Radiative Forcing of Saharan Dust Aerosol at Niamey, Niger

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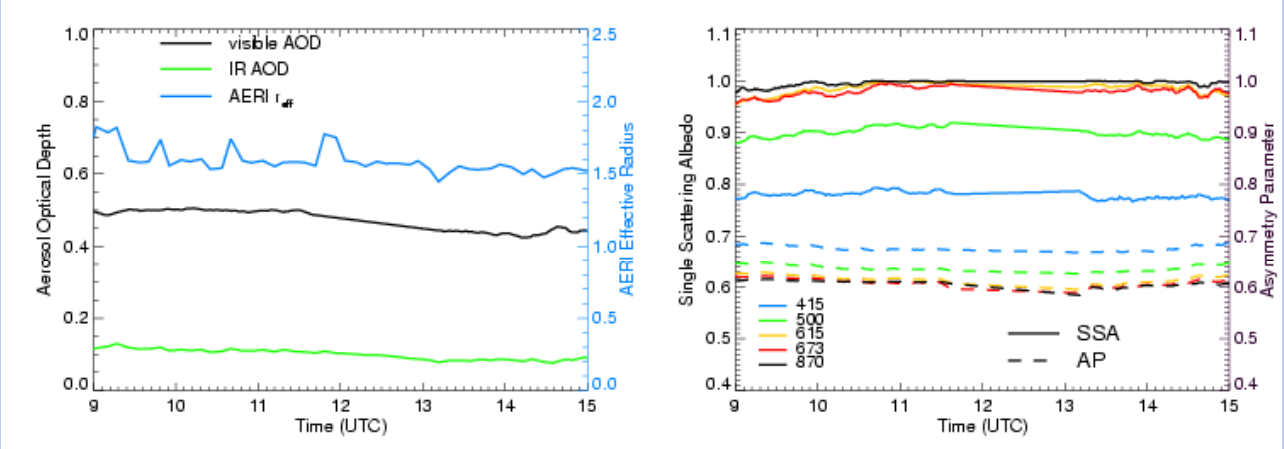
With contributions from J. Mather and J. Barnard

