

Interactive comment on “Interaction of Dust Aerosols with Land/Sea Breezes over the Eastern Coast of the Red Sea from LIDAR Data and High-resolution WRF-Chem Simulations” by Sagar P. Parajuli et al.

Anonymous Referee #1

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Review of “Interaction of Dust Aerosols with Land/Sea Breezes over the Eastern Coast of the Red Sea from LIDAR Data and High-resolution WRF-Chem Simulations” by Sagar P. Parajuli et al. submitted to Atmospheric Chemistry and Physics.

This paper is focused on the effect of aerosols onto breeze circulation over the Eastern Coast of the Red Sea employing direct observations and WRF-Chem model. The paper is well structured and written and the results are sound and novel. Specifically, I am very much impressed with WRF-based estimates of the contribution of dust (along with the other components) the aerosol optical depth, the reported consistency

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of the vertical distribution of the aerosols across different observational diagnostic and model results and the role of breezes in dust deposition in the coastal environment with complicated orography. I would suggest to single out these conclusions somehow. I suggest acceptance of the paper with few minor caveats and suggestions.

(1) 'Study cite' section (2.1) is rather related to the concept and strategy (BTW given nice fig. 1). It would be useful to rename it accordingly.

(2) Lines 186+ The use of MERRA2 should be better justified. MERRA is not spectral reanalysis and does have some minor to moderate problems over the coastlines and orography. This needs to be commented, better with references evaluating MERRA against alternative products in such conditions. Also in the Conclusions it might be useful to mention as a potential avenue the use of this case study for validating alternative HR products, like ERA5.

(3) ...coordinated in time or/and in space... This requires more elaborate and accurate explanation, otherwise looks very unclear.

(4) Section 2.2 – the arrangement of the domains needs a better explanation, specifically D02 (west boundary). General circulation here is such that requires likely extension of this domain westward. Specifically, there are patterns engaging circulations over the whole western coast (e.g. <https://doi.org/10.1175/JHM-D-16-0048.1>) which need to be resolved. Try to comment upon potential problems with this. Also the impact of the lateral outer boundary conditions taken from ECMWF analyses should be discussed better (as the choice for the lateral conditions).

(5) lines 345 and around, fig 3. There is an evident seasonal cycle in the AOD distribution – was it removed before computing correlations?

(6) Section 3.2. Diurnal cycle of winds should be better subordinated also with info on wind directions (given the paper focus).

(7) lines 495-497 – analysis of day/night profiles. This para needs edits, as it stands it

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is very difficult to handle.

(8) Fig 11 – see comment (6) on wind directions

(9) lines 694+ the interaction of sea breezes with the Harmattan winds is explained in a very wordy and contradictory manner, the para in a whole needs edits.

(10) Fig 15 – change please the arrow scale to see the differences in magnitude in the panels. Also you might wish to use a fine resolution for plotting wind arrows.

(11) Fig 17 and text. What is plotted is MSLP I guess, not surface pressure. Also consider using contours for SLP, as the color is not effective for identifying circulation patterns.

(12) conclusive bullets should be grouped according to the paper flow. Otherwise, they are not convincing, see also general comment.

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