A One-year Study of the Diurnal Cycle of Clouds and Radiation in the West African Sahel Region

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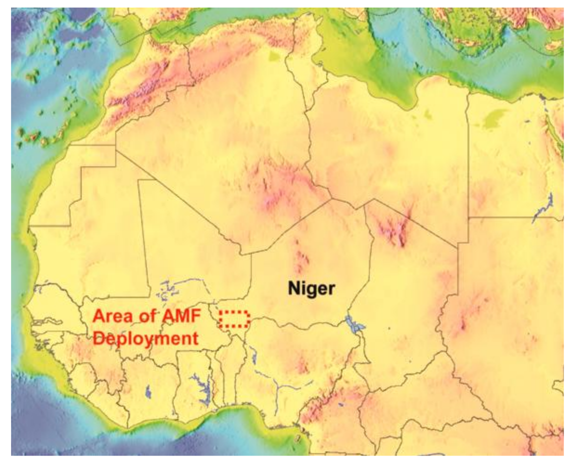
Goals

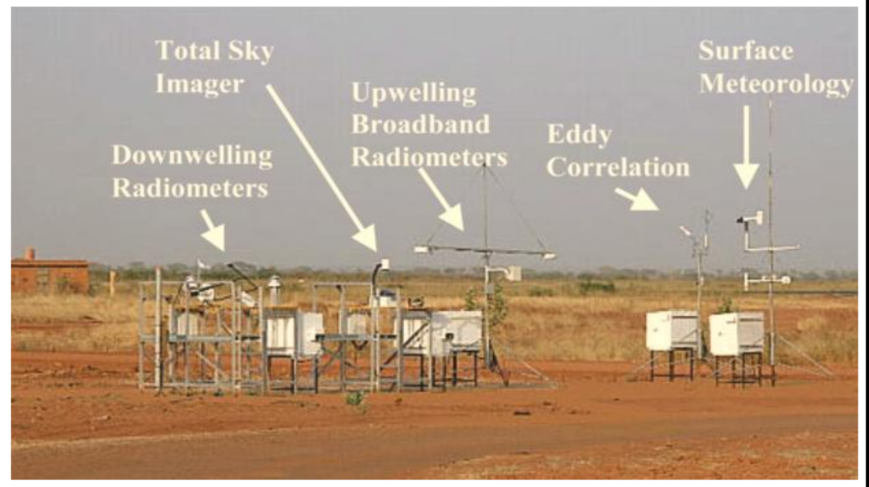
-Measure the cross-atmosphere radiative flux divergence on a diurnal timescale using data collected in the Sahel region of West Africa throughout the year of 2006

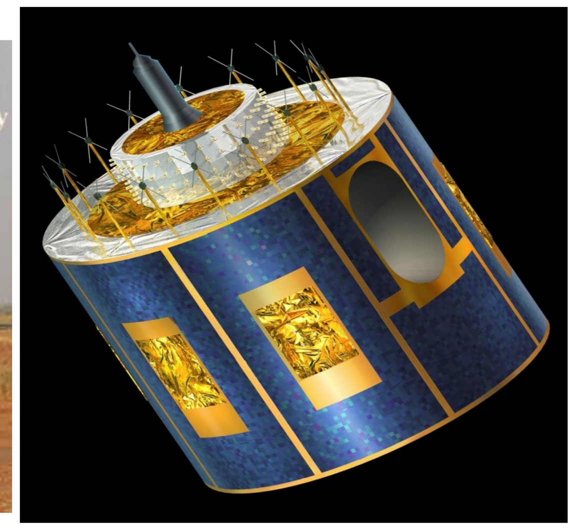
-Quantify the diurnal cycle of cloud fraction

-Determine the factors that influence the diurnal cycle of the cross atmosphere radiative flux divergence and cloud fraction and how they differ between the dry, wet, and transition season of the West African Monsoon

Data







Surface observations were made in Niamey, Niger by the ARM Mobile Facility (Miller & Slingo 2007)

Top of the atmosphere flux measurements were made by GERB, aboard Meteosat-8 (European Space Agency)