AMF Deployment in Niamey

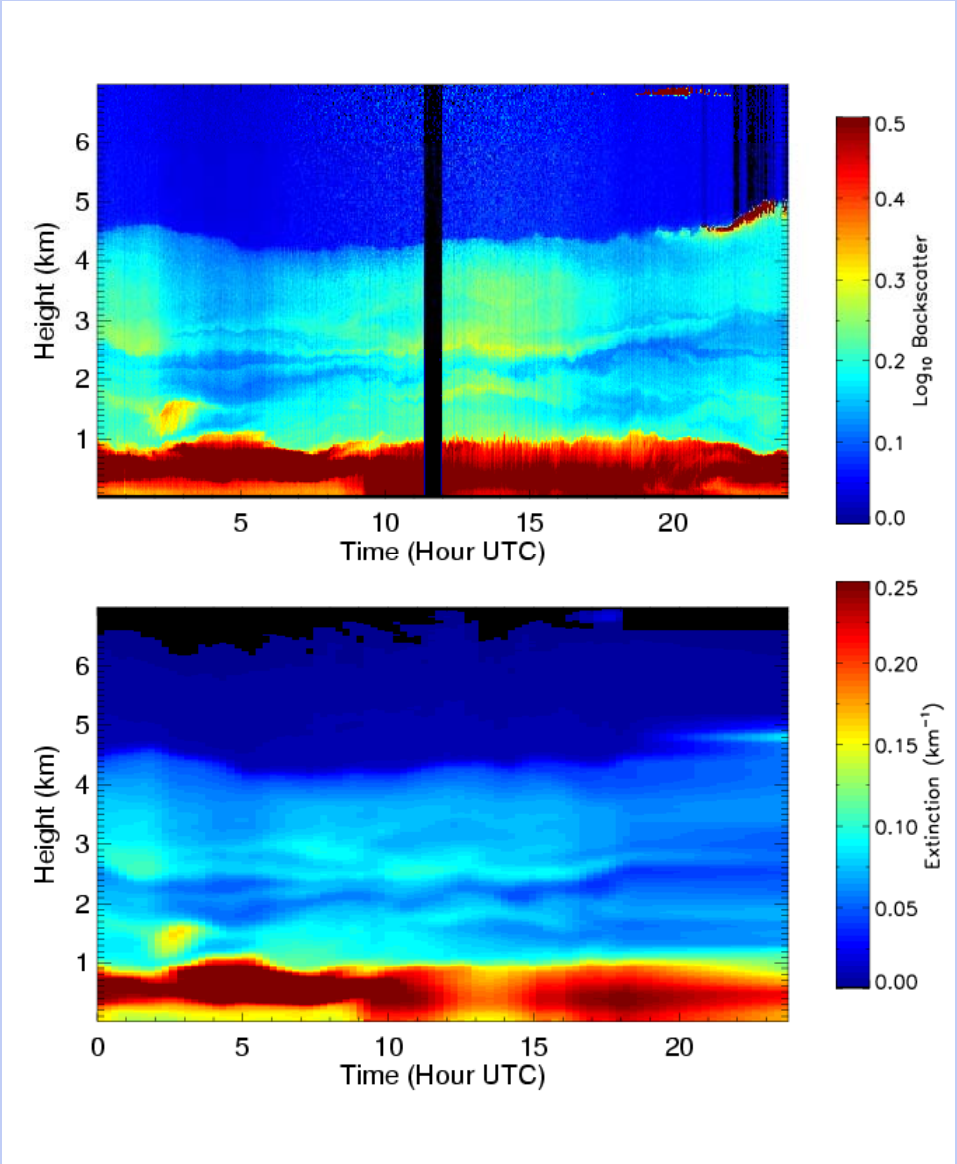
- **Vertical distribution of radiative heating within atmosphere an important driver of atmospheric circulations**
- **ARM Mobile Facility (AMF) deployment in Niger, Niamey as part of RADAGAST allows unprecedented observation of the atmospheric column from the ground and from space (GERB and SEVIRI sensors)**
- **Objective is to retrieve profiles of aerosol vertical distribution, calculate radiative heating rates, and examine radiative forcing of Saharan dust aerosol at Niamey**

Aerosol properties at Niamey

- Retrievals of column visible AOD, g, ω from MFRSR (Kassianov et al.)
- Retrievals of infrared AOD, r_{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)

