

Weather Clim. Dynam. Discuss., referee comment RC2
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Comment on wcd-2021-45

Kieran Hunt (Referee)

Referee comment on "Synoptic processes of winter precipitation in the Upper Indus Basin"
by Jean-Philippe Baudouin et al., Weather Clim. Dynam. Discuss.,
<https://doi.org/10.5194/wcd-2021-45-RC2>, 2021

This manuscript uses an array of statistical methods to explore the processes that control the variability of precipitation in the Upper Indus Basin, by considering their most common cause, western disturbances. Although in some places I found the methodology tricky to follow or disagreed with the authors' physical interpretations, these were relatively minor points in an otherwise sound study. Once the authors have addressed the points below, the manuscript would be suitable for publication in WCD.

Minor comments

L37: Convergence is one of several necessary ingredients for heavy rainfall (see, e.g., Doswell et al 1996, doi:10.1175/1520-0434(1996)011<0560:FFFAIB>2.0.CO;2).

Convergence alone is insufficient to trigger precipitation.

L79: Is this minimum geopotential over the whole dataset length?

L95: 46 PCs seems like an arbitrary truncation, so presumably there must've been some reasoning behind it?

L105: I wonder whether something like "UV700" would be better here. A reader scanning through quickly may confuse "W700" for vertical wind speed.

L109: Is "Q700" weighted specific humidity (i.e. in accordance with the units of Fig 1B)? You don't seem to state it in the text.

I had some difficulty following the methodology in Sec 3.3. I'm not entirely convinced an interested reader could reconstruct the work based on this text.

L230-235: I completely agree; I've long thought the same (e.g. Fig 4ai of doi: 10.1002/qj.3200) as it makes more sense when one considers the dynamics at play.

L295: Not quite sure about the wording here, a gradient in geopotential doesn't trigger advection since they are linked through a diagnostic equation with no time dependence. Consider revising.

L303: "PC regression indicates that the presence of an east-west geopotential gradient across the UIB is more important than the proximity of a WD" – This is perhaps phrased in a slightly misleading way since gradient in geopotential is caused by a WD being slightly upstream, so the location of the WD is still important. Also slightly vague as what it is important for is not stated.

L305-15: Do the authors think that this strong anticyclonic anomaly is in turn associated

with a jet streak? The dynamics associated with a jet streak entrance may explain the larger values of W700 and precipitation in this composite. I see the authors touch on this idea in L380.

L324: The direction of causality in this statement needs additional evidence if the authors intended it to read that way. Otherwise, consider rewording.

L329-334: I'm not sure I follow the reasoning here. If the WD is not moving faster due to advection, as the authors state, then there must be some source of additional vorticity generation downstream. Are the authors suggesting that this is generated baroclinically through WAA?

L351: How does the zonal temperature gradient at 300 hPa affect the geopotential gradient at 700 hPa? The authors have already demonstrated substantial variability in thickness between these levels.

L368: I would argue that these views could be seen as complementary rather than contrasting, but then again, I am the lead author of the cited study!

Fig 9: the vector field has a very high resolution, which makes the pattern difficult to see unless zoomed in quite far. Consider coarsening.

L435: This a sensible conclusion, and increasingly supported by isotopic studies of precipitation over the UIB (e.g. Jeelani et al, 2017, doi:10.1007/s12040-017-0894-z; Dar et al, 2021, doi:10.1029/2020JD032853).

L528: Are the authors sure that vortex stretching likely to be occurring here? On the left side of a jet streak entrance region, there is vorticity creation aloft, but it is balanced by destruction below.

Spelling/grammar

L34: "maxima" should be "maximum"

L54: "counterpart" is not hyphenated

L74: "cf" should be "see"; "cf" stands for "conferatur" and means "to compare". There is no comparison being made here. There are other instances (e.g. L93).

L89: By "wind" do you mean "wind speed"?

L108: "Euclidean" should be capitalised, as an adjective deriving from a proper noun.

L127: These are units of geopotential, not geopotential height.

L133: "figure" here need not be capitalised as it is not a proper noun

L139: presumably by "surface" you mean "surface pressure"

L267: Should dZa_{DW} be dZa_{LW} ?

L279: "Hindu Kush"

L286: "as is evident"

L290: "rises"

L489: Not sure "concomitant" is the right word to use here, perhaps "concurrent"?

L504: "increases"

L534: "UIB"