Radiative Forcing of Saharan Dust Aerosol at Niamey, Niger

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AMF Deployment in Niamey

- Vertical distribution of radiative heating within atmosphere an important driver of atmospheric circulations

- ARM Mobile Facility (AMF) deployment in Niger, Niamey as part of RADAGAST allows unprecedented observation of the atmospheric column from the ground and from space (GERB and SEVIRI sensors)

- Objective is to retrieve profiles of aerosol vertical distribution, calculate radiative heating rates, and examine radiative forcing of Saharan dust aerosol at Niamey

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Aerosol properties at Niamey

- Retrievals of column visible AOD, g, ω from MFRSR (Kassianov et al.)
- Retrievals of infrared AOD, $r_{\text{eff}}$ from AERI, assuming kaolinite (Bedka & Turner)
- Vertical profile of extinction from MPL
- Interpolate aerosol properties over missing/cloudy periods
- Caveats:
  - Aircraft flights during DABEX show frequent cases of biomass overlying dust; we assume column values
  - Currently not requiring consistency between AERI/MFRSR views of aerosol
  - Issues with MPL calibration and possible temperature-dependent diurnal cycle

Jan 21 case (DABEX flight indicated dust only)
MPL corrected backscatter

MPL calculated extinction profile

Jan 21

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Downwelling surface fluxes for Jan 21

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Downwelling surface fluxes for Jan 21

Cloud in observations

Common feature: overestimate of LW\downarrow at night

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“Non-Cloudy” Periods
Calculated SW Radiative Effect at Surface due to Aerosol Only (Jan-Apr 2006)
Calculated LW Radiative Effect at Surface due to Aerosol Only (Jan-Apr 2006)
Calculated Daily Avg Radiative Effect at Surface due to Aerosol Only (Jan-Apr 2006)
**Conclusions/Future Work**

- Niamey AMF data can be used to estimate radiative effect of aerosol on surface fluxes and in vertical column.

- Daily average effect of aerosol on surface fluxes during dry season is -36.5 W/m² on SW and +26.8 W/m² on LW.

- **Future work:**
  - Combine surface estimates with TOA estimates from Slingo group.
  - Examine DABEX aircraft measurements to understand frequency of dust/biomass and vertical variability in aerosol properties.
  - Compare calculated/observed radiation budgets to climate models.
Comparison to Model Radiative Budgets

SW Tot at Sfc

- Calc w/ Aerosol Only
- Obs All Sky
- CAM All Sky
- MMF All Sky

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