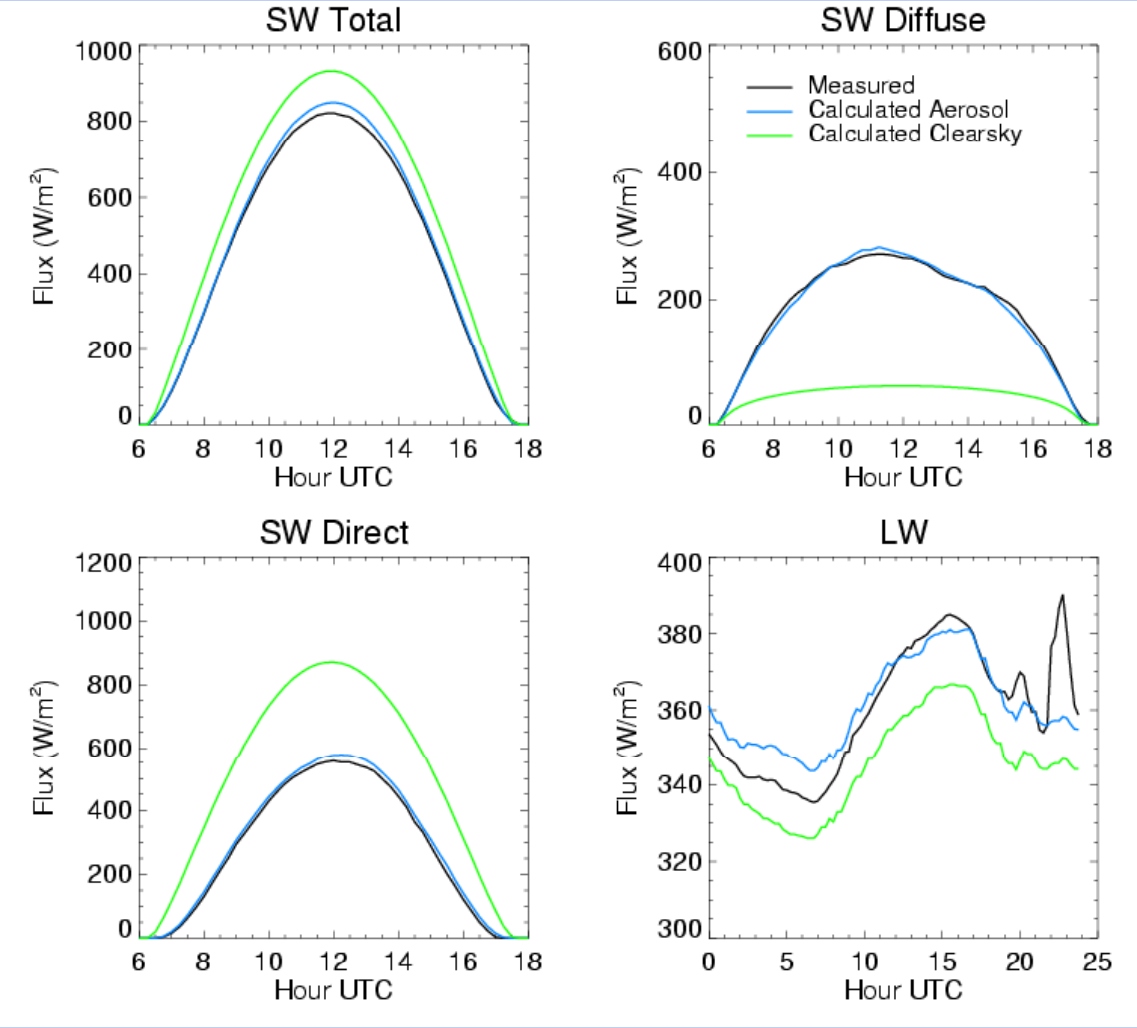


MPL corrected backscatter

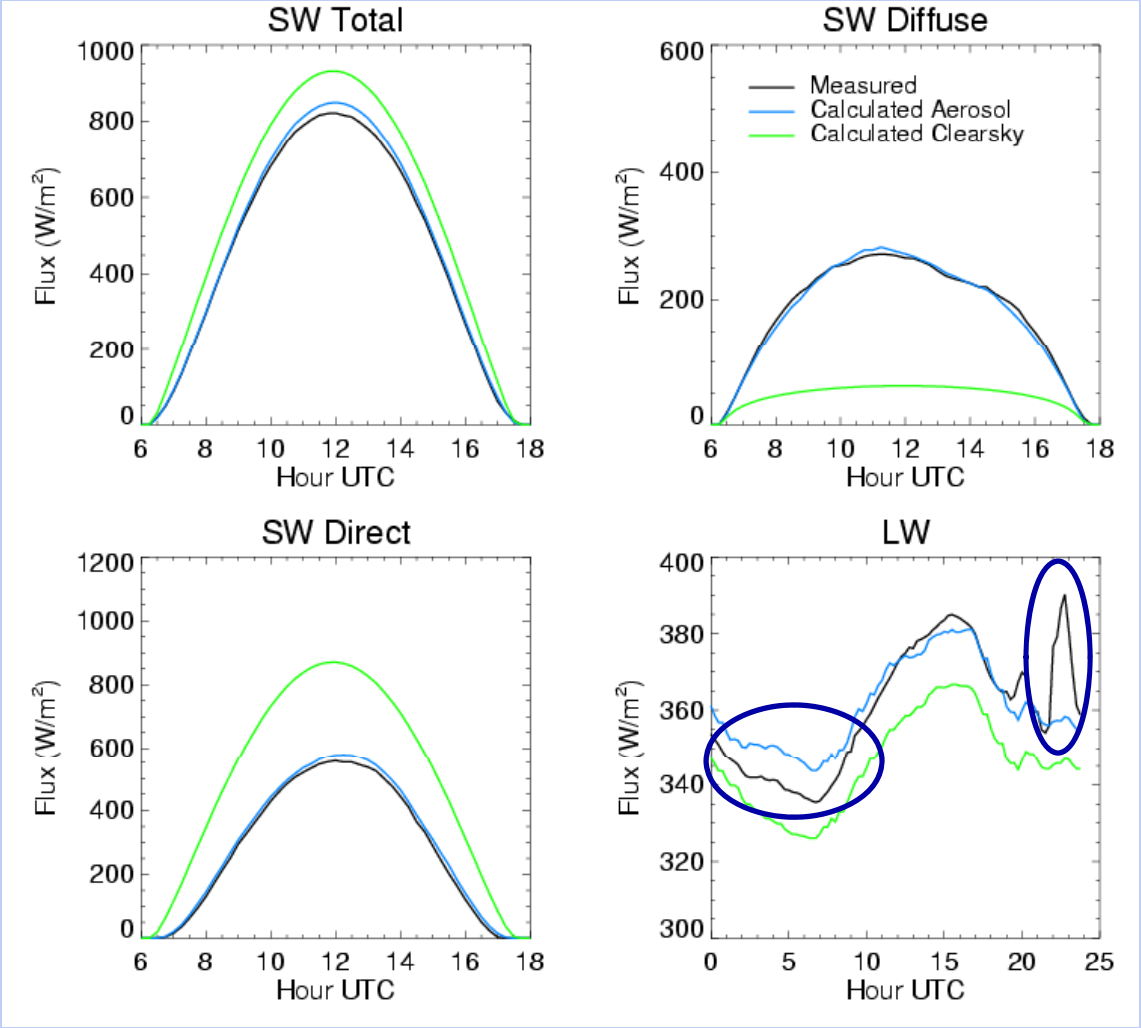
MPL calculated extinction profile

