

## Comment on wcd-2021-5

Anonymous Referee #1

---

Referee comment on "Linking air stagnation in Europe with the synoptic- to large-scale atmospheric circulation" by Jacob W. Maddison et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-5-RC1>, 2021

---

This manuscript examines the link between European air stagnation and the large-scale circulation and synoptic-scale features such as blocking, Rossby wave breaking, and jet locations and strength. The analysis presented appears sound, and the manuscript does present some interesting results connection these different atmospheric features.

However, I am not sure of the real value of this research. It is claimed that "understanding the development of stagnant conditions is therefore crucial for studying poor air quality" and this is the justification for this study. However, I am not convinced of the importance for air quality, as multiple recent studies show there is only a weak connection between air stagnation and air pollution events, and there is also evidence that some of the other atmospheric features examined are better predictors of air pollution events (and hence more crucial).

The connections shown between stagnation and other circulation features is probably worth publishing (although I am not totally convinced), but before this manuscript is suitable for publication there needs to be a major revision of the abstract, Introduction, and conclusions that presents a more balanced view of importance of stagnation events on air pollution, and hence a more balance view of the potential impact of this study on understanding air quality and/or for the weather-climate dynamics community.

### MAJOR COMMENTS

The abstract, Introduction and conclusions are full on statements that air stagnation is closely connected with air pollution, and that understanding stagnation events is key/critical for understanding air quality. However, very few of the referenced studies actually show a close connection between stagnation indices and air pollution (and many just assume there is a connection as it seems like there should be). In fact, several recent studies (that are not discussed in Introduction) actually show a weak, or at least inconsistent, relationship between air pollution and stagnation indices. The results of two

of these (Kerr and Waugh (2018) and Garrido-Perez et al. (2019)) are buried in the conclusions (lines 461-462) but there are more studies: E.g., Huang et al (2018), Wang et al (2018), and Oswald et al (2015) show either weak relations between stagnation and pollution or that stagnation is not a strong predictor of pollution events. Huang et al and Wang et al are referenced but no mention is made that these studies cast doubt on importance of stagnation for air pollution events. Given multiple studies all showing weak relationship many of the claims made in the paper on importance of stagnation are not justified, and these counter studies need to be discussed in the Introduction.

In addition to limited evidence for stagnation events being major driver for pollution events, there are many recent studies showing connections of the other atmospheric features examined here (e.g jet latitude, RWB, etc) with pollution (e.g. some of references on lines 460-465). If understanding air quality is the main focus then why not relate the large-scale or synoptic-scale features to air quality data directly, rather than indirectly through stagnation events? Put another way, the importance of an atmospheric feature in explaining stagnation events is not the same as the importance of this feature on air pollution (with some features probably being more important for air pollution than for stagnation events).

This last point makes me wonder why the analysis presented was not done relating the large-scale / synoptic scale atmosphere features to surface air quality. This would directly address the issue of air quality.

#### MINOR COMMENTS

Title: As much of the paper focuses on blocking, ridges and Rossby-wave breaking, which are synoptic-scale and not large-scale features, the title needs to be modified.

Line 119. Not sure what is meant by "averaged vertically (every 75 hPa ...". Do you mean averaged vertically between 925 and 700 hPa, with data every 75 hPa? Also, later in the sentence I think should say "zonally between 0 and 60 W", as the 0-60 is important.

Line 124: Why 20E-60W as opposed to 0-60W used for eddy-driven jet?

Line 165: space missing "inGarrido"

Fig 2 and 3. Can you add a box to the maps to show the region being considered? Also, I think the histogram and lines in right panels make figures hard to read. Maybe just show the curves?

Line 245-250: I could not follow this discussion, and how it related to figure 4. For example, it is stated that Rossby waves have no impact for souther regions, but the RWB and other indices have a very similar variation in all panels in fig 4.

## REFERENCES

Oswald E M, Dupigny-Giroux L-A, Leibensperger E M, Poirot R and Merrell J 2015 Climate controls on air quality in the northeastern US: an examination of summertime ozone statistics during 1993–2012 *Atmos. Environ.* 112 278–88