We thank Deborah Morgenstern for hers careful reading of our manuscript and for her comments. We highly appreciate the time she invested into helping us to improve the paper.

Responses (in blue) with Deborah's comments in black.

Thanks for your interesting analysis.

Regarding your conclusion about the higher sea surface temperatures and increased water vapor (Abstract line 24 and lines 294-301):

Could you please describe more precisely what you have analyzed and how the SST changed in your observed region? You could replace the link to this clip with global SST by some numbers for your observed region or even produce a plot similar to Fig.6.

We followed the recommendation, and analyzed thoroughly the changes in the sea surface temperatures and added a panel in Fig. 6. Now the number of lightning strokes detected by WWLLN in individual winter periods (October-March) is plotted as a function of a) the median winter sea surface temperatures in the eastern North Atlantic and b) the median NAO index calculated over the same period. The method is now described on lines 312-320 and reads:

"We analyze the monthly SST data provided by the IRI/LDEO collection of climate data in a 1° grid (NOAA NCEP EMC CMB GLOBAL Reyn_SmithOIv2; Reynolds et al., 2002). We calculated the mean monthly sea surface temperatures for winter seasons 2010-2020 in an area limited by coordinates 20°W, 10°E, 50°N, 65°N, where we detected most discharges in winter 2014/2015 (Figs. 3a and 4a). Then we plot total number of lightning strokes as a function of median SSTs calculated for individual winter seasons (Fig. 6a). The median winter temperatures varied from 8 to 9.5°C in the selected area. We can see an increase of lightning activity with increasing SSTs, but the spread of values is very large. During the stormy winter season 2014/2015, when the El Nino event started, the sea surface was unusually warm reaching a temperature of 9.48°C, the highest winter value within the last decade. Nevertheless, the temperatures during the winter seasons 2015/2016 (El Nino peak) and 2016/2017 (El Nino warm to cold transition phase) were only very slightly lower with a substantially weaker lightning activity."

We added a paragraph in the discussion on lines 305-308, which now reads:

"As a mixture of water and ice hydrometeors and their charging by collisions are needed for a cloud electrification (Rakov and Uman, 2003) we speculate that there was an unusual amount of charged hydrometeors in winter thunderclouds. Such increased supply of available cloud charge might be due to: a) larger extent of thunderclouds, b) changes in cloud microphysics, c) higher updraft speeds. As the first step, we checked surface sea temperatures (SST) in the eastern North Atlantic region as their increase would allow setting of the typical meteorological scenario for winter lightning (cold air overblowing a warmer seawater; Williams, 2018). Such SST anomalies were found to occur during El Nino events (Williams et al., 2021) or during the positive phase of the North Atlantic Oscillation (Qu et al., 2012)."

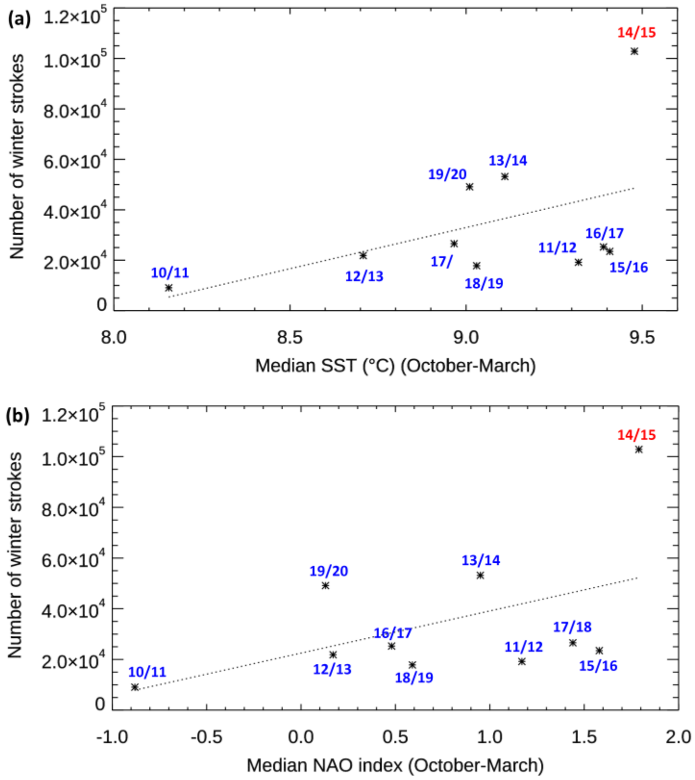

Figure 6: Number of lightning strokes detected by WWLLN in individual winter periods (October-March) as a function of a) the median winter sea surface temperatures in the eastern North Atlantic and b) the median NAO index calculated over the same period. The dashed lines shows the linear trends.

Please support your speculation about enhanced available atmospheric water vapor by data or omit this statement from your manuscript.

We followed the hypothesis of Williams et al, 2021 that during the could–to-warm transition phase of El Nino there probably was a stronger updraft leading to very efficient electrification and anomalous lightning rates. We added a sentence into the introduction on lines 89-90 and a reference to Baker et al. (1999) who showed that the lightning rate is proportional to the sixth power of the updraft speed.

"Williams et al. (2021) hypothesize that the increased occurrence of lightning can be caused by a thermodynamic disequilibrium between the surface and the middle troposphere during the transition."

We also modified the abstract and the summary paragraph.

The abstract now ends by following sentences:

"All these lightning characteristics suppose an anomalously efficient winter thundercloud charging in the eastern North Atlantic, especially at the sea-land boundary. We found that the resulting unusual production of lightning could not be explained solely by an anomalously warm sea surface caused by a positive phase of the North Atlantic Oscillation and by a starting super El Nino event. Increased updraft strengths, which are believed to accompany the cold to warm transition phase of El Nino, might have acted as another charging driver. We speculate that a combination of both these large-scale climatic events might have been needed to produce observed enormous amount of winter lightning in winter 2014/2015."

The summary part now started on lines 330-336 as follows:

"In summary, numerous energetic lightning hit the British Islands and Northern Europe in winter 2014/2015. We found that a documented unusually warm sea surface in the eastern North Atlantic and a large positive NAO index do not themselves explain the anomalously intense winter lightning activity. It is evident that an additional driver was acting in the cloud electrification. A good candidate is an increased updraft velocity, as the lightning rate was found to be characteristically proportional to the sixth power of the updraft speed (Baker et al., 1999). A strong updraft originating in a thermodynamic disequilibrium due the contrast in temperatures between land and ocean was suggested by Williams et al. (2021) to accompany the transition from the cold to warm phase of El Nino especially at the ocean/sea boundary. Above-mentioned factors might have changed the typical winter microphysical thundercloud composition, charging processes, and/or electrical conductivity, and could result in a more efficient cloud electrification (Chronis et al, 2016)."