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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "An inversion of fine particulate matter ($PM_{2.5}$) mass concentrations based on the air quality index (AQI) during dust prone periods in Hotan oasis, Sinkiang" *by* Ju Chunyan et al.

Anonymous Referee #2

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Review of the manuscript entitled "An inversion of fine particulate matter (PM2.5) mass concentrations based on the air quality index (AQI) during dust prone periods in Hotan oasis, Sinkiang" by, Ju Chunyan, Zhang Zili, Zhou Xu, He Qing, No.: nhess-2017-341

This manuscript deals with the investigation of the relationship, in terms of correlation, between the PM2.5 concentrations from ground based measurements, and the satellite-derived Aerosol Optical depth (AOD) in the context of an ultimate goal to provide the frame of the PM2.5 mass concentrations inversion from satellite AOD data in the broader area of Hotan oasis (China) during time periods of the year affected by

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Discussion paper

dust events.

The analysis is based on hourly concentrations of PM2.5 measured by two stations of an air quality monitoring network and AOD values obtained from both, MODIS-Terra and MODIS-Aqua databases, retrieved with the Deep Blue algorithm at a spatial resolution of 10 Km. At first a descriptive statistics in terms of AOD frequency of occurrence and AOD and PM2.5 median and variability as a function of the Air Quality Index (AQI) is presented. In the next, the correlation between PM2.5 and AOD is examined for each class of AQI, whereas the linear regression analysis is applied to the whole dataset of PM2.5 and AOD and to subsets corresponding to different AQI classes as well, in order to determine the fitting relationship between them.

Although the submitted work presents a local interest, the subject treated is interest due to multiple implications of particulate matters in various environmental issues (e.g. climate studies, air quality issues, human health effects, ...). Therefore, any additional information that can contribute to decrease the great uncertainty characterising the aerosol concentrations, optical and physical properties and their effects should be taken into account. A factor significantly contributing to high temporal and spatial variability of aerosol properties and thus to their high uncertainty, is the sporadic nature of some aerosol sources such as the dust emitted and transported from arid and semi-arid regions, particularly when it manifests as episode. Strong dust storm events can be a serious hazard mainly to human health and to ground and air transportation because of the increased load of particulate matter in air.

In this framework the subject treated by the submitted manuscript is relevant to the topics of NHESS journal. However, the paper is confused and not well written. It lacks novel concepts, tools and/or results and the applied methods are basic. Moreover, the discussion of the results and their interpretation is poor. They do not offer any significant contribution to the understanding of the factors determining the PM2.5 levels in the study area. One of the weaknesses of this manuscript is the use of the English that many times makes difficult the understanding of the content. For that reasons I

believe that the present manuscript is not suitable for publication in NHESS.

Some comments are presented below: âĂć Page 3, lines 8-9: It is written “The sand and dust weather of Hotan oasis mainly appeared in April to October, and the period of high incidence was March to June.”. Firstly, I think the first half of the sentence should be modified by replacing the April with March in order to be consistent with the second one and with the whole work. Secondly, in combination with the following sentence in lines 9-10 “Sand and dust weather in meteorology can be divided into three types, dust, blowing sand and dust storms (He, et al., 2003).”, what are the methodology and the criteria used to define the occurrence of sand and dust events and to classify them in one of the three considered types: dust, blowing sand and dust storm? The discussion following this sentence underlines the role of the wind intensity but the last sentence of the paragraph along with figure 2, imply also the use of PM2.5 levels. âĂć Page 3, lines 11: it is written “If two types within a day, the more serious class will be take as the record”, what authors mean by the “serious class”? Do they mean the class with the most severe events? âĂć Though great part of the statistical analysis of PM2.5 and AOD as well as the study of their correlation is conducted as a function of the AQI, authors do not describe this index. They just provide two references and they do not clarify if PM2.5 are accounted for in its calculation. Additionally, they should explain their choice to carry out the analysis in relation to AQI classes and particularly to divide AOD with respect to AQI classes. What the scientific interest is and what they expected to reveal? âĂć Authors, throughout the discussion mention often the local weather characteristics but they do not give any information about the prevailing weather during the study period. For instance, in page 4 (line 4) they state “According to local weather characteristics, the monitoring data was divided into seven classes”. The AOD data are grouped into seven classes with respect to AQI values, and obviously the AQI classes are related to prevailing local weather conditions but authors do not give any information on the weather corresponding to each class. âĂć Page 4, line 33; it is cited “The figures show that AOD has the significant trend in different levels of pollution”, did authors examine statistically the significance of this “trend”? It would

