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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Contrasting seasonal changes in total and intense precipitation in the European Alps from 1903 to 2010" *by* Martin Ménégoz et al.

Anonymous Referee #1

Received and published: 4 March 2020

Synopsis:

The paper analyses trends of precipitation in the Alpine region since 1900 in a dynamical downscaling simulation. They use the regional climate model MAR at 7 km resolution, driven with ERA-20C boundary conditions, for the Alpine region. The focus is is on extreme precipitation events and their seasonal changes. They first evaluate climatological features such as altitude gradients and then assess trends. They find seasonal, regional and altitude-dependent patterns of trends. Trends are mostly only significant when considering the entire centennial time period.

The paper is interesting and scientifically sound, though not ground-breaking. It fits into

the scope of the journal and hence I recommend publishing the paper after revisions have been taken into account.

Major points:

Structure: The paper could be shortened and made more accessible. For instance. The Introduction is long and talks at length about aspects such as the North Atlantic Oscillation etc. These aspects are not taken up later in the paper. I suggest to remove all parts that are not addressed later in the paper (or, alternatively, to revert to these aspects in the discussion part).

Trends: An important question regarding the trends reported is the trend in the driving data set, i.e. ERA-20C. Please report the trends in this data set. If this data set is drying out unrealistically or has other shortcomings, this might affect the final results and its interpretation.

Interpretation: It seems the authors interpret their findings mostly in terms of a regionally closed moisture budget (e.g. when they discuss different moisture availability as a function of altitutde), although they are not very clear about it. They do not address or discuss things like atmospheric rivers or the like. I think they should discuss their findings more broadly and more specifically. Also, perhaps they could give the reader some feeling about the change in moisture advection in ERA-20C or in MAR. Sometimes it is not clear whether they refer to a model diagnistic or their interpretation (e.g., when they write about moisture availability).

Minor:

L 24: longer and more intense?

L. 46: Danube: Alpine an non-alpine headwaters show quite different behaviour in some aspects. So, perhaps just at in brackets (Inn, Salzach, Saalach, etc.)

L. 50: make these

L. 54: has occurred and is expected to occur

L. 162: This is the first instance that a relation is made between the text and the paper. I suggest placing the paper in the context much earlier.

L, 165: I am missing what questions are actually addressed in the paper.

Sec. 2.3. For the sake of completeness, indicate the time resolution of all data sets (e.g. L. 239: is the gridded data set also monthly? Is SAFRAN daily?).

L. 310: 40-80% difference is huge!!

L. 315: Pattern correlation?

L. 319: Again, 20-80% is huge!

L. 366: I can hardly believe the bad correlation of HISTALP. Please double check.

L. 380: dependent

L. 426: twice significant

L. 449: Avoid qualifiers such as "dramatic"

L. 503: I do not understand this sentence.

Discussion: For trends in Rx1day I suggest the authors cite Scherrer et al. (2016), https://doi.org/10.1002/2015JD024634

L. 534: Just to clarify: stratiform precipitation is a separate diagnostic variable in the model?

L. 542: local convective precipitation locally?

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