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Interactive comment on "Extratropical cyclone induced sea surface temperature anomalies in the 2013/14 winter" *by* Helen F. Dacre et al.

Anonymous Referee #2

Received and published: 11 October 2019

The paper explores a connection between SST anomalies and atmospheric cyclones in the North Atlantic. The paper is concise and well written. My major concern is that the authors used a cyclone dataset, while their main finding relates more to cold fronts that are possibly associated with cyclones. I suggest adding a dataset on the location of fronts and calculating anomalies behind objectively identified cold fronts (perhaps within a cyclone area or independently) rather than deducing the location of fronts within cyclones.

Specific comments:

Why only 2013/14 season is taken into account to calculate cumulative effect of the passage of multiple cyclones.There must be some other anomalous seasons.

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Discussion paper

Tilinina et al. 2018 (https://doi.org/10.1175/MWR-D-17-0291.1) investigate anomalously high heat fluxes in the North Atlantic during winter and related those to the cyclone activity. They concluded that the area of interaction between cyclones and anticyclones is very important for a heat flux anomaly. I wonder if this is also true for the summer season and it will also be nice to see some analysis on this.

l. 3: are the processes not fully understood or not quantified?

l.29: I believe it should be Rudeva and Gulev (2011)

5. l33: should it be left-rear quadrant?

l.41: I'd add 'ocean' surface mixed layer

l.89-92: you say 'MLD is the depth at which the density difference .... reaches 0.01 kg/m3' and then 'the density difference MLD can overestimate MLD'. Define MLD otherwise then.

l.98-100: 200 most intense cyclones - how does that number compare with the total number of cyclones for 1989-2009? How intense are those cyclones (perhaps, add a pdf intensity for all cyclones and those 200). As you focus on the North Atlantic, I'd suggest 30-70N, instead of 90N (though looking at the track in fig. 1 it will hardly make a difference for the results). Consider showing this area in Fig.1.

l.105-113: How composites are built should be better described here. It is only in sec. 4.1 that we find out that the radius of composites is 30deg (it is also mentioned in fig 4 caption). I believe that the rotation of composites does not help interpretation of the results as meridional gradients in some plots get also rotated (e.g., fig. 4), I'd recommend skipping this step.

l.111: Following your comment on the rate of intensification and decay, I think a pdf will be helpful (together with a pdf of intensity mentioned in my earlier comment)

l.116: give a range for the meridional gradient

All Figures: show lon/lat

Figures 1 and 2: Add Qsw,Qlw, etc. to the captions (as in other figures)

l.143: check the figure number

l.152: SST tendencies are discussed in the next section

l. 163: 'westward direction': as the composites are rotated it is hard to say where the west is.

L 159:164: how much are sensible and latent heat fluxes in summer different to those in winter in previous studies (in Tilinina et al. 2018 and Rudeva and Gulev 2011)? From this you may possibly deduce a potential effect of cyclones on SST in winter (which can also be estimated directly in another paper)

l.165: this sentence suggests that wind should also be shown in fig 5b

Fig 3b and d: fix colours in the colour scale (blue - negative, yellow/red - positive)

Fig.4: I'd comment that positive values are into the surface in the caption.

Fig.5: add 'air' to panel (a) caption

l.225-232: this paragraph should be in Methods

Fig.9: The relative sizes of the circles are wrong: if the big circle is 30 deg, as the small circle has a 14 deg radius.

l.237: I do not get why the mask shows the cyclone along the trailing cold front. It suggests that cold fronts always extend along the cyclone centres in the last 30 hours. If that is your assumption, that needs to be proved. As I said at the beginning of the review, I think you need objectively identified cold fronts instead of what has been invented here.

Fig 10: Maybe swap the panels to have 24 Dec on the right and 20 Dec on the left

l.245: 14-18% - what variable does it relate to?

l249, 250 : fig 11c and 8f, respectively

Fig11: perhaps I missed it, but was QN due to cyclones calculated for all cyclones in 2013/14, or the strongest? Fig. 11c shows SSTQN due to cyclones or any Qn? I think 11c should be due to cyclones only. Can you explain why strong negative anomalies in the west of the North Atlantic (fig. 11c) are not seen in fig. 11d? I'd say that 11d matches well with 11a, which makes sense, but anomalies in the west North Atlantic in 11d are confusing.

l.255: is it entrainment of the cold air?

l.265: As the mask stretches backwards from the cyclone centre, it captures the cold sector. However, the effect of the warm sector remains not assessed (which can also be done if warm fronts are identified).

Fig. 7 suggests that the warm sector will have relatively small effect during the max development, but at other stages of cyclone lifecycles the balance might be different.

Typos and language concerns:

The word 'flux' is often used in plural form (e.g., flux occur). My preference is either to say 'flux occurs' or 'fluxes occur'.

l. 73: magnitudes

l.101: position is

l.126, 166,173: Figure shows

l.128: 'teh' to 'the'

l.135: put comma after 4000Jkg-1K-1

l. 137: change 10's to 10s

l.147: remove ‘are’

Fig 7: ‘Normalised’ and ‘negative’ should start with a small letter

l.246: remove ‘is’

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