Jan 21

Downwelling surface fluxes for Jan 21



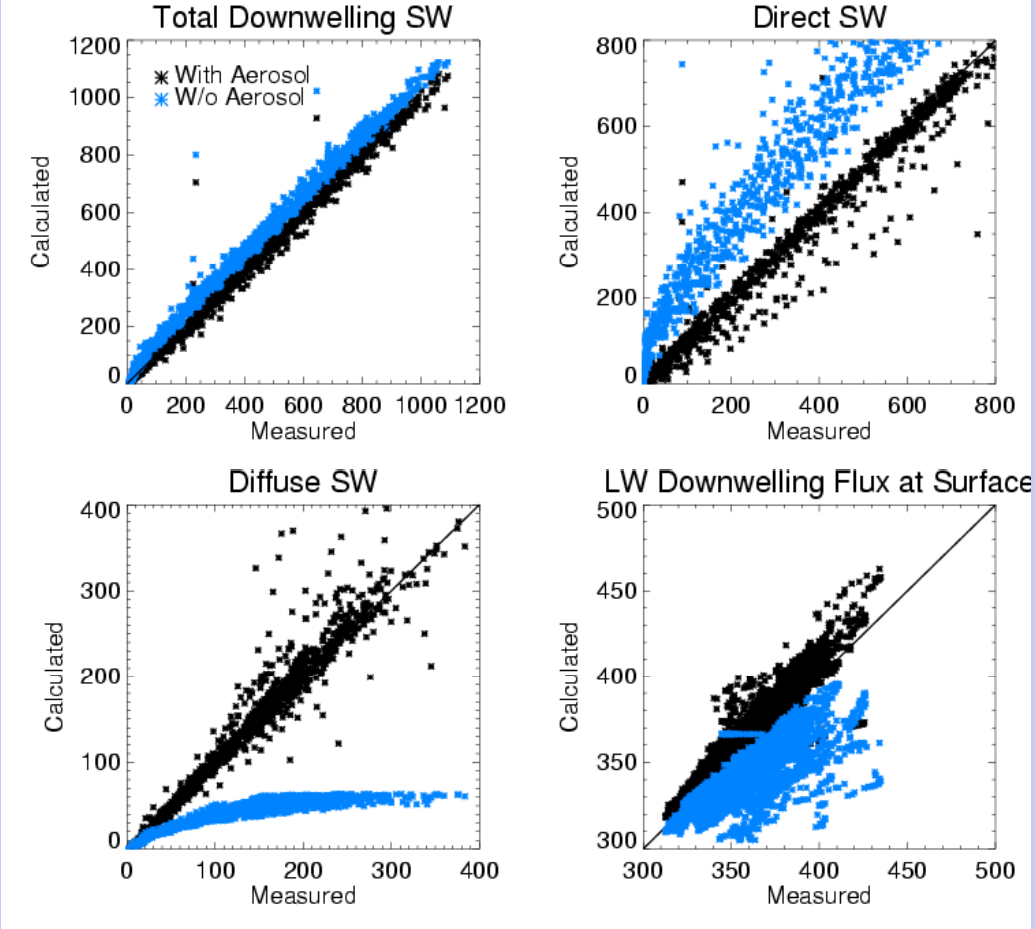
Downwelling surface fluxes for Jan 21



