

Characterization of soil dust aerosol particles in the proximity and downwind of 'hot spot' source areas

A Draft Mission Proposal for HALO

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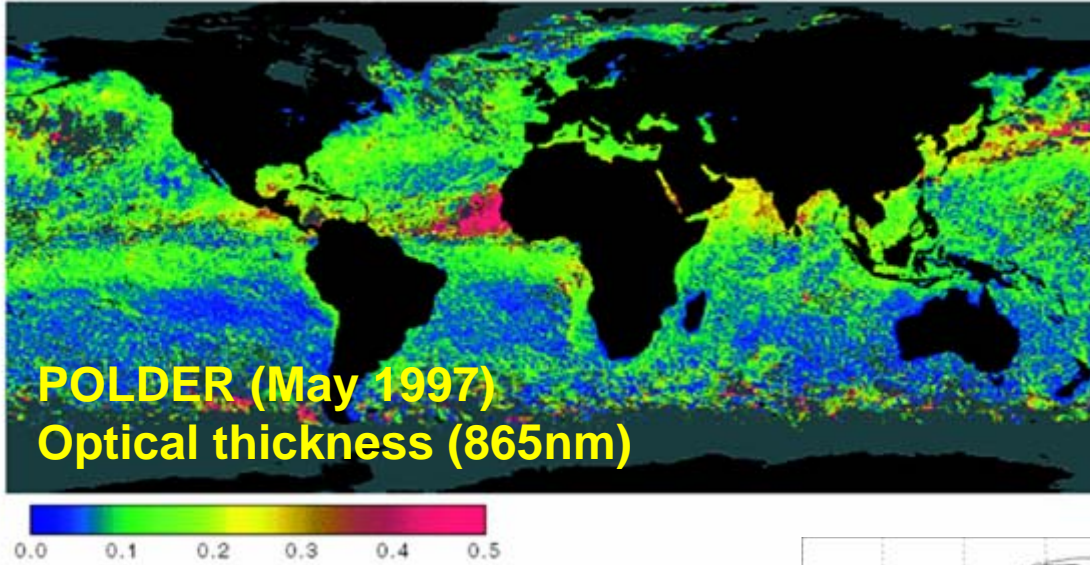
¹SAharan Mineral dUst experiMent, <http://www.tropos.de/samum/>

Effects of Soil Dust Aerosol

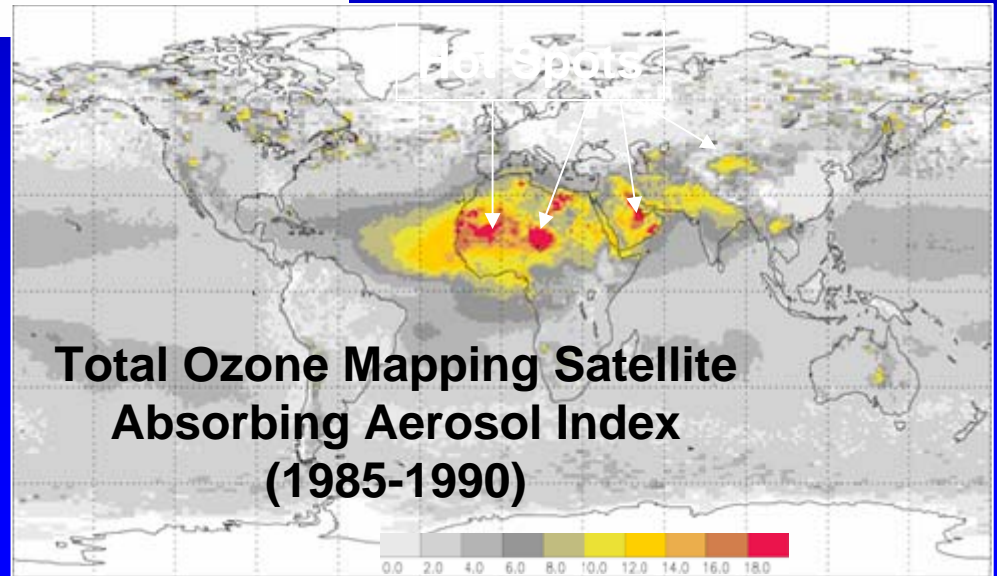
- Direct and indirect radiative forcing, regionally impacting temperatures, atmospheric stability and the hydrological cycle
- Nutrient supply to oceanic and terrestrial ecosystems
- Influence on heterogeneous atmospheric chemistry
- Adverse health effects (silicosis, spread of bacteria)
- Visibility reduction

