A Case Study on Atlantic Tropical Cyclogenesis and Saharan Air Layer Simulated Using WRF/Chem Coupled with an AOD Data Assimilation System

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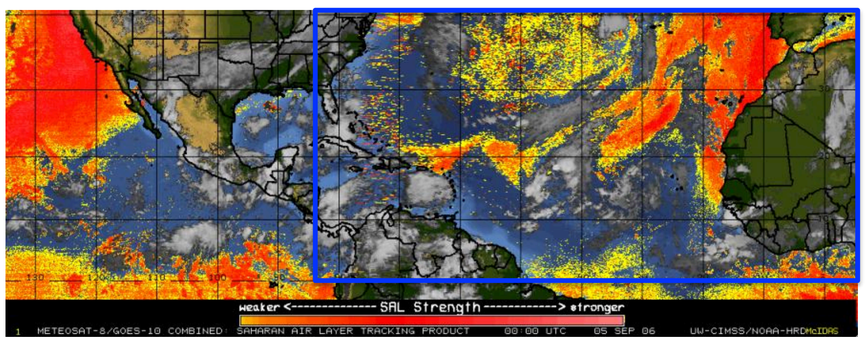
Satellite observed SAL on Sep 5 (top) and Sep 12 (bottom), 2006



(Image from http://tropic.ssec.wisc.edu)

This imagery is created by differencing the 12.0 and 10.7 μm infrared channels on the GOES satellite and 12.0 and 10.8 μm infrared channels on the Meteosat satellite. The algorithm is sensitive to the presence of hot/dry and/or dusty air in the lower to middle levels of the atmosphere (~600-850 hPa or ~4,500-1,500 m) and is denoted by the yellow to red shading.

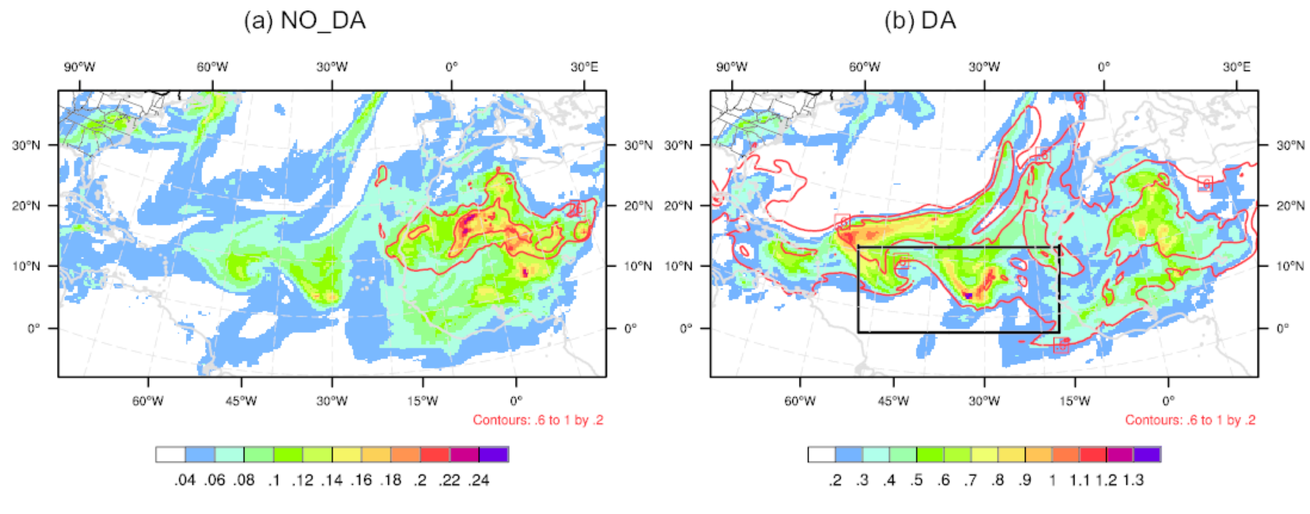
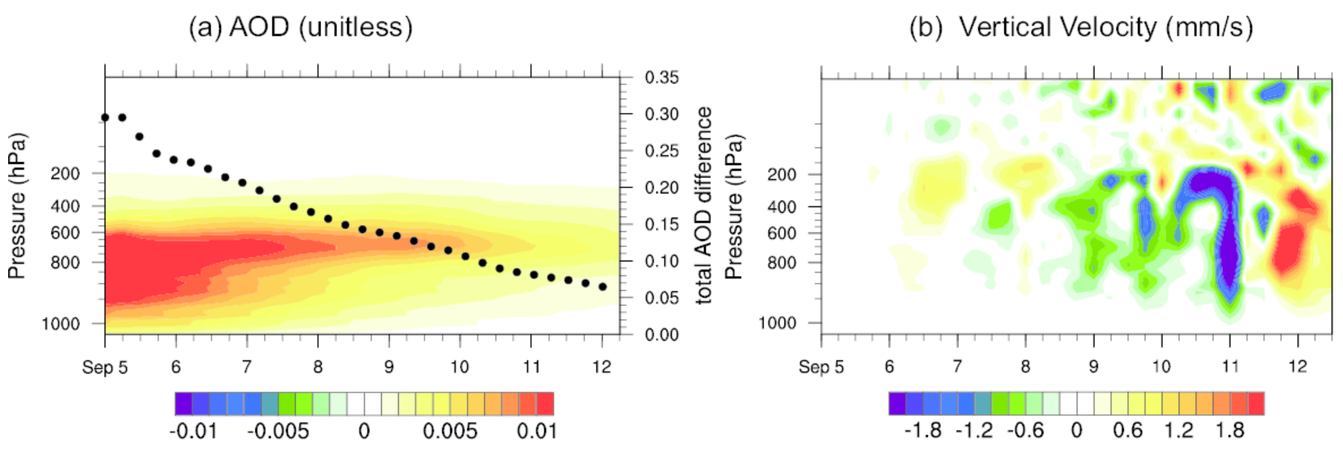


