Comparing Observations and Calculations of Radiation During the RADAGAST Experiment

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Introduction

Fig. 2: ARM Mobile Facility instrument field at Niamey airport, Niger (2.17E 13.47N).

• Using the Edwards-Slingo RT code (ES), the radiation measured at TOA by GERB and at the surface from the AMF during its Nigerien deployment is compared with calculations during Nov-Dec 2006.
• Satellite data is also used to scale surface properties and provide a cloud mask.
• Surface aerosol loadings in the SW are from the AERONET station at Niamey.
• Estimates of the broadband atmospheric flux divergence for one diurnal time can then be calculated from the measured and calculated flux components.

Longwave comparisons

• Used ‘sonde launches between November and December 2006, at 06, 11, 17, & 23 UT to create RT input profiles.
• Launch times chosen to be cloud free via satellite (NOWSAF SEVIRI) and surface (in-house) cloud masks.
• Aerosol loading for RT profiles is empirically derived from calculation of surface direct effect. (Measured LW flux less calculated pristine flux).
• Comparisons with IR retrievals indicate approach is reasonable, although may be some positive bias at 11 UT.
• Resulting downwelling surface flux matches the AMF values to ±0.5 Wm⁻², as expected.
• Surface emissivity is 0.93 & surface temperatures are scaled using MODIS retrievals across the GERB area (ARG product, ~50km x 50km).
• Net surface flux is -4.7 ±1.8 Wm⁻²; surface temperature scaling leads to primary difference at 11 UT.
• At TOA, radiance differences are constant with UT, but the fluxes have a variation:
  - Error in emissivity may account for the radiance difference.
  - Error in GERB radiance-to-flux conversion would cause disparity between radiance and flux differences.

Shortwave comparisons

Fig. 6: Distributions of measured less calculated SW fluxes for the surface upwelling, downwelling, & direct beam, and TOA reflected.

• Merged profiles with AERONET AOT(500nm) retrievals allow RT calculations of SW flux at 10 min time resolution.
• Aerosol optical properties are from DABEX (Jan-Feb 2006) aircraft campaign, fixed with only dust present.

Radiative Divergences

Fig. 9: 11 UT flux divergence across the atmosphere. Measured & RT-derived values are denoted by crosses and points.

• From the results at TOA and the surface, and LW & SW, flux divergence across atmosphere can be calculated.
• The measured and calculated values have significant difference.
• Future work: investigate the TOA comparisons to eliminate seen biases.

Acknowledgements: AMF data from ARM archive; GERB data from GGSPS & RMIB; AERONET level 2 data courtesy Rick Wagener, BNL; DABEX data from Ben Johnson, UK MetOffice; MIXCRA AOT retrievals from Dave Turner, Uni. Wisconsin-Madison; NOWSAF SEVIRI cloud mask via Gary Robinson.