

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-609

Anonymous Referee #1

Referee comment on "Atmospheric rivers and associated precipitation patterns during the ALOUD/PASCAL campaigns near Svalbard (May–June 2017): case studies using observations, reanalyses, and a regional climate model" by Carolina Viceto et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-609-RC1>, 2021

General comments

This manuscript presents a detailed analysis of three atmospheric rivers affecting Svalbard during May – June 2017. A number of observational, reanalysis, and satellite datasets are used to analyze the events and the consistency between these data sources is assessed. A strength of this paper is its detailed comparison of two different AR detection algorithms, including an assessment of “potential AR” events that are hydroclimatically significant but may miss detection by the geometric criteria of certain AR algorithms. The potential impact of these events in the Arctic is a topic that has not been well explored in the literature. The detailed evaluation of several different reanalysis datasets and the HIRHAM model is also a strong contribution to the field, particularly the assessment of vertical profiles of wind and humidity. The paper is very well referenced with the appropriate literature. I have a few minor suggestions that I feel would further strengthen this work, including some quantitative validation of the various datasets and further discussion of the HIRHAM model deficiencies. Pending these minor revisions and the correction of some grammatical items as detailed below, I feel this paper will be suitable for publication in ACP.

Specific comments

This paper has a lot of nice qualitative discussion of the differences observed among the various reanalysis and model datasets and their comparison to observations. However, quantitative assessment of these datasets is lacking. I think that providing and discussing some simple summary statistics (e.g. RMSE, bias) comparing the most important parameters that are available from both the model/reanalysis datasets and observations (IWV, IVT, wind speed) would strengthen the paper and increase its value to other researchers.

A notable feature of the results is the poor performance of the HIRHAM model compared to the reanalysis datasets, including the ERA-Interim dataset that it was forced with. This result is somewhat surprising to me since this model has high spatial and vertical resolution and has been extensively used in Arctic climate studies. I think the paper would benefit from some additional discussion of why the HIRHAM model performed so poorly. Have problems with the HIRHAM wind and humidity fields been documented in other studies? Do the authors think this may be an issue with how HIRHAM was implemented in this particular case or a more general problem with the model?

L31: Does “the model” here refer to a deficiency in the performance of the HIRHAM model

specifically, or to all the reanalysis products?

L207: The purpose and application of the successively increasing IVT percentile thresholds in the Guan algorithm are not clear from this description. How is the AR area ultimately determined from this procedure? Some additional description here would be useful.

L281-282: What makes the Guan algorithm less restrictive compared to the polar-specific algorithms? Could the differences in algorithms have to do with using IWV (Gorodetskaya) versus IVT (Guan) for AR detection?

Technical corrections

L11: Specify that *atmospheric* moisture content has increased.

L19: Define what AWIPEV is an abbreviation for.

L43: "On contrary" --> "On the contrary"

L44: Does this refer to an increase in the severity of winter weather events or in overall winter seasons?

L71: Specifically, ARs have been shown to influence the mass budget of *ice sheets* in the Arctic and Antarctic.

L84: "on" --> "of"

L90: Remove the word "study" from this sentence.

L92: "point" --> "pointed"

L96: "resultant of" --> "resulting from"

L111: "does it identify" --> "it identifies"

L117: "suit" --> "suite"

L147: "exception" --> "the exception"

L156: "cyclones" --> "cyclone"

L222: "on" --> "of"

L227: "is" --> "are"

L301: I think this sentence describes figure 4 rather than figure 3.

L305 and elsewhere: "associated to" should be changed to "associated with".

L307: "phenomena" --> "phenomenon"

L356: "previous" --> "prior"

L394: "this type" --> "these types"

L412: I think a different word choice than "approximation" should be used here. Is this referring to the "approach" or "arrival" of the AR to Svalbard?

L420: Remove the word "the" before 850 hPa.

L506: The word "foehn" does not need to be capitalized.

L584: "big" --> "large"

L586: "bigger" --> "larger"