

## ***Interactive comment on “Variability of lightning hazard over Indian region with respect to ENSO Phases” by Sreenath Avaronthan Veettil et al.***

**Anonymous Referee #2**

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Review of the paper: “Variability of lightning hazard over Indian region with respect to ENSO Phases”, by Sreenath A V, Abhilash S, and Vijaykumar P The paper concerns the variation of the lightning flash activity over India and around during cycles of ENSO and at different seasons, pre-monsoon, monsoon and post-monsoon. Before to can evaluate the study and all comments in the paper, some information and clarifications are necessary. It is especially not clear how is calculated the anomaly for different parameters as LFR, graupel concentration at different seasons and in different regions. More specific comments are in the following. Major comments 1- The authors have to define the periods distinguished as premonsoon, monsoon and postmonsoon, because it is not made and it is a main information to well understand and interpret the values of the LFR provided in flash per day and per km<sup>2</sup>. What is the duration and the dates

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of each season? At line 64 the data beginning is given in July 1995 and in Table 1, a value is given for each season of 1995. Does it mean the premonsoon is in July? 2- The LFR is calculated from the flashes detected by LIS or OTD. Is it estimated for the whole periods by extrapolation of the flashes detected by the sensors? Indeed, the sensors were above the region for a short time according to the low orbit satellite location. 3- At line 100, can we talk about three hot spots during the premonsoon season? In southern India it is not really a hot spot and in NNWI no more. “Hot spot” needs to be very distinctly higher than around. 4- Figure 2 needs explanation, how is calculated the anomaly? Why it is so different at NEI between El-Nino and La-Nina? While it is not very different for LFR in Figure 1 and even it seems LFR is larger in NEI during La-Nina while the anomaly is negative there. By comparing Figures 1a and 1b, I do not understand the differences between Figures 2a and 2b? I do not understand the negative value of anomaly in Figure 2b for NEI? (It is even lower than in Figure 2C for the same region NEI. Anyway, the values of the anomaly are < 0.015 for LFR values of about 0.1.. Is it significant? At line 115, it is said “the cold ENSO phase suppresses LFR over NEI” but in Figure 1b the hot spot over NEI is not suppressed at all! The other comment at line 115 can be discussed on the same way. Clarification is necessary, especially to describe the anomaly estimation. Same at line 119, it is impossible to say “which firmly indicates that the cold phase suppresses the LFR over NEI,” according to Figure 1b. Same for comment about “the warm phase enhances it over SPI”. 5- The same comments for the season “Monsoon” about the anomaly not obvious by looking at Figure 1d-e. They talk about increase of LFR along the coast of NWI at line 132 for El-Nino, not obvious in Figure 1d. At line 139: “The NEI is showing positive anomaly of LFR during both warm and cold phases of ENSO” this comment does not seem justified in Figure 2e, no increase. 6- The profiles in Figures 4-5-6 show concentration anomalies for graupel, snow and latent heat, respectively. The values seem very small to explain something. Why to not display the concentration directly? The values could be used to explain the storm occurrence? 7- Line 141: “The similarity in the LFR anomaly is noticeable in the distribution of graupel and snow

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during the two phases (Figure 4 (b), 5 (b)).” The anomaly is close to zero in this case for graupel and snow. Does it can explain the positive anomaly for the LFR during the two ENSO phases commented at line 139? Line 142 : Where is it visible that the LFR is suppressed in NWI for the warm season during monsoon? In Figure 1d it is well visible there is a hot spot like in cold season (Figure 1e).

Minor comments - The parameter LFR could be LFD as lightning flash density since it is a density ( $\text{km}^{-2} \text{day}^{-1}$ ). It is a daily density. Is it more consistent to talk about density? - Figure 1: the unit for the scale could more visible and written along the colored scale. - Line 72 : “seasons” - Line 90: With such average values of CAPE ( $1500 \text{ J/Kg}$ ) all over India, we can think storms are produced everywhere over India during that season. However, Figure 1 shows the LFR is  $< 0.05 \text{ km}^{-2} \text{ day}^{-1}$  over a large part of India. Do they want to say the CAPE is 1500 in average during the whole season or just during a short period? - Line 100: They could keep the same order for longitude/latitude in the definition of the regions. - Line 103: Is it better to use “neutral” and not “normal”? Check for others. - Line 105: I do not see a decrease of the LFR for El-Nino during the season pre-monsoon in NNWI (Figure 2a) while I see a decrease of LFR (negative anomaly) during La-Nina (Figure 2b). Can you check? - Line 110: Is LH defined before? (Latent Heat I suppose?). - Line 110: “decreases” since it is the amount? - Line 111: “unable” or “unbaled”? - Figure 3: Check the symbol of the variable on the graphs? It has to be LFR? - Figure 4 caption: graupel and not groupel. Figure 4h “India” - Figure 4 and Figure 5: Unit is  $\text{g m}^{-3}$  and not  $\text{gm}^{-3}$  but the values seem very low.. For graupel the maximum should be  $0.0008 \text{ g m}^{-3}$  i.e.  $0.8 \text{ mg m}^{-3}$  isn't that a little weak? -

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