Dust Source Attribution Experiment (DUSA)

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1. Objectives:

- Estimate the contribution of dust from different source regions to various land and ocean receptor regions.
- Assess the change of simulated dust size distribution between source and receptor regions.
- Compare the dust optical depth between mid-visible (550 nm) and thermal infrared (10 μm) wavelengths.

2. Background

Dust is prevalent in the global atmosphere affecting the Earth's climate, ecosystem, and environment. Dust is known to interfere incoming or outgoing radiative flux and dust is also known as an effective ice nuclei for cirrus cloud formation. The source of global dust is well established as most of them are originated from a few major source regions of North Africa, Middle East, and Asia which accounting for more than 80% of global dust emission. Although it is easy to understand that local generated dust is the major dust contributor in or near source regions, it is more difficult to attribute the source of dust over the downwind land and remote ocean regions since dust experiences complex atmospheric processes during the long-range transport, including horizontal-, vertical-advection, wet deposition including precipitation, and dry deposition including sedimentation. This experiment will investigate the impact of dust from the prominent dust source regions, and the source-receptor relationships over land and remote ocean regions. In addition to the previous AeroCom experiments which focus on the regions where dust amount is significant, this proposed study will also analyze the source-receptor relationships over more extended regions including Arctic, Antarctic, Tibetan Plateau, and oceanic areas. In addition, this multi-model experiment also tackles two areas that have not been examined before in AeroCom: the change of dust particle sizes during the long-range transport, and the dust optical depth at the thermal infrared

(10 μm) wavelength that is mostly sensitive to dust aerosols, which can be compare to the commonly used value at the mid-visible wavelength.

This proposed model experiment will lead to future AeroCom investigations, such as dust minerological composition from different source regions, dust transport and deposition of nutrients, depending on the availability of resources.

3. Proposed model experiment

3.1 Simulation period: Jan. 1, 2009 ~ Dec. 31, 2012 (four years)

3.2 Tagged run

The experiment is consist of 1 base run and 9 runs with different source-reginos (Figure 1 and Table 1). Each tagged region is defined as simple box-like shapes. BASE run will emit dust as a standard model setup, whereas each tagged run will have zero emission for the corresponding region. For example, for BOD run, the emission over Bodele (10°~20°E; 10°~20°N) should be turned off, but the other area emits dust as in BASE. A mask file of each region (0.5x0.5 deg) is provided (accessible from the AeroCom Wiki webpage).

Table 1. Tagged region setup for the Experiment

Rgion Number	Region Name	Tagged Region	Longitude(°E)	Latitude(°N)
-	BASE	Global (no tag)	-180°~180°	-90°~90°
1	WAF	West Africa	-20°~10°	10°~37°
2	EAF	East Africa	10°~35°	10°~37°
3	BOD	Bodele	10°~25°	10°~20°
4	CAS	Central Asia	35°~75°	0°~55°
5	MDE	Middle East	35°~60°	0°~37°
6	EAS	East Asia	75°~120°	35°~55°
7	TAK	Taklimakan Desert	75°~92°	35°~45°
8	NAM	North America	-130°~-65°	20°~50°
9	SOH	Southern Hemisphere	-180°~180°	-60°~0°

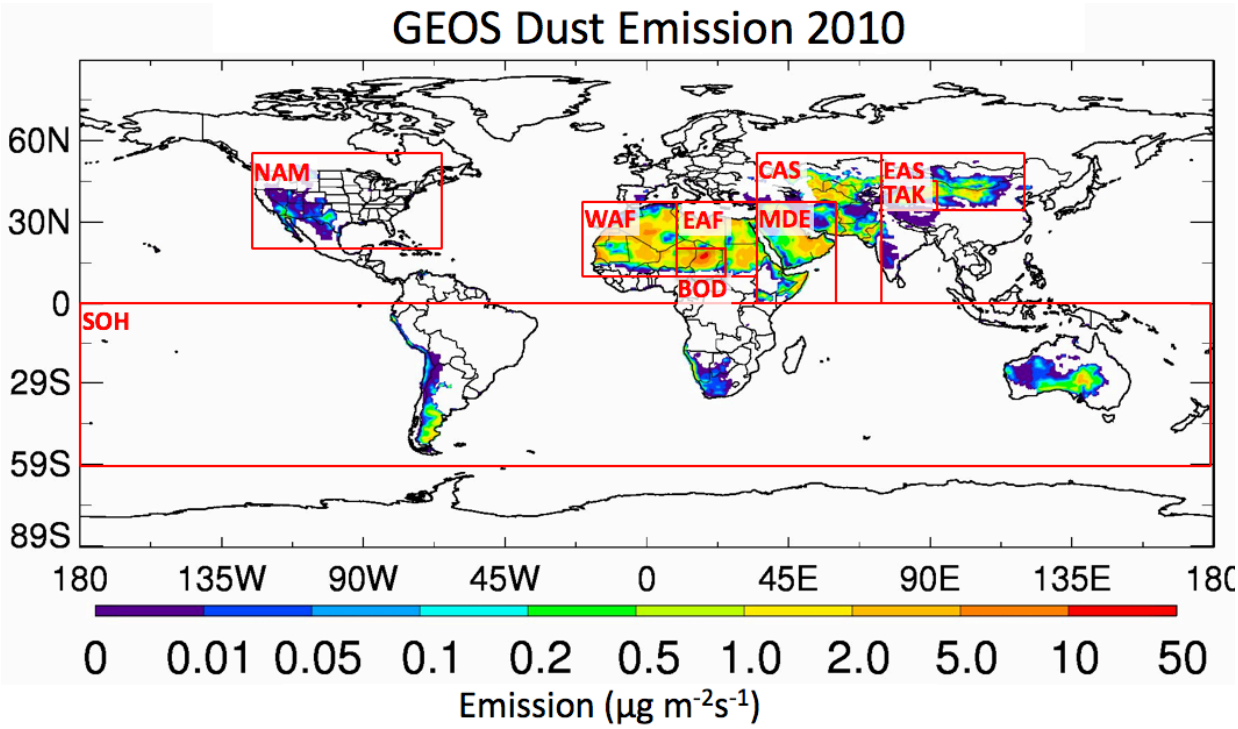

Figure 1. Nine tagged region. Color contour is the dust emission flux simulated by GEOS for 2010.

3.2 Output frequency and fields

Frequency: Both daily and monthly
Required diagnostic fields: See [AeroCom Wiki webpage]