



EGUsphere, referee comment RC2
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Comment on egusphere-2022-1438

Anonymous Referee #2

Referee comment on "Large uncertainty in observed estimates of tropical width from the meridional stream function" by Daniel Baldassare et al., EGU sphere,
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In this manuscript the authors attempt to estimate the observed uncertainty in recent Hadley cell extent trends/changes as seen in ERA5. For this the authors analyze the spread across ERA5 members in different Hadley cell metrics. Lastly, the authors link the uncertainty in the HC extent to the uncertainty in the magnitude of the circulation around its edge. The overall motivation for this research, as stated in the abstract and introduction, is the different expansion rates across different Hadley cell metrics, reported by previous studies. In this manuscript, however, the authors do not address this issue. In fact, the ERA5 uncertainty of each metric, is not as large as the inter-metric spread, reported before, nor as the trend it self of each metric. So I am not sure that this manuscript helps us better constrain the different Hadley cell expansion rates. Moreover, as discussed in previous studies (which the author cite), the lack of correlation between the different metrics suggests that they represent and driven by different processes, and we thus not necessarily expect to observe the same trend in each metric. Only reporting the uncertainty in the Hadley cell trends (which seem to be small, relative to the signal and the inter-metric spread), in my opinion, is not sufficient for publication. The most important conclusion here is the reduction in uncertainty across ERA5 members over the years. But this is a technical result.

Below I list several more comments (major and minor):

1. The introduction, in my opinion, should be broaden to give a larger context for this problem, and why its important to investigate the expansion of the circulation. The authors should discuss how/where the Hadley cell is projected to change in coming decades, the mechanisms underlying recent and future Hadley cell changes, and the impacts of such expansion.

2. How much the ERA5 spread is different than large-ensemble spread, which has been documented in previous work (e.g., Grise et al 2019).

3. The missing December in the beginning of ERA5 should not be a motivation to define the annual mean from March to February. This does not allow a proper comparisons to previous work. I suggest using, only for the first year, January and February, for NH winter, and DJF for other years. And use January to December as the canonical definition for the annual mean.

4. Please itemize the different paragraphs in the methods section discussing each metric.

5. The Hadley cell extent is usually found by doing an interpolation of the data to a finer grid; have you done the same here?

6. In the normalized STD you divide the inter-member spread with interannual variability, but these two may represent different processes. I am thus worried that this metric does not represent a normalized uncertainty.

7. In Sec. 3.5 the authors argue that the uncertainty in Hadley cell expansion is linked to the gradient of the streamfunction at the Hadley cell edge. However, such link is based on correlation of only eight points, where 5 of them do not follow the regression line, and show no sign of correlation. I am thus not convinced by the authors' arguments, and suggest to remove this analysis along with its discussion.