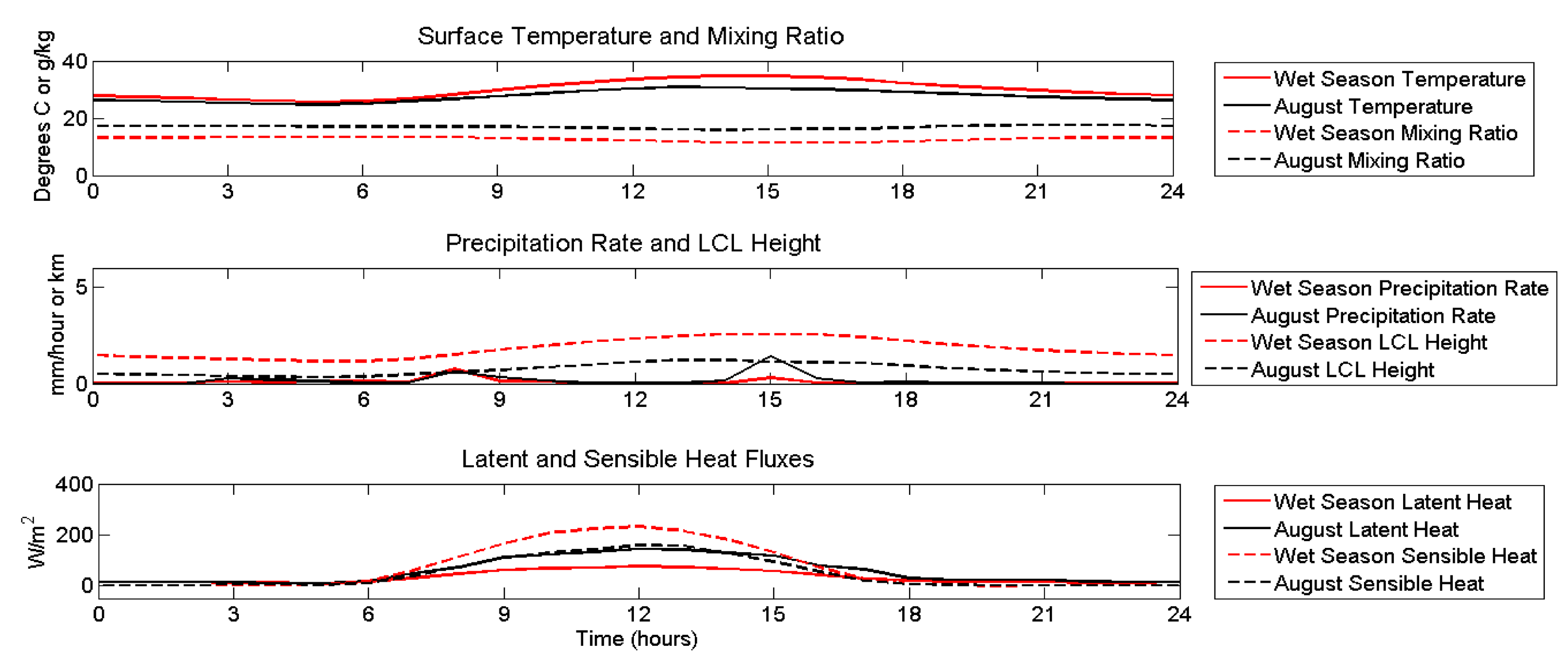


Figure 1: Hour averaged diurnal cycle of meteorological conditions in August 2006 and the 2006 wet season

