

**Author response to Anonymous Referee 3 for “Brief Communication: An Electrifying Atmospheric River: Understanding the Thunderstorm Event in Santa Barbara County during March 2019” by Deanna Nash and Leila M.V. Carvalho.**

5 Responses to reviewer comments are given in **blue text**. New or changed text is given in **italics** (**bold italics** for emphasis where noted)

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**General Comments**

10 The manuscript analyzes an AR event that occurred on March 2019. Despite having a relatively low amount of precipitation (77.6mm in 30h) it was extraordinary amount of lightning strikes in the region that stands out. The topic of this study is of interest to be published and the manuscripts is in general well written however I have a few structural issues that need to deal with before the manuscript is ready for publication.

We thank the reviewer for the time they took to review this paper and the constructive feedback that helped improve the paper, specifically with regard to the structure of the manuscript. Please see responses to comments below.

**Specific Comments**

15 I believe the entire Introduction section needs to be re-written. In the present form it’s a mixture between introduction and results. Therefore, should have the following in mind when re-written the introduction: - What is an ARs; - Possible impacts and benefits (first paragraph should be in here); - Lightening brief introduction and precipitation measures and radar. - I would remove everything that is results from this specific event.

20 We have separated the introduction and results, and updated the introduction section to include a paragraph on the background of ARs and their relevance and impact to Southern California. We have also added a short background on lightning to the introduction.

Section 2. Parts of the introduction are already stated here. So, I would keep all the dataset and methodologies in this section and avoid repetition with the introduction.

25 Repetition with the introduction has been removed and care has been taken to make sure this section is only dataset and methodologies and no results.

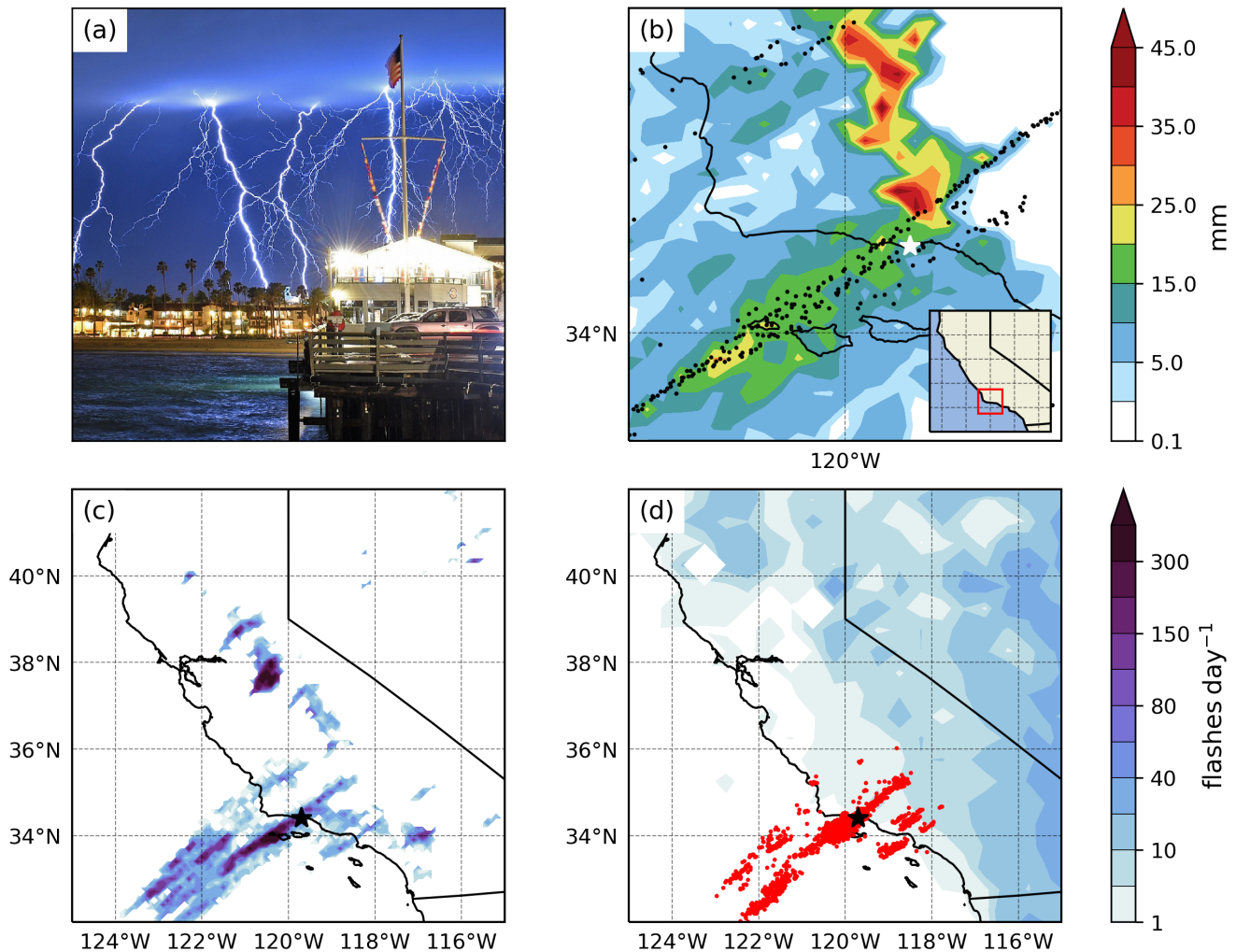
Section 3. I would include a new sub-section before sub-section “Extratropical Cyclone and AR Conditions”. This new sub-section would be the description of the March 2019 event, with most of the information being taken what was already mentioned in the Introduction.

