Direct radiative effects by Saharan dust

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Mineral dust that is one of the major components of the atmospheric aerosol plays an important role in the Earth's climate system. Saharan dust outbreaks occurred over the Central Mediterranean basin from 2003 till 2006 are analyzed in this work to calculate the diurnal evolution of the direct radiative effect (DRE) by dust particles. Aerosol backscatter coefficient vertical profiles by lidar measurements, analytical back trajectories, and satellite images are used to characterize the evolution with time of the intrusion of Saharan dust particles over the Mediterranean.

Aerosol optical and microphysical properties from AERONET sun-/sky-photometers and aerosol vertical profiles by lidar measurements are used to initialize radiative transfer simulations and to study dust DREs by a two-stream radiative transfer model [1]. Clear-sky DREs are examined at the top of the atmosphere (ToA), within the atmosphere and at the Earth's surface (SuF) both at the solar (0.3-4 µm) and infrared (4-200 µm) wavelengths.

It is shown that aerosol optical depths at 550 nm vary within the 0.2 - 0.5 range and that ToA- and SuF-DREs span the – (10 – 30) W/m^2 and – (10 – 60) W/m^2 range, respectively at solar wavelengths. Conversely, ToA- and SuF-DREs vary within the 0 – 15 W/m^2 and 4 – 30 W/m^2 range, respectively at infrared wavelength. The DRE due to the presence of background anthropogenic particles during dust outbreaks is also investigated.

Ground measurements of net flux values are compared to corresponding model data to support model results.

[1] Bergamo *et al.* (2008) *Atmos. Chem. Phys*. **8**, 6995-7014.

Transport of heat and mass in a Barrovian belt: What do we know from nature?

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To understand Barrovian metamorphism, we require data on pressure, temperature, time and spacial movement of units (tectonics). Here we attempt to constrain the P-T-t-d evolution of a Barrovian belt by presenting pressure / temperature data in combination with *in situ* isotope dating using retentive chronometers and structural data on the Lepontine dome of the Central Alps, a classical example of a Barrovian belt. We consider the protracted processes of migmatisation followed by rapid cooling in the south (Southern Steep Belt; SSB), with the thermal evolution in the north (Northern Steep Belt, NSB, some 50 km from the SSB). In the southern part, partial melting occurred from 31 – 22 Ma at temperatures between 700°C – 650°C and pressures around 0.7 GPa. Slightly later (at 19 Ma) on a similar depth, the NSB was heated to maximum temperatures of ~580°C. The higher temperature in the south, together with structural information and the fact that partial melting occurred over a long time interval indicate differential upward transport of the migmatites relative to the surrounding units. Transpressional tectonics with a strong pure shear component was effective in extruding the migmatites. The mass transport implies efficient advective heat transfer at that time. The southern area then cooled relatively fast (~100°C/Ma), as the extruded mass was small, hence relaxing the isotherms did not take much time, even though cooling did not involve substantial advection (tectonics). After the peak temperature at 19 Ma, heat was essentially transported by conduction into the overlying units; mass transfer in the north of the Lepontine dome was limited to large scale folding (Chiera-phase). Dominantly conductive heat transport produced discordant mineral isograds with respect to the tectonic contacts. Exhumation was essentially accomplished by erosion, with moderate cooling rates (30°C – 40°C/Ma). At the same time, the SSB had already cooled down through the zircon FT annealing zone (19 Ma Zir FT data).