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The importance of the diurnal cycle of Aerosol Optical Depth in West Africa

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High resolution atmospheric simulations with the AROME model coupled with a dust module over West Africa for the whole of June 2006 and 2011 were used to calculate Aerosol Optical Depth (AOD). But the simulations showed a significant diurnal cycle of 0.2 in the dust AOD that could not be inferred from the MODIS Deep Blue satellite retrievals due to their time of overpass. The AROME AOD diurnal cycle have been compared to the new SEVIRI AOD retrievals in June 2011 and shows simlar AOD diurnal cycle. In fact, dust sources are mainly driven by the breakdown of the early morning low-level jet and by moist convection in the afternoon, leading to opposite diurnal cycles. The contribution in dust production is calculated for each processes.

Moreover, simulations show that cloud cover significantly prevents the observation of AOD in convective areas. The under-sampling of the diurnal cycle by satellites like MODIS plus the impact of cloud masks on the space-borne AOD retrievals induce an underestimation of 0.28 ($\sim$40%) over the convective regions and an overestimation of 0.1 (17%) over morning source areas like Bodélé.

Finally, the vertical dust distribution is explored via CALIPSO monthly mean from 2006 to 2011. The vertical dust distribution is a clue element to determine the dust raciative impact. Over the June month, the dust radiative impact affect the atmospheric energetic budget by an absorption of the short wave of 58W/m^2/AOD into the atmosphere and a reduction of 50W/m^2/AOD at the surface.