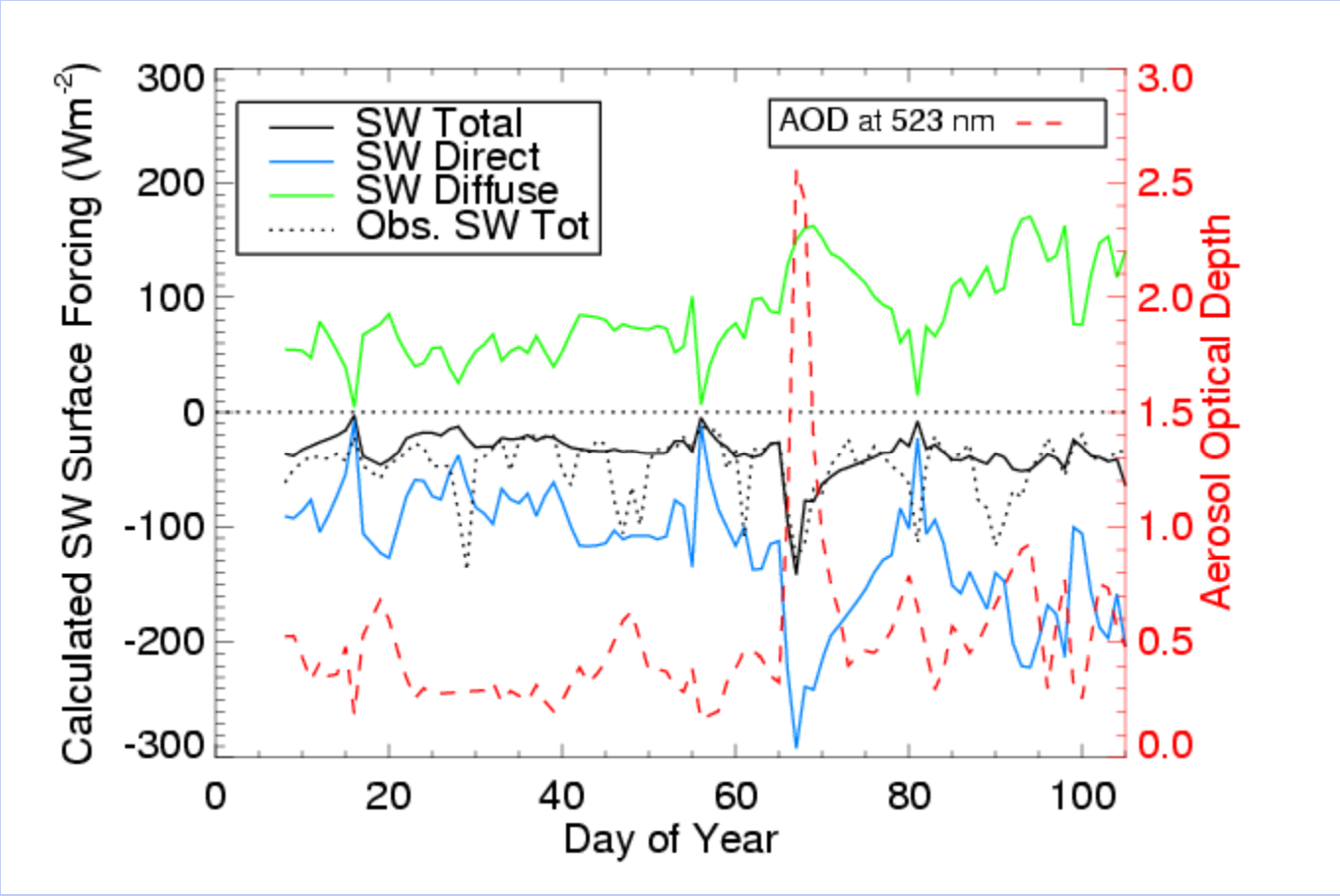
Cloud in observations

Common feature: overestimate of LW↓ at night

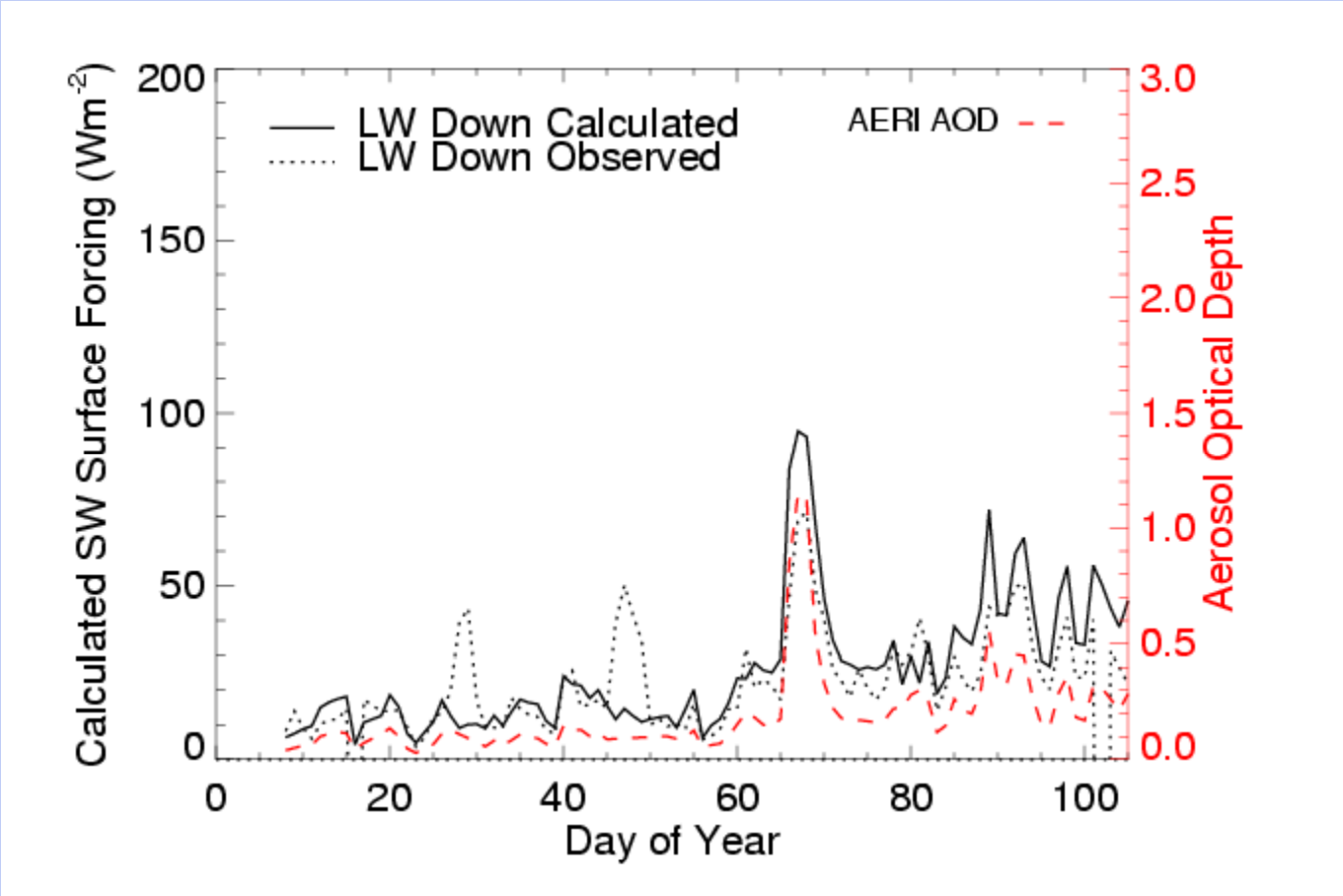
