

Interactive comment on “The combined effect of two westerly jet waveguides on heavy haze in the North China Plain in November and December 2015” by Xiadong An et al.

Anonymous Referee #2

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This paper is a case study of a period in November and December 2015 that was characterized by many haze days in the North China plain. The authors describe the synoptic conditions that led to an environment that was conducive to the occurrence of haze and relate this to the larger scale waveguide and quasi-stationary wave environment. Overall, it's concluded that Rossby wave trains propagating from Western Europe along two waveguides toward east Asia were responsible for setting up decent over the North China plain and a weaker than normal winter monsoon - both of which were favourable for haze. Overall, I found this to be a worthwhile study and I think it nicely describes the conditions that have led to this event. In the end, there is also some discussion of the extent to which other events have related to this kind of large

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scale environment, which I think is valuable. I have only relatively minor comments to suggest before publications, although I do have quite a number of them that are mostly aimed at improving readability. I think there is some confusion throughout the text of the difference between the waveguide and the wave themselves. The authors often refer to waveguide when I think they should really be referring to the waves. I've pointed out a couple of cases below, but I suggest attention be paid to that during the revisions.

Minor comments by line number

I16: it is stated that "two Rossby waveguides within the westerly jet" are responsible for the haze. But isn't it really the Rossby waves that propagate along these waveguides that are ultimately responsible. If so, the wording could be clearer with something along the lines of "...anomalous Rossby waves that propagated along two waveguides within the westerly jet..."

I27: I would recommend simply stating "This study elucidates the formation...". Let the science speak for itself and determine whether it is of "great significance" or not.

I46: It's not clear what the anomalies here are referring to. I assume it's geopotential height, so suggest stating "In the negative EU, there is a positive anomaly in geopotential height in Europe..."

I94-95: It doesn't seem like the Cressman paper is actually cited here. Suggest "using the Cressman interpolation method (Cressman 1959)"

I103: I don't find it clear what "function of interpolation" means. Would it be clearer to state, "is the interpolated value at point i,j ". Also, since the same symbol is used for latitude below, perhaps it would be better to choose a different symbol for this.

I105: I think it should be "Plumb" not "Plum"

I115: I think some more explanation of what standardization means. Does this mean they are anomalies from the mean and normalized to have standard deviation = 1?

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I126: I'm confused about what 70% is referring to. 70% of the total of what? 22 days isn't 70% of the total days in November and December, so I'm not sure what this is referring to.

I133: suggest being more specific since this is only referring to the lower troposphere e.g., "so that the lower troposphere was relatively stable"

I153: Are these number of 37% and 25% referring to this particular event or to air pollution in China more generally. I think this could be stated more clearly to distinguish between the two.

I161: There are many anomalies in this figure from west to east. I suggest being more explicit about which you are referring to e.g., "there was a clear northerly anomaly in western China and southerly anomaly in eastern China in the meridional wind..."

I164: Similarly, it's not very clear what "the wave train" is referring to. Suggest pointing to Figure 4b here and describe the wave train of relevance.

I172: suggest pointing to the figures for the variables described here.

Figure 5: Why show the anomalies in figure 4 and the actual values here. It makes it difficult to compare them. Suggest that it might be more useful to show the anomalies in Figure 5 as opposed to the actual values.

I216: it doesn't make much sense that the positive phase of the EOF means that the jet is strong when above it has been stated that the EOF represents a north-south movement of the subtropical jet. Presumably accompanying this north-south movement is an overall change in the jet strength, so I suggest stating that where the north-south movement is mentioned.

I217: Here's another place where I think there is some confusion between a Rossby wave and a Rossby waveguide. The meridional wind is associated with the Rossby wave which is propagating along the Rossby waveguide, so I suggest "waveguide" -> "wave".

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I222-224: I think the wording here would be clearer as "To investigate the relationship between the position change in the jet and the Rossby waveguide, the time series of the 200hPa vector wind field and meridional wind are regressed onto the principal component time series of the first EOF of meridional wind and the first EOF of zonal wind in Figs 8 a and b, respectively"

I224: To back up this conclusion that the first EOF of meridional and zonal wind are strongly related to each other, why not just state the correlation between the principal component time series of the two EOFs?

I248: It's not clear to me that the dispersion of Rossby wave energy necessarily should result in heavy rainfall. I'm not sure to what extent these two things are always connected. Perhaps this could be clarified.

I281: A value of 0.38 quoted here sounds like it's a correlation coefficient that's being quoted as opposed to a regression coefficient. If it's a regression coefficient then there should be some units.

I288: I don't think this further shows the combined effect of the two waveguides has important influence on Haze. Doesn't it just show that the meridional wind and the geopotential height are related to each other? If so, this is to be expected, so I suggest deleting this statement.

Figure 3 caption: I think what's plotted in (a) is the difference in temperature between 1000hPa and 850hPa, but that's referred to simply as the lapse rate in the caption. I think it would be clearer to state that this is the vertical temperature difference between those levels. Suggest stating also what this is an Average over e.g., "Anomalies averaged over November and December 2015.

Figure 4b: I'm not sure if it'll make too much difference, but since the intention is to look at the wave motions, it might be clearer to plot eddy geopotential height as opposed to just geopotential height.

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Figure 6: Best specify in the caption whether these are anomalies or not.

Figure 8 caption: line 2 suggest "(a) meridional wind and zonal wind" -> "(a) meridional wind and (b) zonal wind"

Typo's/wording:

l34: "The causes of haze in China, except for pollutant emissions,... "Aside from pollutant emissions, ..."

l70: suggest deleting "is analyzed only"

l72: "are significant" -> "were significant"

l121: "mean in November" -> "mean over November"

l128: "less 10" -> "of less than 10"

l145: "was a negative" -> "exhibited a negative"

l155: "anticyclone" -> "anticyclonic"

l168: "anomaly" -> "anomalies" (since this is referring to multiple anomalies.

l170: "circulation southern" -> "circulation in southern"

l181: "conductive" -> "conducive", but also it may be clearer to state "stabilizes the atmosphere, creating an environment that is conducive to haze"

l191: "at the 200hPa" -> "at 200hPa"

l191: "average locations" -> "averages"

l196: "intruding China" -> "intruding into China"

l197: "provides" -> "provided"

l213: I think this needs some rewording. Perhaps "To explore the influences on Rossby wave propagation along the subtropical westerly jet and associated influences on

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haze..."

l228: "regressed by" -> "regressed onto"

l230-231: "the adjacent Sea of Japan areas" -> "the Sea of Japan" ?

l252: "is very weak" -> "was very weak" and "is still" -> "was still"

l275: "of Rossby" -> "of the Rossby"

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-826>, 2019.

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