Figure 1. After one-week period (28 August – 5 September 2006) for aerosol spin-up, total 550-nm AOD distribution valid at 00 UTC 5 Sep. 2006 from the (a) NO_DA and (b) DA experiments. Also shown are dust AOD ratios in red contours. Note that color scales are intentionally made different between NO_DA and DA for a better visualization. Black rectangle in (b) is defined as the Main Cyclogenesis Region (MCR).



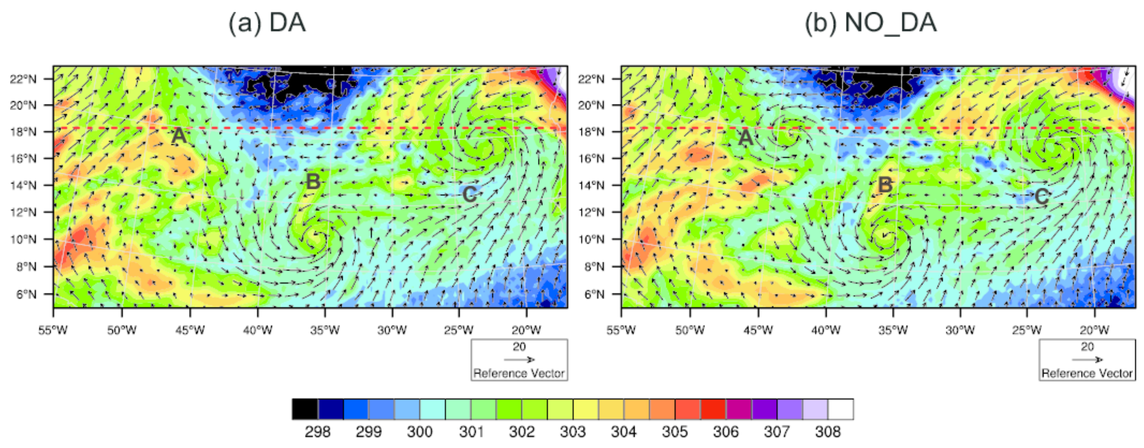


Figure 3. 10-m u-v wind vectors (m/s) and potential temperatures (shaded, K) in MCR for 120-h forecast valid at 00 UTC 10 Sep.

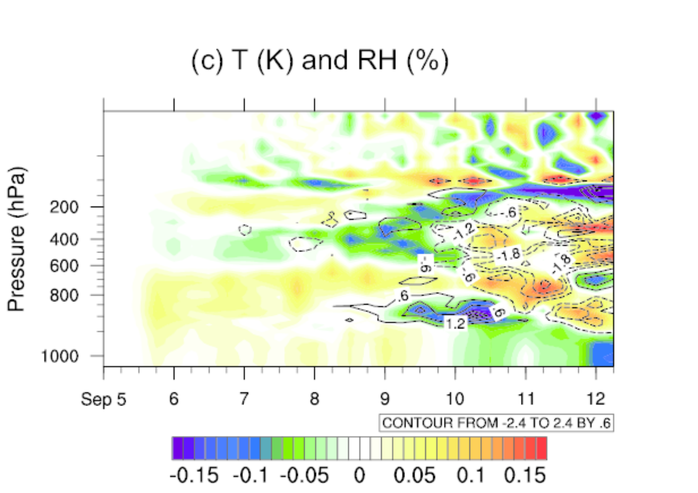


Figure 2. MCR-averaged differences (DA - NO_DA) for (a) AOD, (b) vertical velocity, (c) temperature (color shaded) and relative humidity (contours), and (d) liquid and ice clouds as a function of height and time.

