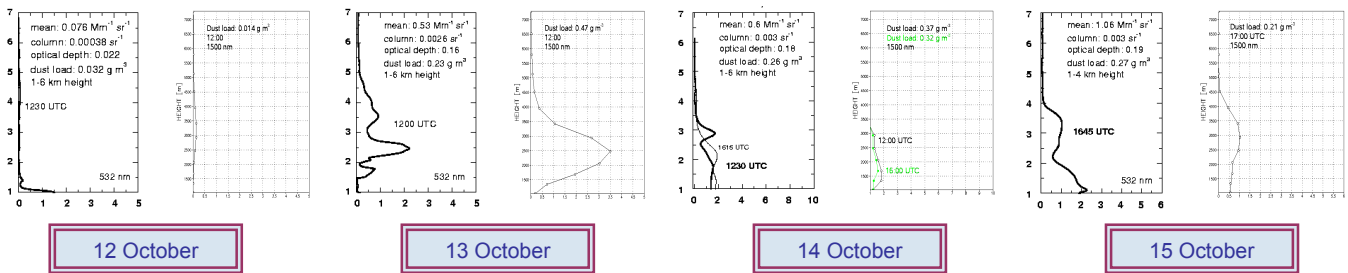


MODIS: 03 Feb 03

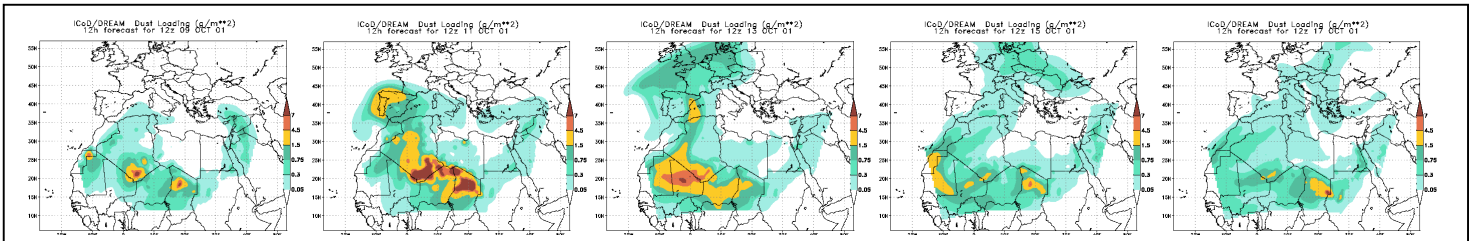
October 2001 dust storm case study

A major dust storm was generated during beginning of October 2001. The unique feature of this event was an exceptionally large amount of dust that was injected into the atmosphere and later driven to the north by large-scale atmospheric circulation. About 10 days after the initial phase, dust was observed even in western and northern European countries. Lidars and satellite and in-situ measurements observed increased concentrations in the atmosphere. The DREAM model successfully simulated the event, providing additional information about the temporal and 3D spatial features of the Saharan dust.

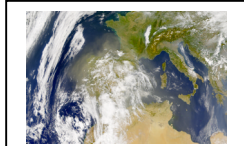
LIDAR VS. MODEL COMPARISON: MUNICH 12-15 October 2001



TIME EVALUATION OF THE DUST EVENT



SeaWiFS: African Dust over Iberia (visibleearth.nasa.gov)
On October 11, 2001, SeaWiFS had a view of a large dust cloud over the Iberian Peninsula.



SeaWiFS: Dust over Europe (visibleearth.nasa.gov)

On October 13, 2001, SeaWiFS had this haze-obscured view of Europe. The tan color of the haze over northern France and Germany and up into the North and Baltic seas suggests dust. This dust most likely has its origins in northern Africa (note the tan haze over the Mediterranean to the east of Spain). The more bluish color of the aerosols over Italy's Plain of Lombardy suggests possible human origins.