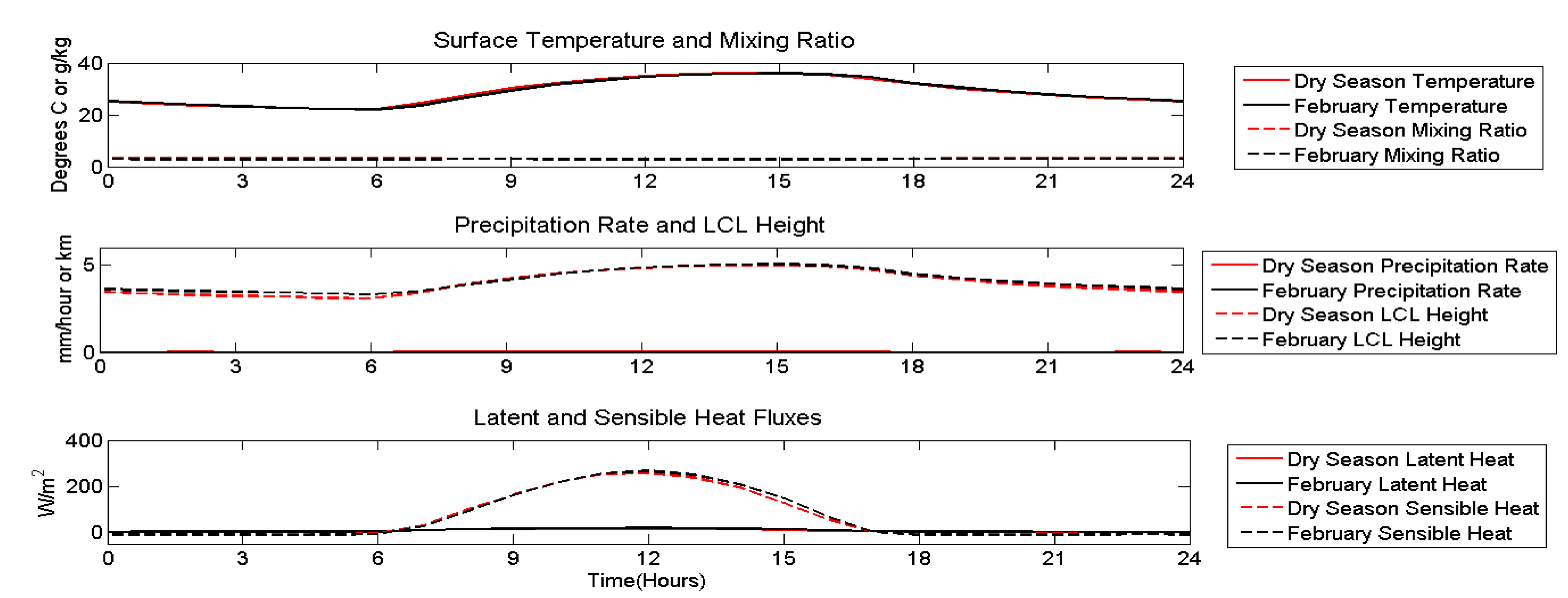


Figure 2: Hour averaged diurnal cycle of meteorological conditions in February 2006 and the 2006 dry season