Why do we need aircraft measurements? (1)

(a) May 1997 Aerosol optical depth at 865 nm from Polder on ADEOS



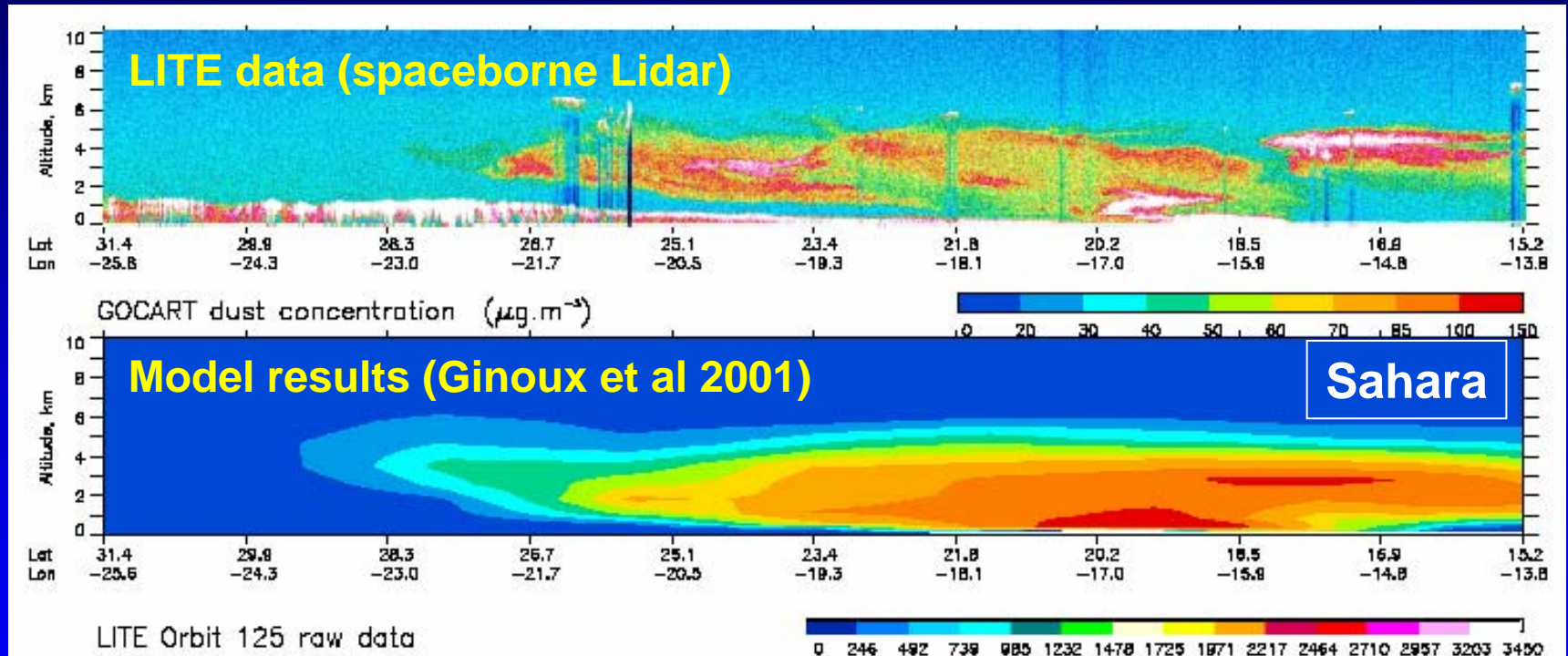
➤ Quantitative retrieval over ocean surfaces only - Continents mostly blank.



➤ Qualitative indicators only. Verification missing.