30 After restructuring the introduction (see above), we have moved the description of the March 2019 event to a new subsection in the results titled “Extratropical Cyclone and AR Conditions” to make sure the results are all in the results section.

**Minor Comments**

Figure 1. The color scales are a bit confusing.

A similar comment from RC2 was made. The colormaps in Fig. 1 were updated to only go to the maximum, and black and brown were removed from the colormaps.

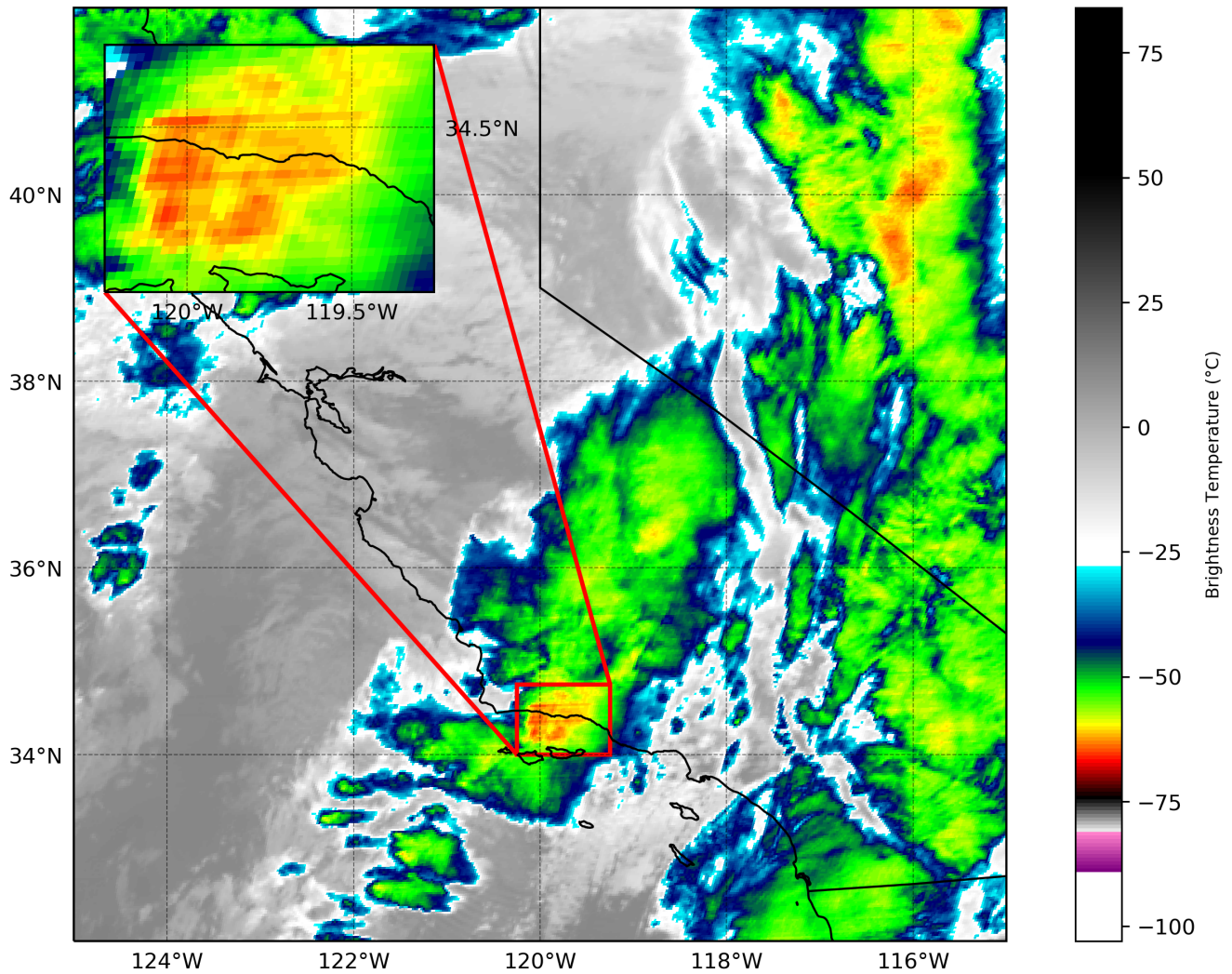


**Figure 1.** (a) Photo of lightning at the Santa Barbara Harbor in Santa Barbara, CA taken by Mike Eliason from the Santa Barbara County Fire Department during the storm at 6 March 2019 04 UTC. (b) NOAA NEXRAD L3 precipitation accumulation (shaded; mm) and locations of NOAA NEXRAD L3 Hail Signatures (black points) between 5 March 2019 12 UTC and 6 March 2019 23:59 UTC. The location of Santa Barbara is indicated by the white star. (c) ENGLN lightning strike frequency (shaded; flashes day<sup>-1</sup>) on 6 March 2019. The location of Santa Barbara is indicated by the black star. (d) Climatological mean lightning density (shaded; flashes day<sup>-1</sup>) between 1995 and 2014 using TRMM LIS-OTD lightning climatology and lightning strike locations (red points) between 04 and 05 UTC on 6 March 2019 based on ENGLN. The location of Santa Barbara is indicated by the black star.

35 How much do you trust in the vertical speed from reanalysis data?

We recognize that vertical velocity from reanalysis data is a calculated value. We found that the details provided from vertical velocity in the manuscript were not necessary to show updrafts and deep convection, so we removed vertical velocity from the manuscript and supplement. We have instead decided to focus on what the observed GOES-R infrared brightness temperature tells us, which is that there was an overshooting cloud top at approximately 4:30 UTC, indicating deep convection. We have

40 updated Fig. S5 to highlight this information (see below).



**Figure 2. Figure S5.** Infrared brightness temperatures (shaded, °C) derived from band 13 of the GOES17 ABI L2 Cloud and Moisture Imagery Brightness Temperature at 6 March 2019 4:24 UTC. Detailed infrared brightness temperatures around Santa Barbara (outlined in red) are shown in the top left area of the map.