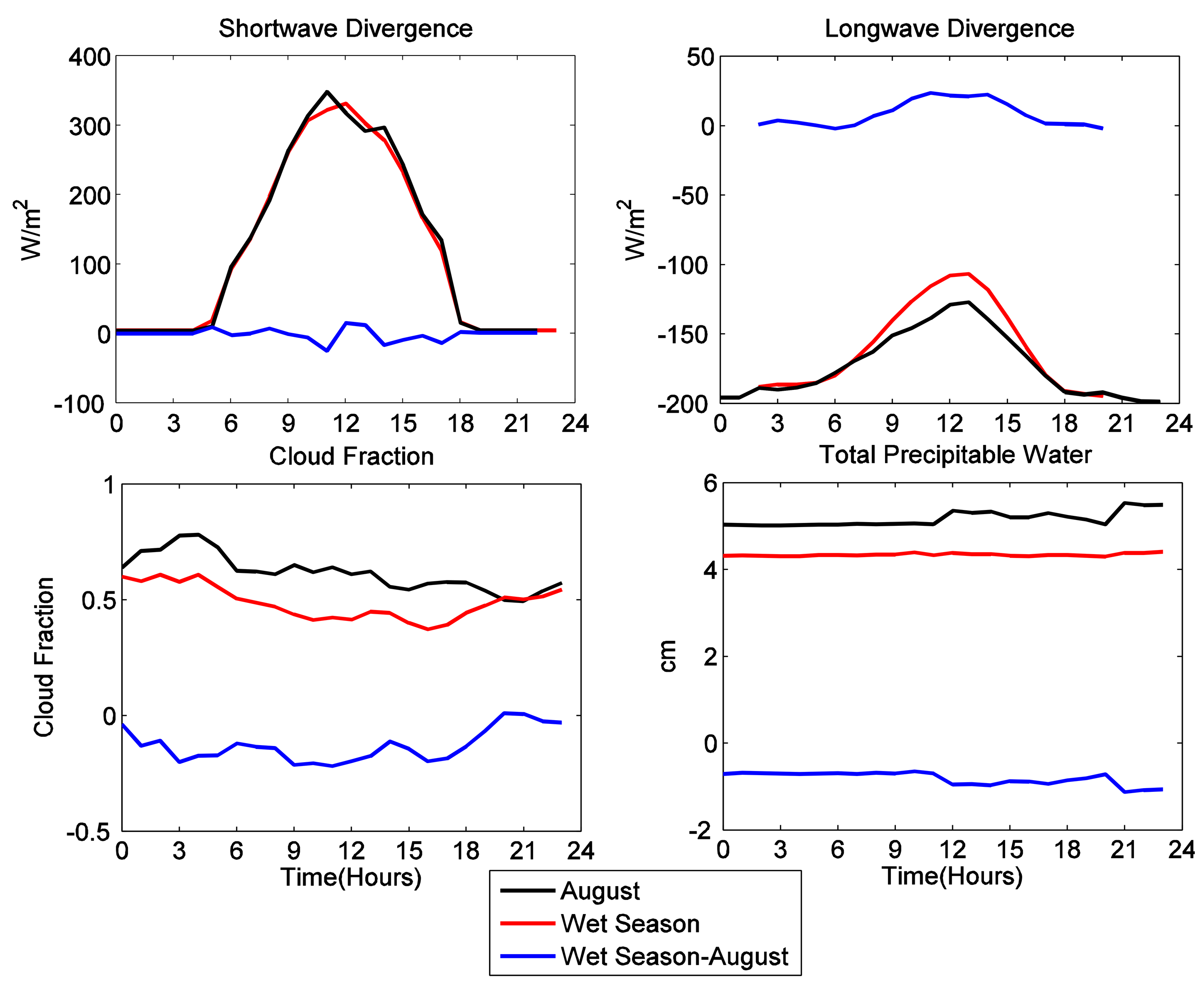


Figure 3: Hour averaged diurnal cycle of a) shortwave divergence, b) longwave divergence, c) cloud fraction, and d) total precipitable water in August 2006, the 2006 wet season, and the wet season minus August

