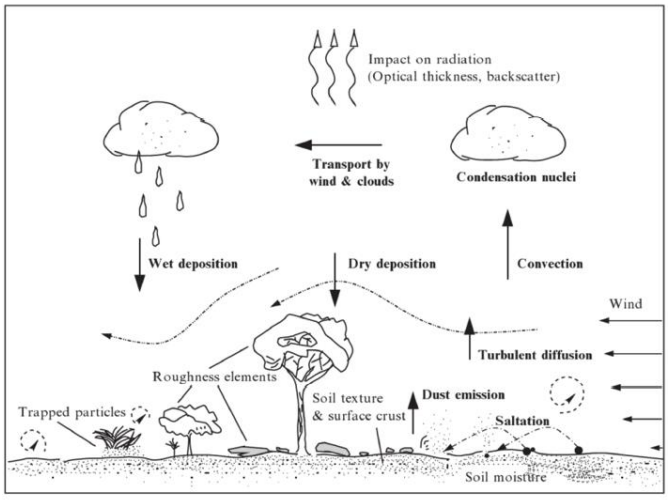
Model Description: BSC-DREAM8b

OVERVIEW:

The Earth Sciences Department from the BSC-CNS maintains a dust forecast operational system with the updated version of the former Dust Regional Atmospheric Model (DREAM; Nickovic et al., 2001) called BSC-DREAM8b v2.0 (Pérez et al. 2006a, Pérez et al. 2006b, Basart et al. 2012) and conducts modelling research and developments. The model predicts the atmospheric life cycle of the eroded desert dust and was developed as a pluggable component of the Eta/NCEP (National Centers for Environmental Prediction) model. It solves the Euler-type partial differential non-linear equation for dust mass continuity and it is fully inserted as one of the governing prognosis equations in the atmospheric Eta/NCEP atmospheric model equations.



Injection, transport and deposition processes of dust. Extracted from Shao et al. (2008)

Since September 2006, the model runs in the Earth Sciences Department from the BSC-CNS. Along these years, different updates have been implemented in the model giving us new model versions. The operational period of each model version is the following:

- DREAM from September 2006 to May 2009
- BSC-DREAM8b v1.0 from May 2009 to August 2012
- BSC-DREAM8b v2.0 from August 2012 to now

MAIN FEATURES:

The main general features of the original DREAM model (Nickovic et al. 2001) are:

- Dust production scheme (Shao et al. 1993) with introduced viscous sub-layer (Janjic, 1994).
- Soil wetness effects on dust production (Fécan et al. 1999).
- Dry deposition (Giorgi, 1986) and below cloud scavenging.
- Horizontal and vertical advection, turbulent and lateral diffusion (Janjic, 1994) represented as for other scalars in the Eta/NCEP model.

The developments included in the BSC-DREAM8b v1.0 model (Pérez et al. 2006a, Pérez et al. 2006b) are:

- Eight size transport bins between 0.1 and 10 μm range are considered following Tegen and Lacis (1996). Within each transport bin, dust is assumed to have time-invariant, sub-bin log-normal distribution employing the transport mode with mass median diameter of 2.524 um and geometric standard deviation 2.0.
- Dust-radiation interactions are taken account. Dust affects the radiative fluxes at the surface and the top of the atmosphere and the temperature profiles at every model time step when the radiation module is processed (Pérez et al. 2006b).
- Grid points acting as desert dust sources are specified using arid and semiarid categories of the global USGS 1-km vegetation data set and the FAO 4-km global soil texture data set.

The latest developments that included in the BSC-DREAM8b v2.0 model (Basart et al. 2012) are:

- A preferential source mask is included in its emission scheme which is based upon topographical approach from Ginoux et al. (2001). Modelling studies show that inclusion of “preferred” source regions improves the realism of the model dust load in the vicinity of the sources.
- Dry and wet deposition schemes have been updated improving the description of the dust transport. The new dry deposition scheme is based on Zhang et al. (2001) and takes into account Brownian diffusion, interception and impaction are considered. Moreover, gravitational settling based on the seminal work by Slinn (1982) is also included.

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