better to use the expression “dependence” instead of “trend”. âĂć The presentation of the results is rather descriptive while there isn’t any interpretation or scientific explanation. For instance what factors determine the variation of PM2.5 and AOD among the AQI classes? Similarly, based on their analysis (page 5, lines 11-13), authors found that the correlation between PM2.5 and AOD increases with polluted condition (increased AQI values) but they do not address any explanation for this behavior. âĂć Many times in the discussion authors mention differences in the PM2.5 levels within the day and specifically between morning and afternoon (e.g. page 4, lines 21-25: “Among them, PM2.5 mass concentration was significantly higher in the morning than in the afternoon, and the range increased when air pollution increased.”, “The PM2.5 mass concentration in the morning was more obvious than afternoon period, especially range reaching the maximum in 2016. And PM2.5 mass concentration varies greatly in 25 different pollution weather in the morning.” or page 4, lines 34-39 “In the morning, the data was the highest in pollution weather of hazardous (VI).”, “Range is maximum during serious pollution weather in morning in 2016, and the maximum of range appeared when AQI reaches 500(VII) in afternoon.” and page 5, lines 13-14: “Correlation value reached highest(0.961) in morning in 2016.”, page 5, lines 22-23: “The correlation was higher and the R2 value decreased. In general, the result in morning is better than afternoon.”, page 6 line 5: “Acquisition time of data has the obvious difference in the morning and afternoon.”, page 6, line 25: “The rang of AODT is larger than that of AODA in the morning.”). Additionally, they stated that the PM2.5 values used in this work are hourly averages around the time of satellite overpass in order to match them with the AOD values (page 3, lines 32-33: “In this article, the data of Terra and Aqua are divided into two groups for comparison and analysis, and the matching PM2.5 data is chosen as the average value of the satellite transit time in 1 hour”) and in page 3, line 30 it is cited regarding the satellite time overpass that “The time of passing study region of Terra is 13 or 14, and Aqua is 15 or 16.”. First, it should be made clear if this time is local time (LT) or universal (UTC). Second, in any case I can’t see how PM2.5 values referred to satellite overpass time allow examining differences between morning

and afternoon time. If the time is local, values matched to Terra overpass correspond to midday (noon) time period with values matched to Aqua to correspond to the afternoon. If it is UTC time (-8 hours) values correspond to early in the morning and morning time period. âĂć In the concluded section it is reported “The rang of AODT is larger than that of AODA in the morning. The collection time of AODT is about 13 to 14, while AODA is 15 to 16, all of which have an impact on AOD.” but in the results analysis authors do not discuss the possible factors that induce this difference in a time space of two hours. Is it the development of the boundary layer (if the overpass time is the local time) or it is related to anthropogenic activities or an established local atmospheric circulation affects the dust transport? âĂć Authors point out the role of meteorological conditions and particularly of the wind in influencing the PM2.5 levels (e.g. page 6, lines 7-9: “The change of atmospheric particulate concentration in spring and summer in Hotan oasis is obviously affected by the dust weather (Liu, et al.,2011), and the wind speed is a very important factor. The particle size of PM2.5 is relatively small, the greater the wind speed affect its gathered.”), but they do not consider this factor in their analysis. âĂć Though authors state in the text (page 2, lines 40-42) “The aim is to construct the suitable model for regional characteristics from March to June in 2015 and 2016. The results may provide a reference for inversion of PM2.5 mass concentration based on AOD in the oasis.”, the section treats the regression analysis between PM2.5 and AOD is too short and the discussion is really poor. In their analysis, better correlation and fitting were obtained for sub-datasets created based on the AQI classes compared to the entire dataset, however authors do not interpret or explain the possible reasons of this improvement. âĂć Page 5, lines 26-28: it is stated that “The main goal was to study the difference of relationship between PM2.5 and AOD to improve our ability to know quantitatively spatial relationship patterns of PM2.5and AOD.”, however the spatial variability of the PM2.5 and AOD correlation is not investigated or discussed in the manuscript. âĂć Discussion section: the content of this section doesn’t interpret the findings of this work neither attempts a comparison with other studies. Actually, it is a repetition of the introductory section. âĂć Concluding section: conclusions are rather

qualitative than quantitative. âĂć Finally, English should drastically improved

Some minor comments âĂć Page 2, line 2: aerosol optical thickness is denoted as AOT and not AOD. AOD is used to express the aerosol optical depth. âĂć Page 2, lines 110-12: the sentence “The visible light band of these areas has the highlight feature which makes it difficult to recognize the optical thickness of aerosol for satellite remote sensing data” is not clear. Please rewrite it paying attention to English. âĂć Page 3 in the Data section (2.2): please note at which wavelengths is referred the AOD used. I suppose that it is the AOD at 550 nm. âĂć Page 14, Table 4: Table 4 is not discussed in the text. âĂć Page 17, Figure 3: The figure’s caption contains some Chinese symbols. Do they have any meaning? âĂć Page 18, Figure 4: The figure and the figure’s caption as well miss the units of the PM2.5 concentration. âĂć Special care should be given to references.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-341/nhess-2017-341-RC2-supplement.pdf

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