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Interactive comment on "The importance of model resolution on simulated precipitation in Europe – from global to regional model" *by* Gustav Strandberg and Petter Lind

Anonymous Referee #2

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The paper "The importance of model resolution on simulated precipitation in Europe – from global to regional model" by Strandberg and Lind assesses the ability of a large set of climate models in simulating precipitation (particularly extremes) in European sub-regions. The authors find that models with coarse grid spacings underestimate the amount and frequency of extreme precipitation but that the variability between models can be larger than the sensitivity to grid spacing. The novel contribution of this study is the inclusion of global climate model data in their analysis since very similar and more detailed analyses have been done with regional models over Europe. I have two major concerns with this manuscript. First, it does not account for the spatial dependence of extreme precipitation. I argue that the authors can obtain the same

results by first aggregating E-Obs observations to a coarser grid and then comparing the aggregated extreme precipitation with the original E-Obs data. They would also see that the coarser version of E-Obs "underestimates" extreme frequency and magnitude. Coarse-resolution models should not reproduce the magnitude of extreme events on local scales since they model aggregated rainfall over large areas (e.g., 100x100 km). My second concern is the use of E-Obs for this analysis. E-Obs has very low station density over large parts of Europe and heavily underestimates extreme precipitation. There are other observational datasets available that are far more appropriate for the presented analysis. More details on these comments including relevant literature is provided below.

General Comments: 1. I have major concerns with your approach to compare extreme precipitation. Extreme precipitation is strongly scale dependent and largest on point scales (e.g. measured by precipitation gauges) and decreases on larger spatial-scales. E-OBS for example has way weaker extreme precipitation than other regional datasets in Europe that feature higher resolution and a higher station density (e.g. Prein and Gobiet 2017). If you compare extreme precipitation on the model native grid, you mix the model ability in simulating extreme precipitation with the spatial scale on which the model simulates extremes. E.g., extreme precipitation in a 100 km grid spacing model should not match observed extreme precipitation on a 25 km grid. In this case the only way to do a fair comparison is to aggregate the 25 km grid observations to the 100 km model grid. This aggregation does not introduce large biases such as you state for interpolation (in Line 127-128).

2. E-Obs should be used with care for extreme precipitation (Haylock et al. 2008). There are other/regional datasets in Europe that are much better suited for the assessment of extreme precipitation (see Prein and Gobiet et al. 2017).

3. You are missing to discuss and to refer relevant literature on the ERUO-CORDEX simulations that performed very similar analysis as you present. Kotlarski et al. (2014), Casanueva et al. (2016), and Prein et al. (2016) address similar questions and come

to fairly similar conclusions. The novelty of your analysis is that you also include GCM data, which is a valuable contribution but does not change the major conclusions. You should also take a look at Thackeray et al. (2018) who show a highly relevant analysis of model grid spacing and extreme precipitation on a global-scale.

4. Please be careful with the use of model resolution. In most cases you refer to model grid spacing. Model resolution depends on the numeric diffusion in the model and models with the same grid spacing can have different resolutions. The effective resolution of a model is typically 4-8 times its grid spacing (e.g., Skamarock 2004).

5. There are many typos and grammar errors in the document. Please consider using a proofreader before resubmitting the document.

Literature: Casanueva, A., Kotlarski, S., Herrera, S., Fernández, J., Gutiérrez, J.M., Boberg, F., Colette, A., Christensen, O.B., Goergen, K., Jacob, D. and Keuler, K., 2016. Daily precipitation statistics in a EURO-CORDEX RCM ensemble: added value of raw and bias-corrected high-resolution simulations. Climate dynamics, 47(3-4), pp.719-737.

Haylock, M.R., Hofstra, N., Klein Tank, A.M.G., Klok, E.J., Jones, P.D. and New, M., 2008. A European daily highâĂŘresolution gridded data set of surface temperature and precipitation for 1950–2006. Journal of Geophysical Research: Atmospheres, 113(D20).

Kotlarski, S., Keuler, K., Christensen, O.B., Colette, A., Déqué, M., Gobiet, A., Goergen, K., Jacob, D., Lüthi, D., Van Meijgaard, E. and Nikulin, G., 2014. Regional climate modeling on European scales: a joint standard evaluation of the EURO-CORDEX RCM ensemble. Geoscientific Model Development, 7, pp.1297-1333.

Prein, A.F. and Gobiet, A., 2017. Impacts of uncertainties in European gridded precipitation observations on regional climate analysis. International Journal of Climatology, 37(1), pp.305-327.

Prein, A.F., Gobiet, A., Truhetz, H., Keuler, K., Goergen, K., Teichmann, C., Maule, C.F., Van Meijgaard, E., Déqué, M., Nikulin, G. and Vautard, R., 2016. Precipitation in the EURO-CORDEX 0.11 and 0.44âĹŸ simulations: high resolution, high benefits?. Climate dynamics, 46(1-2), pp.383-412.

Skamarock, W.C., 2004. Evaluating mesoscale NWP models using kinetic energy spectra. Monthly weather review, 132(12), pp.3019-3032.

Thackeray, C.W., DeAngelis, A.M., Hall, A., Swain, D.L. and Qu, X., 2018. On the connection between global hydrologic sensitivity and regional wet extremes. Geophysical Research Letters, 45(20), pp.11-343.

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