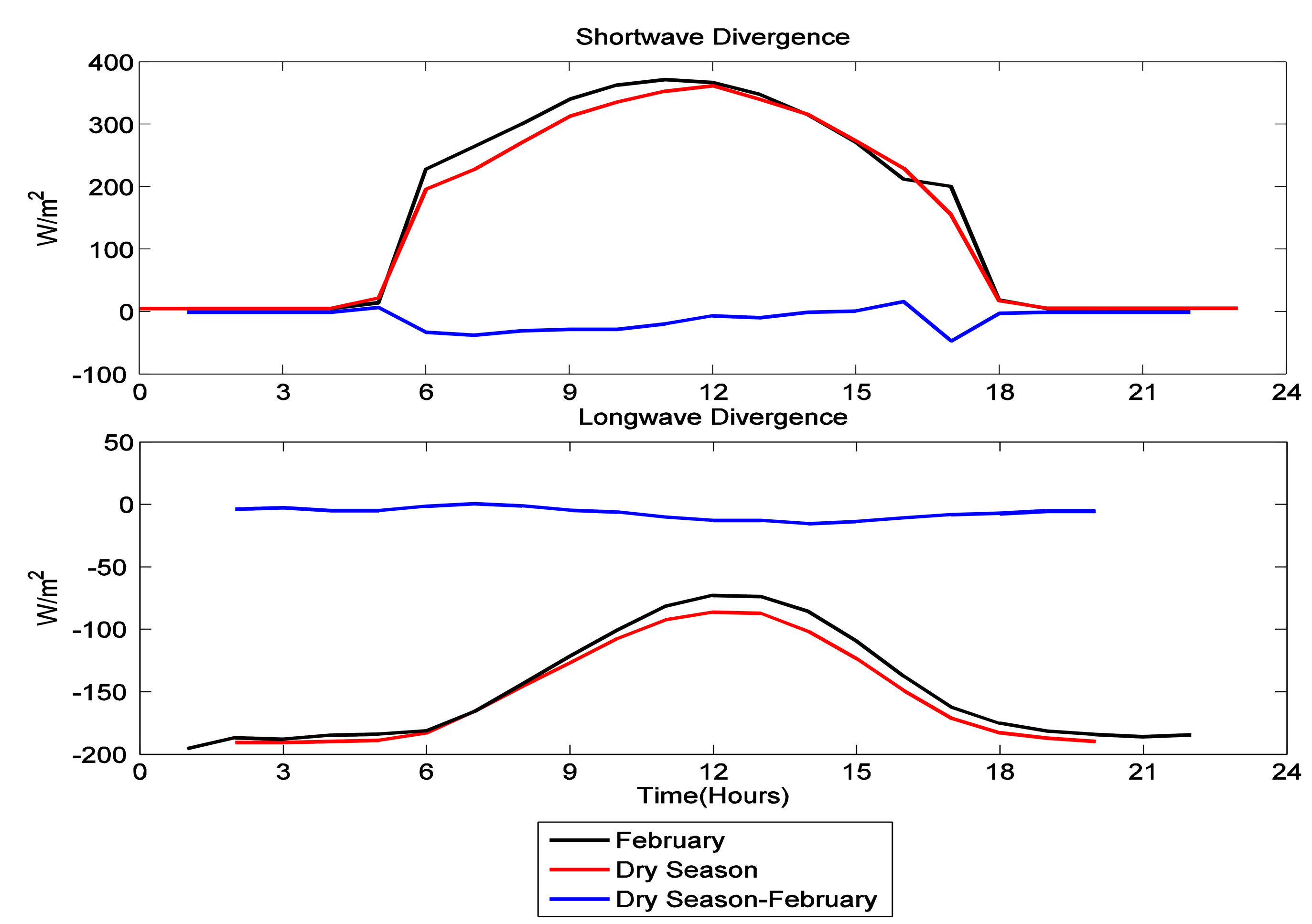


Figure 4: Hour averaged diurnal cycle of a) shortwave divergence and b) longwave divergence in February 2006, the 2006 dry season, and the dry season minus February

