Review of "Characteristics of dust storm events over the western United States" by H. Lei and J. Wang

General Comments

The authors used the reports of dust storm events by media or NASA earth observatory and the in-situ measurements of surface particulate matter concentrations to understand the characteristics of dust storm processes over the western US. This study aims to develop a comprehensive and objective methodology by integrating measurements from various observing networks in order to support further reconstruction of dust climatology and model verification. All dust storms recorded are classified into four types related to typical meteorological conditions, and their characteristics are analyzed accordingly. The study finally suggests that the combination of in-situ and satellite observations can provide a good chance to better record the dust storms.

Dust is an important aerosol species in the atmosphere and has significant impact on the air quality and climate at regional and global scales. The dust over the western US may affect the air quality and hydrological cycles over the around regions. I find this topic about the characteristics of dust storms over the western US is interesting and important. However, I don't quite understand how authors divide the dust storms into 4 types based on meteorological conditions and how they can link the storm types with the specific observations, which are critical. I have some specific comments listed below.

Specific Comments

1. In terms of observations, this study uses IMPROVE PM2.5 and PM10. Since IMPROVE has PM2.5-dust measurements, why not use them as the direct measurements of soil dust? In addition, MODIS deep-blue has been found with large biases compared to in-situ measurements (e.g., AERONET) over the bright surface. It is questionable to use it as a reference for dust storms.

2. Kim et al., 2012 at the line 5 of page 14198 is not in the reference list.

3. At the line 10 of page 14199, please provide reference for the media reports and NASA earth observatory record.

4. The methods to classify the weather systems into fronts, downbursts, tropical disturbance, and cyclogenesis should be provided (e.g., based on winds, temperature, pressure?). I don't understand why and how weather systems are classified into these four sub-systems.

5. In Figure 2, I don't know how authors can associate a specific observation site with one dust storm type. Does it mean one dust storm type always occurs in the selected site? Or you only analyzed one dust storm for each type and selected one observation site most representable in that storm. In this case, I don't think you conclusion is statistically important. This is most confused and critical in your study. Please clarify it.

6. If different observation sites are selected for different types of dust storms, how can you wipe off the influence from the different observation sites? That is, different observation sites may be affected differently by the dust storms. Therefore, the different measurements from different observation sites may not be due to the different characteristics of dust storms. Instead, they are different because the observation sites are affected differently. In addition, different observation site may also have different components for PM10 (e.g., some observation sites may have larger contribution from dust than others).

7. Comparing Figure 4 and 5, why high AOD in D3 lasts longer than its high PM10 concentration?

8. The way to identify the satellite observed dust AOD needs to be clarified in pages 14205 and 14206. It seems that some dust storms shown in satellite AOD are not selected. If there are local records, please provide detailed references. For example, in Figure 6, the bottom right panel shows a dust signature near the Gulf of California that is not selected.

9. It's difficult to understand how you use the satellite AOD to derive the statistic information in Figure 7. The methodology should be better clarified.