Anonymous Review of "Radiative impact of mineral dust on monsoon precipitation variability over West Africa" by Zhao et. al. (acpd-10-27185-2010-1)

In this article, the authors examine the impact of mineral dust aerosols on the West African Monsoon (WAM) climate using the regional WRF-Chem model driven by NCEP/NCAR global reanalysis. They find that the interplay between short-wave and long-wave dust effects impact the diurnal stability of the atmosphere - stabilizing the atmosphere during the day and destabilizing it at night. As a result, late afternoon precipitation decreases and nighttime/early morning precipitation increases; this improves agreement compared to measurements. They also show that the impact of dust on precipitation is highly sensitive to the assumed absorptivity of dust.

General Comments

I find this paper to be very well written and timely in its content. With a few mostly minor adjustments, I find it acceptable for publication in ACP. However, I would like specific attention at addressing points 6 and 7 in the Specific Comments, as I feel these points are important.

Specific Comments

1. Model Description: Here you discuss the two possibilities for representing aerosol distributions in WRF-Chem: modal (MADE/SORGAM) and size-binned (MOSAIC). However, it is not at all clear to me which representation is used in this paper. Are you using both? I don't believe so, but why discuss both if you are not using both? If you are using both, then why? This point really needs clarification.

2. Section 4.1, Page 27195, L.9-12: Is the low bias at the southern boundary really due to chemical boundary conditions? What exactly do you mean by the southern boundary? (i.e. the WAM boxed region or the whole region including Southern Africa?) If the latter, could the low bias be due to a low-bias in biomass burning aerosol over this region?

3. Section 4.1, Page 27195, L.20: Define the domain referred to by "domain averaged."

4. Section 4.1, Page 27196, L. 17: You state the WRF-Chem captures the AMF retrievals well when dust is included. I don't really see this in Figure 3. Can you provide quantitative support of this (i.e. correlation coefficient)?

5. Section 4.1, Page 27196, L. 27: Can you show how small the dust impacts on OLR are, or quantify how small they are in comparison to differences related to using the Lin cloud microphysics scheme or other schemes?

6. Section 4.2.1, Page 27197, L. 15: You mention that the underestimate in heavy precipitation events results from use of the Lin cloud microphysics scheme. Later in the conclusions, you state that the Lin scheme is included to account for dust indirect effects on stratiform cloud microphysics -- even though convective precipitation dominates during the WAM season. Why, then, if you are not focusing (or paying any attention to, really), aerosol indirect effects, do you use this scheme? Would it not be better to have less bias in convective precipitation (by using another convective scheme) since this is your focus? I do not understand the reasoning here other than to preclude the inevitable reviewer question "what about the indirect effect." Most

importantly, would you expect your results (i.e. dust impact on convective precipitation) to change if another scheme were used?

7. Section 4.2.1, Page 27198, L. 22-24: I think you may need to qualify this statement. While the *immediate* impact of dust on precipitation over the ocean may be small due to ocean heat capacity, is it true that the dust impact on cooling SSTs would have no, perhaps longer-term, impacts?

Technical Corrections

1. Abstract, P. 27186, L. 17-23: These sentences should be reworded, as they seem contradictory and are hard to digest. A reword might look like: "Sensitivity simulates show that, at the surface, dust longwave warming at night surpasses daytime shortwave cooling; this leads to a less stable atmosphere associated with more convective precipitation in the nighttime. When considering weaker to more absorbing dust solar absorptivity, which is uncertain, daily WAM precipitations varies from ...."

2. Section 3.2, Page 27192, L. 21: Change "...called 'Deep Blue algorithm' ..." to "...called *the* 'Deep Blue algorithm'..."

3. Section 3.2, Page 27192, L. 22: Change "...integrated with existing MODIS algorithm ..." to "...integrated with *the* existing MODIS algorithm ..."

4. Section 3.3, Page 27193, L. 10: Change "... to be used not depending on ..." to "...to be used that do not depend on ..."

5. Section 4.2.1, Page 27199, L. 14: Change "...by up to 2.5 K/d and warms ..." to " ... by up to 2.5 K/d, and warms ..."

6. Section 4.2.1, Page 27199, L. 16: Spelling, change *heaing* to *heating*

7. Section 4.2.1, Page 27199, L. 27: This last sentence is hard to digest. Perhaps reword to something like: "CAPE has a much larger value during daytime, and convective precipitation accounts for over 90% of precipitation in the simulation. Therefore, the net change is a reduction of the *daily?* precipitation due to a larger reduction during daytime and smaller increase during nighttime."