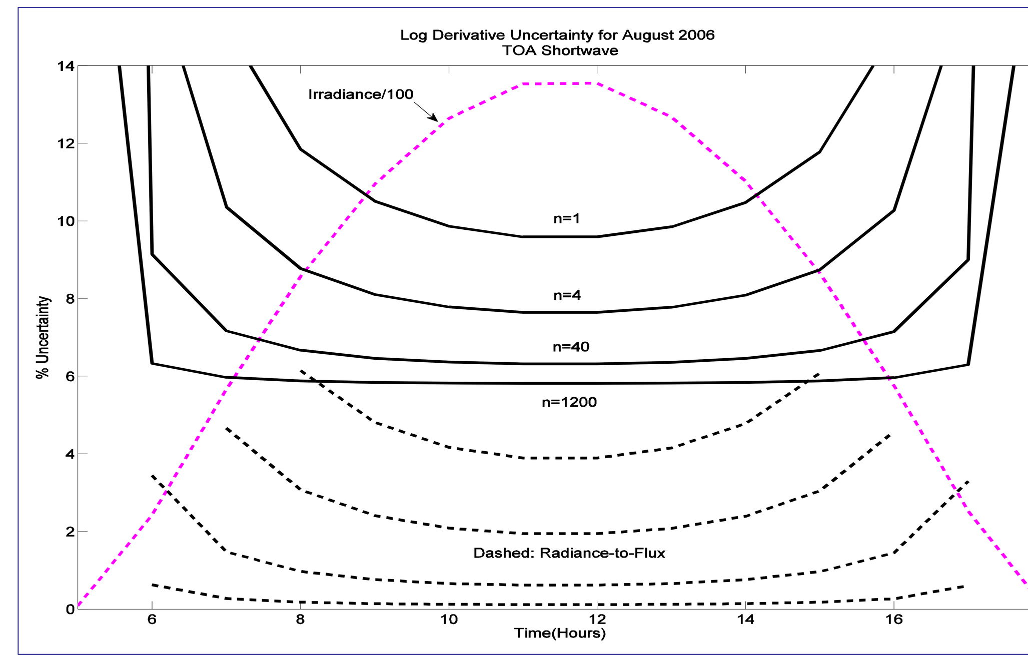


Figure 5: Percent uncertainty in the diurnal cycle of TOA shortwave fluxes in August 2006 using the log derivative method

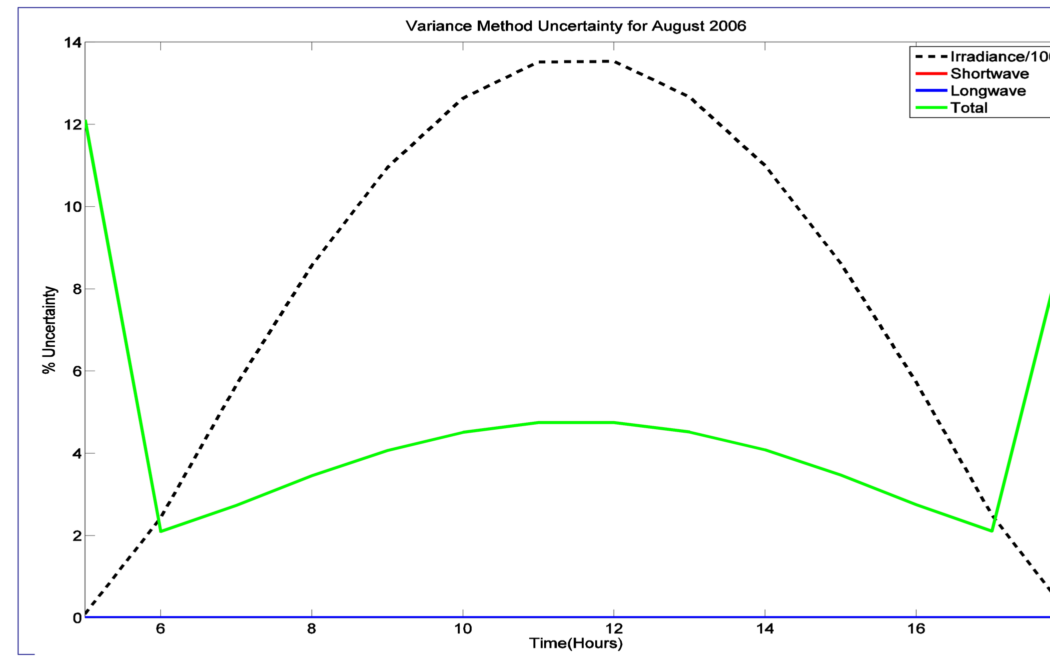


Figure 6: Percent uncertainty in the diurnal cycle of the radiative flux divergence in August 2006 using the variance compensation method

Conclusions

-During the day the total cross atmosphere radiative flux divergence is heavily influenced by the solar insolation, while it is controlled by the longwave divergence at night

-Clouds are not present during the dry season and coincidently the diurnal cycle of divergence tends to be less variable

-Clouds appear to have a negligible impact on the magnitude of the total divergence during 2006 because they impact both the TOA and surface fluxes in a compensatory manner.

-There is a nocturnal peak in the diurnal cycle of cloud fraction

Acknowledgements

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References

Miller, Mark A., Anthony Slingo (2007), The ARM Mobile Facility and its first international deployment: measuring radiative flux divergence in West Africa. *Bull. Am. Meteor. Soc., 88,* 1229-1244, doi:10.1175/BAMS-88-8-1229.