“Non-Cloudy” Periods



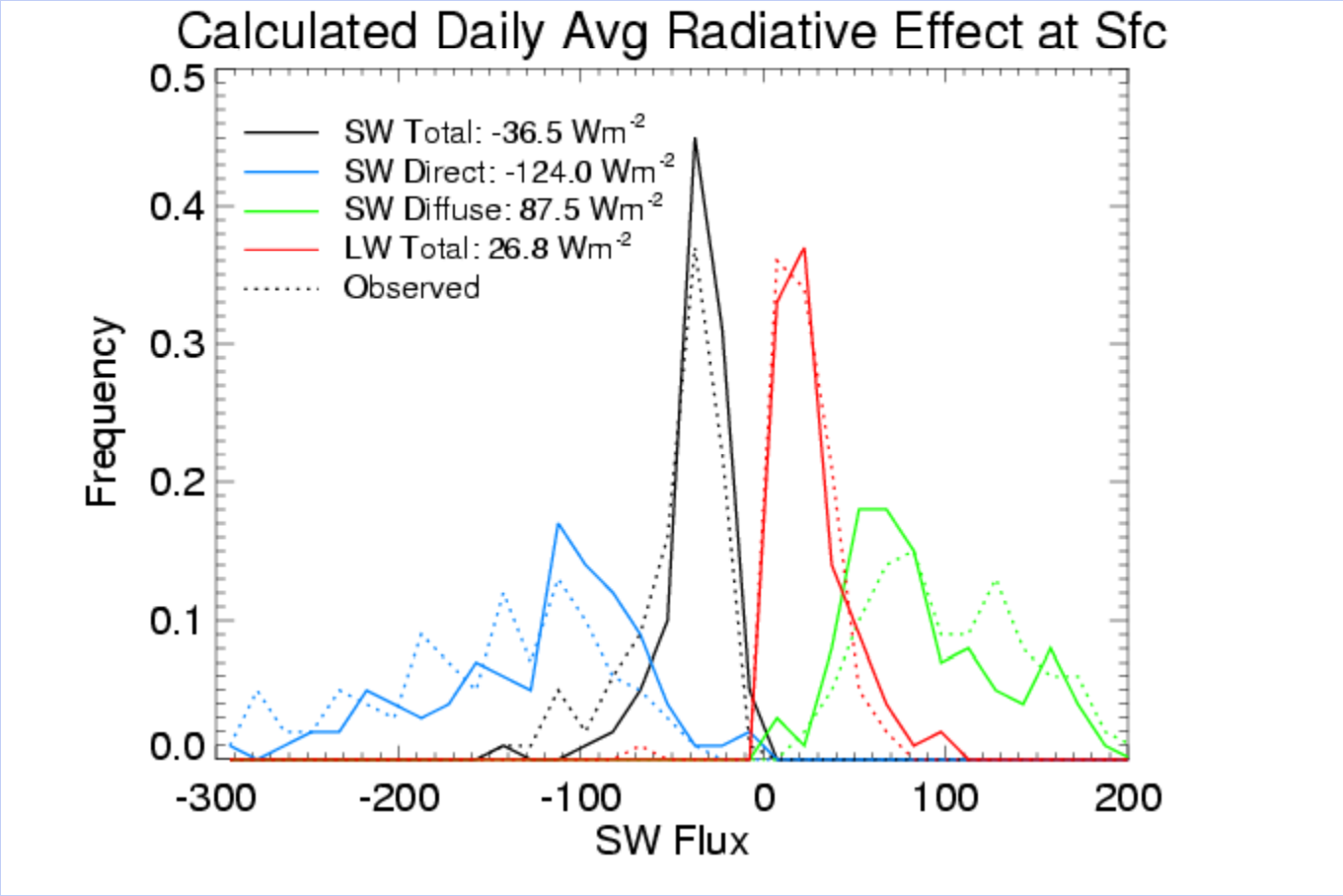
Calculated SW Radiative Effect at Surface due to Aerosol Only (Jan-Apr 2006)



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/m^2 on SW and +26.8 W/m^2 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