Preprint egusphere-2023-436, RC1

Response to Anonymous Referee #2 (RC2):

Thank you very much for your careful review, critical comments and improvements! Please find below the original comments and the authors' response (in blue). Revised sentences are in italics.

The manuscript explores the precipitation properties in Granada using a set of remote sensing and in situ instruments. The study focuses on the relationship between precipitation and aerosols, measured over 11 years. There are minor corrections to be made by the authors, but the overall manuscript is very good and well-written. Thus, I suggest the manuscript to be published.

Specific comments:

Point 1: Line 5: I would say that the objective is to characterize the precipitation events regarding the aerosol and meteorological properties, with much less emphasis on forecasting. In particular, the forecast aspect of the paper is not discussed enough to have it as a clear aim of the study.

Response 1: Thank you! We have removed this sentence.

Point 2: Line 15: How many rain-day events were identified by the weather station data? Please make it clear here.

Response 2: We have added the number of rain-day events identified by weather stations (please see line 13).

Point 3: Line 126: I suggest replacing "etc" with "among other products".

Response 3: We have replaced the "etc" (please see line 125).

Point 4: Line 135: replace "uJ" by "µJ"

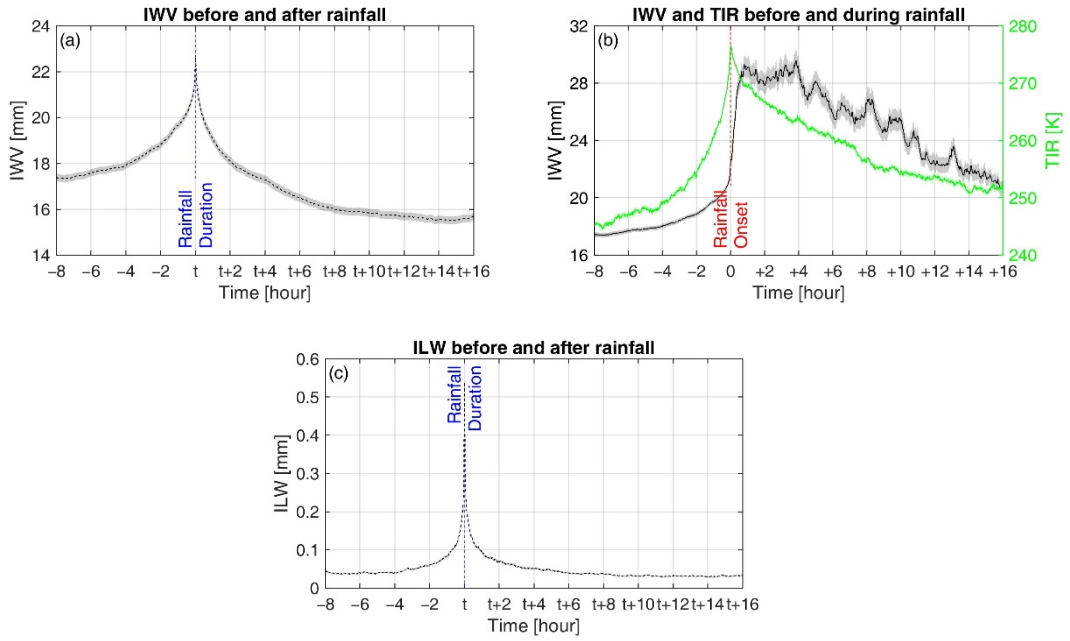
Response 4: We have changed the unit (please see line 135).

Point 5: I suggest the authors indicate in the manuscript methodology section, together with the start period of measurement, the amount (percentage) of data used in the study for each instrument. It is unclear if there are gaps in the measurements that could add bias to the data.

Response 5: Thank you for your suggesttion. The instruments obtain corresponding time series based on rain events, and the missing of radiometer HATPRO data directly affects the number of rain event detections. We added the percentage of missing HATPRO data (please see line 215).

"22% of data are missing during this time interval due to reasons such as unexpected shutdown of HATPRO."

We also added the standard errors ($\sigma/\sqrt{n}$, shaded areas) of IWV, ILW, and IR to characterize the deviation of the composite (please see Figure 3).



Point 6: Regarding the nephelometer measurements, did the authors correct the data for standard temperature and pressure measurements? What were the humidity conditions in which the data were collected? This information must be explicit in the manuscript.

Response 6: Yes, the nephelometer uses pressure and temperature to correct for scattering from aerosol particles (please see line 164-166).

"Temperature and pressure are measured to calculate the scattering of air molecules. This value is subtracted from the total scattering to isolate the scattering attributed to aerosol particles."

Data were collected under dry conditions with relative humidity less than 40%. We added this information (please see line 159):

"The TSI Model 3563 integrating nephelometer measures the light-scattering coefficient of particles at three wavelengths (450, 550, and 700 nm) at dry conditions with relative humidity less than 40%."

Point 7: Line 174: remove the extra ".". After "zenith", add a ";" and remove the ".".

Response 7: We have removed the dots and added the comma (please see line 178).

Point 8: Lines 269-271: I suggest moving the sentences "The scattering coefficient could be used as a proxy of aerosol mass or volume concentration while the AE provides an estimation of the predominant aerosol mean size at dry conditions. Values of AE>2 indicate a predominance of fine particles while values of AE<1 indicate the predominance of coarse particles." to the in situ measurements section.

Response 8: We have moved the sentences to the in situ measurements section (please see lines 160-163).

Point 9: Lines 275 - 276: the authors stated: "Thus, the diurnal variation pattern of aerosols is not the main cause of the significant increase in scattering coefficient 4 hours prior to the onset of rain". I suggest the authors add a figure (which could be, for instance, in the supplementary material) confirming this affirmation.

Response 9: It is a good idea to add a figure. We plotted the distribution of the number of rain events

(please see Figure 5).

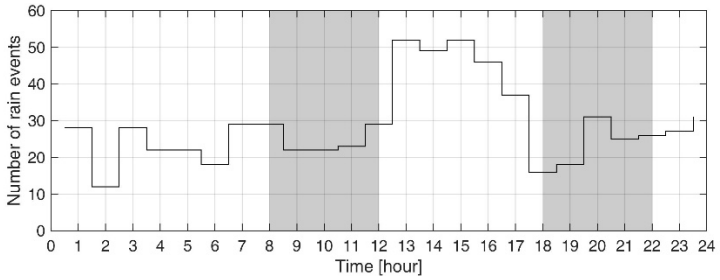


Figure 5. Stairs plot of the distribution of the number of rain events (694 in total). The grey areas represent the peak time period of the scattering coefficient at 550 nm between 8:00 to 12:00 UT and 18:00 to 22:00 UT.

We also restate these sentences (please see lines 275-280).

"In Granada, the scattering coefficient at 550 nm peaks between 8:00 and 12:00 UT in the morning as well as between 18:00 and 22:00 UT in the evening due to intense urban emissions (Lyamani et al., 2010). As shown in Figure 5, rain events mainly start to occur from 12:00 to 18:00 UT in the afternoon. Because of insolation, there is convection of moist air during daytime. In the afternoon hours, the moist air has reached a high altitude, so that formation of cloud droplets and raindrops occurs in the adiabatically cooled air parcel. It also illustrates that the diurnal variation pattern of aerosols is not the main cause of the significant increase in scattering coefficient 4 hours prior to the onset of rain."