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Interactive comment on "Merits of novel high-resolution estimates and existing long-term estimates of humidity and incident radiation in a complex domain" *by* Helene Birkelund Erlandsen et al.

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The authors have set out to determine if there are vertical gradients in near surface humidity and down-welling radiation in Norway (Ha) and to test whether there is added value to generating high-resolution (0.1 x 0.1 degree) estimates of humidity, SWdown and LWdown for this country (Hb). They documented their processing of meteorological observations from across Norway, generated new data (HySN) and then compared their results to observations, raw surface reanalyses data (from MERRA and ERA-Interim), bias-corrected reanalyses (PGF and WFDEI) and two VIC-generated forcing

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datasets.

This is a careful and well written piece of work. Although they clearly showed that humidity and down-welling radiation have significant vertical gradients (Ha), they also conclude that to an extent there is not a huge added value obtained by generating the new data (Hb). These are justified conclusions, but they could choose to amplify their results a little as explained below.

They have justified their effort by indicating that the high-resolution forcing data will be of value for land surface models including Norwegian operational hydrological models. They have shown that new data, assessed as isolated meteorological variables, out-perform existing datasets in many situations. However, although this is of course primarily a paper about a dataset, of additional value to the reader would be at least a partial test of whether the differences between the various datasets cause large differences to the output from a hydrological model.

Therefore I would urge the authors to select a single catchment for which they have observations of discharge and then to simply illustrate whether there is much spread in the discharge estimates from a single hydrological model according to the various forcing datasets for SWdown, LWdown and humidity - but with every model run using the same 2m temperature and precipitation forcing. Hopefully this would not be too onerous (one model, one catchment, one observational dataset, seven model runs) and would clearly illustrate the relative significance of a spread in forcing in terms of SWdown, LWdown and humidity to the performance of a hydrological model.

It is entirely possible that the authors already plan to publish this type of model analysis so I do not wish to imply that I think it is essential for this paper, but I do think it would provide more impact. It could be a starting point for further exploration in a subsequent paper (multiple catchments, isolating impact of LWdown, SWdown and humidity separately and possibly multiple hydrological models).

The minor corrections below mainly relate to typographic errors plus ways in which

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Figs 1f, 1g, 3 and 7 could be made much easier to digest.

Minor corrections: p1 line 22: a latent heat flux, which in turn > a sensible heat flux as well as a latent flux which in turn

p4 line 7: restrains currently > restraint, currently

p4 line 29: MT-CLIM > MTCLIM

p6 line 10: WATCH > WFDEI [Note: WFDEI was entirely funded by EU-EMBRACE. EU-WATCH had finished by the time it was created].

p7 lines 7-8: Bras full-sky LW v algorithm. Provide a reference describing this algorithm.

p7 line 18: snow cover the > snow cover in the

p7 line 7: snow season varying from a few days to 300 days a year. Provide an explanation in brackets for this large range for those who don't know Norway. E.g.: "(dependent on latitude, elevation and distance from the coast)".

p8 line 4: The quality of the observations are fair . . . "Fair" is far too vague to be helpful – it might mean the results are reliable to within +/-5 or +/- 50%! Please provide a quantitative estimate of reliability.

p8 line 7: red and purple. There is no good reason to use two colours for LW V sites in Fig 1g. See the notes on Figure changes below – I suggest using one colour that can easily be seen such as orange.

p9 line 9: conducted this study > conducted for this study

p9 line 14: time-series > time series [two words (e.g. see primary mathematical literature) only hyphenate when writing time-series analysis]

p10 line 9: located at the ground > located on the ground

p10 line 13: time-series > time series

p10 line 18: to not introduce spatial or temporal smoothing > to avoid introducing spatial or temporal smoothing

p10 line 23: analysed multiple > analysed using multiple

p11 lines 11 to 14: Use separate lines for each equation. Indicate that “mu” = mean.

p11 line 15: time-series > time series

p11 line 18: probability of the that the > probability that the

p11 line 24: differs significantly > differ significantly [dependencies and model estimates are both plural in this sentence]

p12 line 2: a air mass > an air mass

p12 line 16: time-series > time series

P13 line 19: weakened with 0.11 hPa/100 m > weakened by 0.11 hPa/100 m

p16 line 21: fall is > fall (autumn) is

p20 line 21: trough > through

p22 line 22: higher found in > higher than found in

p23 line 11: average to a five times larger > average in a five times larger

p25 line 12: produced points to that great care > produced indicates that great care

P25 line 23: sensitivity too > sensitivity to

p27 line 9: conducting in the production > conducted in the production

p27 line 12: which might to do > which might be to do

p27 line 16: does not implies > does not imply

p28 line 26: e.g. in ISI-MIP. Provide reference to ISI-MIP research.

p28 line 27: made available may easily > made available and may easily

Figure changes: Fig. 1f and 1g The resolution of the background map plus the background colours (green, yellow, white) make it very hard to see the plotted points in blue and purple. I suggest removing the background colour in 1f and plot points in red. There is no need to plot the LW V stations in different colours in 1g. Use a colour that stands out instead (e.g. orange for LW V sites).

Fig 2 Make sure the observations stand out. I suggest using a thick continuous black line instead of a thin dashed line lacking plotted points. Increase the size of all the text (including key, heading and axis label) relative to the figure. Add a horizontal axis label "Calendar month".

Fig 3. It is extremely difficult to distinguish these lines. Avoid using red and green on the same plot. Remove all the plotted shapes – it confuses things. I suggest instead using a thick continuous line to make the observations easily distinguished. For the models use fewer colours according to dataset type (e.g. MERRA and ERA-Interim = red; PGF and WFDEI = blue; V1 and V2 = orange, HySN = grey). Then distinguish within pairs of lines of the same dataset type by using one continuous and one dashed (e.g. MERRA continuous red, ERA-Interim dashed red). Add explanation of the key letters to the caption.

Fig. 5 Make plotted symbols much bigger.

Fig 6. Use system suggested for fig. 3.

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