Why do we need aircraft measurements? (2)

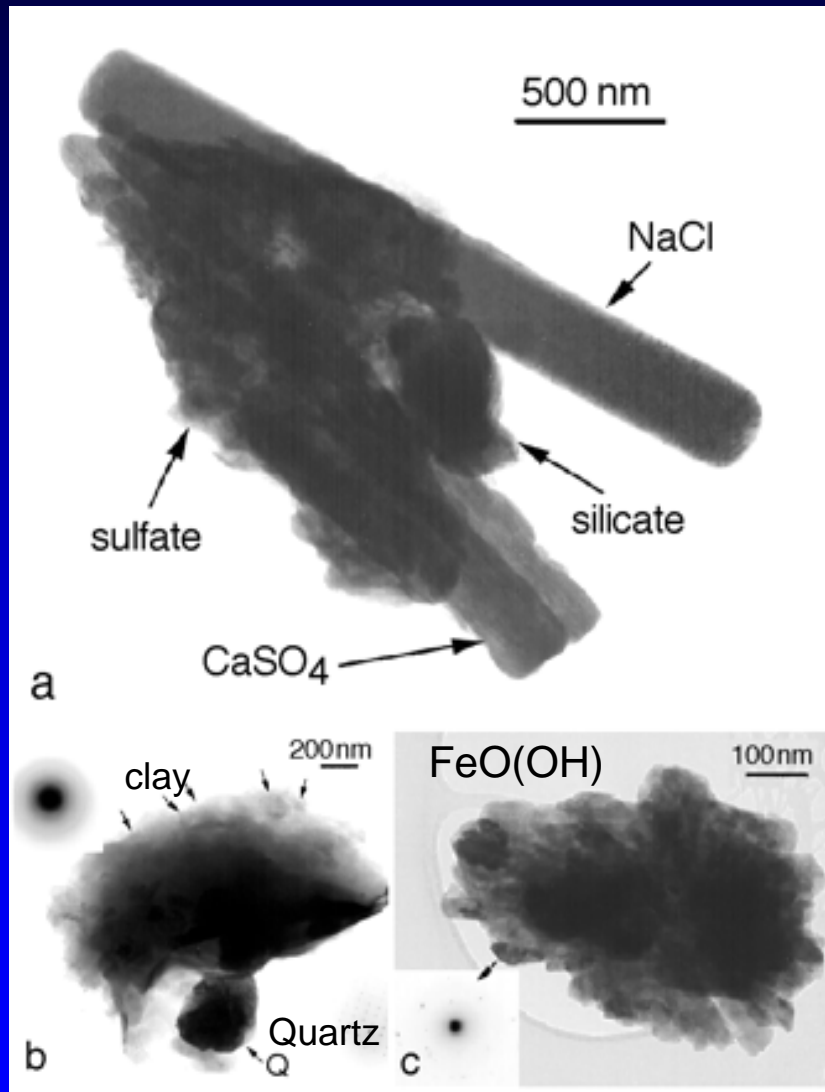
Vertical Dust Distribution



Ginoux et al. (2001)

- Dust is often transported at several km height, thus surface measurements are not representative.

Why do we need aircraft measurements? (3)



- Mixture of different species, possibly changing during transport

Busek and Posfai, 1996

Saharan Dust Experiment SAMUM¹

- DFG Forschergruppe (Research Group) to address uncertainties in radiative properties and impact of dust
- Duration: 2004-2007 (anticipated 2nd phase: 2007-2010)
- Scope:
 - Surface and profile (aircraft, lidar, satellite) measurements of optical, physico-chemical and morphological properties of Saharan dust near the source (Morocco, summer 2005)
 - Evaluate the modeled regional radiative impact with concurrent airborne irradiance measurements
 - Model regional radiative effects + feedbacks of Saharan dust by mesoscale models

¹Saharan Mineral dUst experiMent, <http://www.tropos.de/samum/>

Objectives for HALO

- Extend SAMUM to larger scales.
- Study remote continental dust sources.
- Follow the life cycle of a dust outbreak. Repeated flights over the course of several days, following the plume, would allow making measurements of microphysical, optical, and chemical dust properties during atmospheric transport.
- Study interactions of the dust plume with clouds or anthropogenic aerosols, and trace gases.
- The results will enhance our understanding of the controls on atmospheric dust properties, as well as help to evaluate its impacts.

Required Instrumentation

- Multi-wavelength lidar (including polarization)
 - particle extinction profiles
- Particle sampling
 - particle shape and chemical analysis
- Microphysical in-situ probes
 - size distribution, concentration
- Passive spectral radiation sensors (irradiances, radiances, including polarization)
 - validate the radiative impact of the desert dust particles and satellite remote sensing products
- Drop sondes
 - meteorological measurements