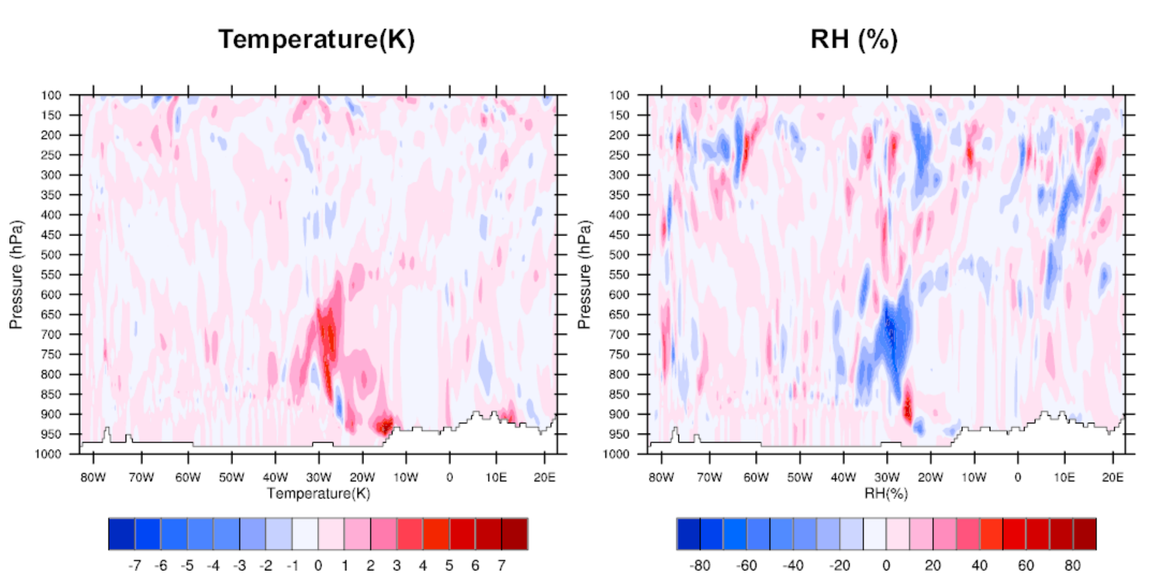


Figure 5. Cross sections (along black solid line in Figure 4) of (a) temperature difference and (b) relative humidity differences of DA minus NO_DA for 168-hr forecast valid at 00 UTC 12 Sep. 2006.

