This paper reports on testing the performance of a regional dust-atmospheric modeling system. The study aims at optimizing the WRF-Chem model performance with added dust aerosol component in order to be capable to operationally forecast of dust transport over the eastern Mediterranean. The presented model is another one in the family of dust prognostic systems which development follows the interest of community to better predict dust process and its various impacts.

The authors successfully performed a series of tests to understand the performance of three used emission schemes, and to tune the model to achieve the optimal accuracy in different regions of the model domain. I recommend this paper to be accepted for publication after the authors consider suggestions and revisions as listed below:

We would like to thank the Reviewer for his/her constructive comments that helped us improve the manuscript. All suggestions have been taken into account and the paper has been changed accordingly.

Page 1 line 28: Tuning the model performance by applying a coefficient to dust emissions I agree this is the most straightforward way to vary the intensity of emissions and accept it as one of ways to tune the model. However, by this approach only a linear change of values every time everywhere is done. There are other possibilities as well such as e.g. modifying values of the threshold surface wind or friction velocity, aeolian surface roughness length, etc. Please discuss more this aspect and other possible ways for tunning.

Our main objective is to test the model sensitivity to different emission schemes. Tuning was used here only as an empirical modification in order to adjust model outputs into a realistic level. We have rewritten parts of the introduction in order to be clearer that tuning *per se* is a secondary objective. In addition, we now discuss other ways of improving model performance in the conclusion. Finally, we performed additional sensitivity tests enriching the discussion in section 4.2 where mass fraction of dust bins has been modified for the 8-bin simulation (only for the GOCART simulation). We added the following in the conclusion:

"Empirical tuning of dust emissions has no physical basis and corresponds to a model adjustment that is valid for the specific model set-up (e.g. grid spacing, number of vertical levels, physical parametrisation). In fact, applying tuning only modifies linearly the model performance. Optimization of dust emissions would demand modifications of the parametrization (e.g. change the thresholds of surface and friction wind speeds) or the relevant surface fields (e.g soil erodibility). Such modifications focus on modelling assumptions and thus provide a more physics oriented optimization of the model performance. Given the differences in the physical assumptions of the dust schemes, such sensitivity tests could only focus however on specific parametrisations yielding non-linear effects on the results. Therefore, future work will be concentrated to further test the model sensitivity to realistically reproduce dust transport events using both eight dust size bins and finer model resolutions. Furthermore, we will concentrate on the climatology of dust transport over the Mediterranean by performing long term simulations also aiming at investigating the aerosols direct and indirect effect."

Page 3 line 138: we nudged wind, temperature and water vapour at each grid point to the ERA-I reanalysis: The authors claim that one of their objectives is ...to establish an empirically tuned dust forecasting model for the effective forecast of dust transport... By using nudging, operational features of the model could be contaminated. Once used, why nudging is not applied only to wind as the most critical parameter for emission? My general concern is that frequent nudging as applied in the experiment could affect the thermodynamic features of the atmosphere with unknown consequences. Please discuss possible impact of nudging to the operatibility of the model and eventual affecting the model thermodynamic balance.

Our objective is to find an optimal dust emission configuration for the purposes of operational dust forecasting. For this reason our model results are compared to satellite and ground observations of AOD. Valid conclusions from such comparison require that the modeled AOD uncertainties are entirely -at best- or in majority related to the WRF emission schemes and not e.g. to uncertainties related to meteorology. To this end, using nudging we introduce to the model additional tendencies on wind, temperature and water vapor. These tendencies guide the model outputs in order not to diverge from the reanalysis. The use of nudging is hence a convenient trade-off that bounds model performance to the reanalysis (i.e. reduces feedback of modeled physical processes to the outputs) but relaxes the model outputs towards the "more realistic" reanalysis. Nudging would indeed jeopardize the robustness of our conclusion if for instance we were testing the model sensitivity to dust direct and indirect effect. However, here we do not treat explicitly such issues. We are now clearer in our motivation to use nudging in the introduction.

"In particular, it was found that applying nudging reduces the model 10-meter wind speed absolute bias over North Africa by approximately 35%, while it also allows for a better subjective agreement between the observed and modelled synoptic-scale patterns associated with dust transport. Furthermore, in long simulations of more than a few days, nudging is beneficial in reducing uncertainties in the atmospheric circulation due to the model internal variability. Our choice to nudge is thus based on achieving realistic seasonal atmospheric circulation over the domain which is particularly important for dust emissions. Since nudging introduces additional tendencies to the model for wind, temperature and water vapour, it would affect our results if only we compared simulations that treat dust direct and indirect effects. However, here dust is treated as a passive tracer."

General:

The presented extensive verification is certainly a good guidance how to select model setup based on more reliable emission options. However, since the authors' intention is to have a well tested model to be used for forecasting purposes, I strongly suggest that they select one of major dust storms during the considered experiment period and present a more close-up view so that a reader could get a better feeling on the model capability to successfully predict particular dust events.

We agree with the Reviewer. We now comment and include a new figure in section 3.2. This figure presents a dust transport episode that took place in July 23 over the eastern Mediterranean. In the end of the section, we qualitatively compare model to observations.