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# Surface radiation and thermodynamic couplings in West-Africa: contrasting re-analyses, CMIP5 climate simulations and in-situ AMMA observations

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Surface radiation and thermodynamics display strong couplings across West Africa and play an important role on the monsoon dynamics. These couplings are also found to consistently vary according to the climate types encountered over this wide continental region, from the wet cloudy Tropics to the arid Sahara desert (Guichard et al. J. Hydrology 2009, Gounou et al. 2012).

The data and observational studies carried out within the AMMA project allow for the first time to evaluate in a consistent way the modelling of these key features of the West African climate. In the present study, we make use of data acquired from several automatic weather stations installed along a meridional transect from the Guinea coast to northern Sahel, at the fringe of the Sahara. (The representativeness of each measurement site is documented by systematic comparisons of data acquired at different stations.) Additional information will be presented at the conference by Bouniol et al (2012) and Guichard et al. (2012) regarding data and observational studies.

This study explore the simulation of the annual cycle by (i) reanalyses (ERA-Interim, MERRA and NCEP-CFSR) and (ii) CMIP5 climate simulations (amip, historical and piControl runs), using sub-daily, daily and monthly model outputs.
It is found that the re-analyses provide a reasonable depiction of the annual cycle of the surface thermodynamics but a much more approximative estimates of surface radiation with monthly biases reaching several tens of W.m-2. These limitations are traced back to the modelling of physical processes involving surface properties, but also clouds and aerosols.

The depiction of the annual cycle by climate models is much more diverse. It is interesting to note that the scatter increases outside of the monsoon wet season, which suggests an important role of night-time processes in shaping the low level temperature and longwave radiative exchanges between the surface and the atmosphere. Overall, it appears that the annual cycle cannot be properly captured by these models without a proper modelling of the diurnal cycle. These results raise concerns regarding the simulation of climate and climate change over this region.