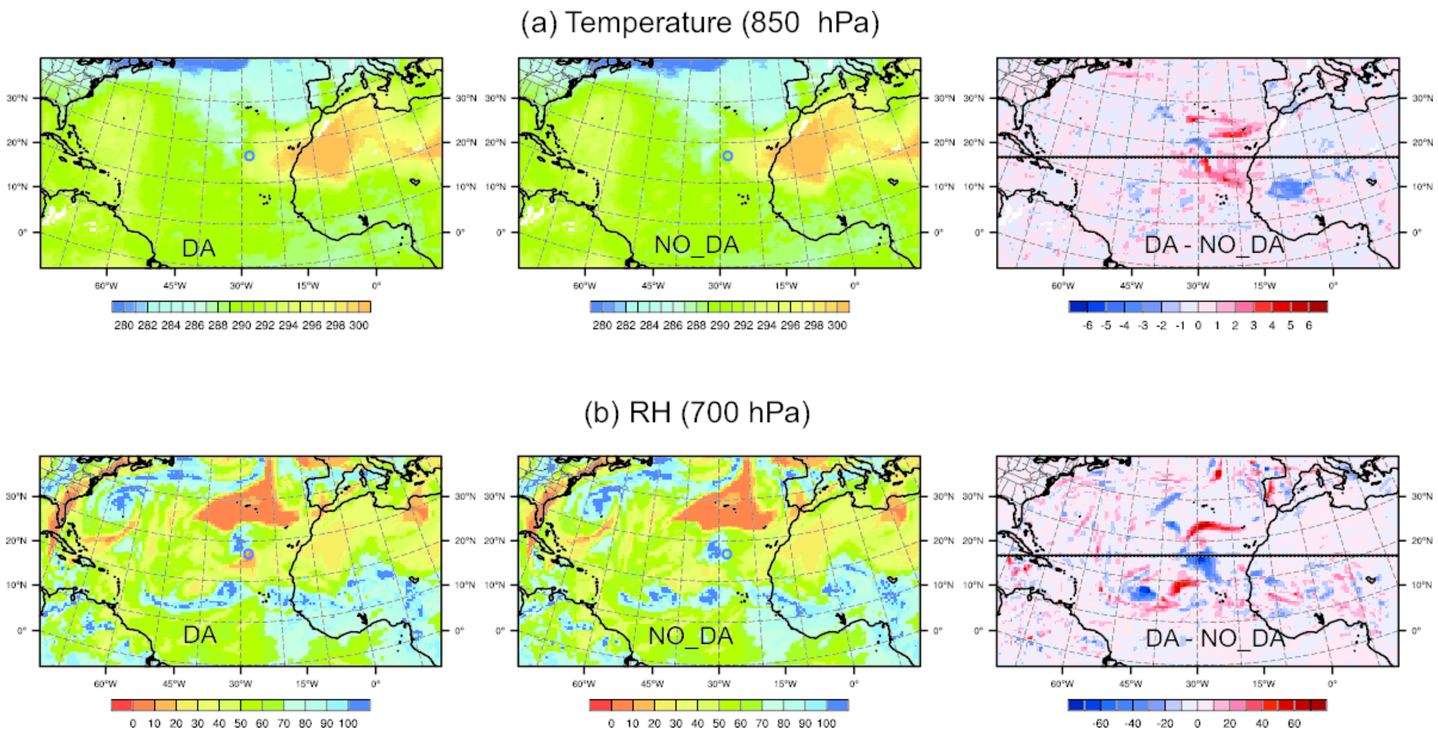


Figure 4. Spatial distributions of (a) 850 hPa temperature (K) and (b) 750 hPa relative humidity (%) from two experiments for 168-hr forecast valid at 00 UTC 12 Sep and the their corresponding differences. The blue circle is the selected SAL location used in Figure 6. The black solid line in the difference field is for the cross sections used in Figure 5.

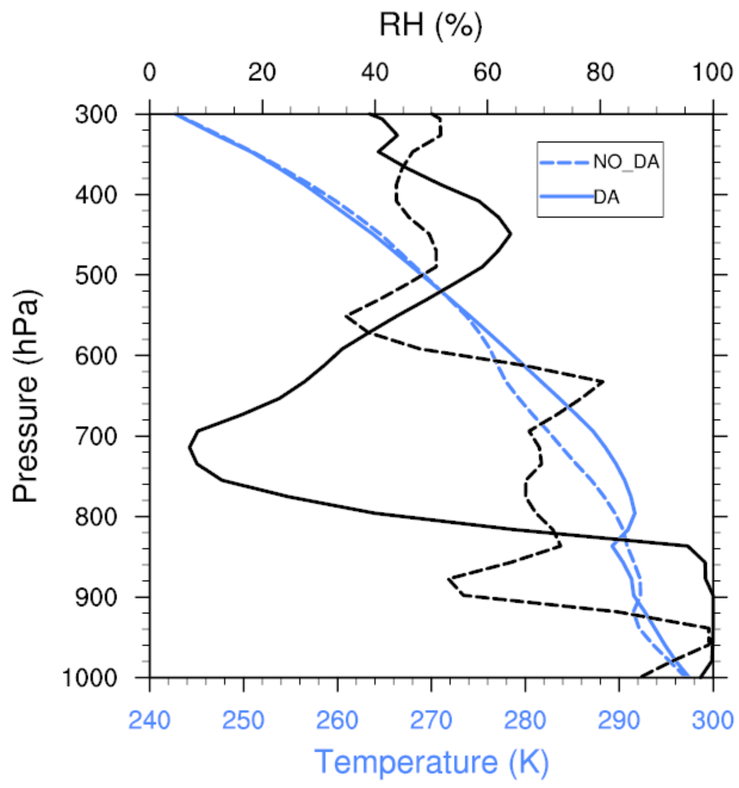


Figure 6. Vertical profiles of temperature (K, blue) and relative humidity (%, black) at the selected SAL location (blue circles in Figure 4) from the two experiments (solid: DA, dashed: NO_DA) for 168-hr forecast valid at 00 UTC 12 Sep 2006.