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Geoscientific Model Development Discussions

Interactive comment on "Validation of the ALARO-0 model within the EURO-CORDEX framework" *by* O. Giot et al.

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We wish to thank the referee for his/her comments and useful suggestions that have now improved the manuscript and have acknowledged his/her efforts in the manuscript.

1. p 8389 line 27 better predicted: What is improved? The chronology or the intensity? Getting a better chronology is not useful for climate application.

Indeed, chronology is not useful for climate applications, but intensity is. Although one could argue that a systematic error in chronology will eventually also result in a error in the intensity as the two are obviously interconnected through the physical processes involved. But in the end one does not expect climate models to get the timing right, but the statistics, which is the pdf of the variable

at hand. We have changed the manuscript to further clarify this and added other relevant effects (diurnal cycle, convection onset, less drizzle): "Nowadays, NWP Limited Area Models (LAMs) are designed for resolutions down to a few kilometres, with adapted physics parametrisation schemes. At even higher resolutions, these models can (partly) resolve clouds and convective systems. Since a correct treatment of the cloud feedback is of critical importance for climate modelling (e.g., Sun et al., 2009; Lin et al., 2014), some of these NWP models have been used in climate mode: studies by De Meutter et. al 2015, Hohenegger et al., 2008, Kendon et al., 2012 and Chan et al., 2014, where models with resolution at the kilometer scale are used without convection parameterization, show a better representation of the intensity of extreme precipitation, the diurnal cycle, afternoon convection onset and less drizzle."

2. p 8393 lines 16-22: Explain why you interpolate differently temperature and precipitation. Is it to save the precipitation extremes?

Temperature and precipitation are interpolated in the same manner. First, from the ALARO-0 grid to the EUR-11 grid, using the closest grid point value. For temperature, here an additional height correction of 0.0064 K/m * $(h_E - h_A)$ was applied, with h_A the ALARO-0 grid point height and h_E the EUR-11 closest grid point height. Then from EUR-11 to the E-OBS (.22°) grid, 2x2 grid box averages were taken for both precipitation and temperature. This method was adopted from K14 in order to be able to compare to those results.

We have changed the text to clarify this: "For the high-resolution simulations, first the values of the closest grid point were taken to go from the native Lambert ALARO-0 grid to the EUR-11 grid for both precipitation and temperature. For the latter, an additional height difference correction between the ALARO-0 and closest EUR-11 grid point was performed using the standard climatological lapse rate of 0.0064 K/m. Second, on this grid, for both precipitation and temperature two-by-two grid box averages were calculated to obtain an identical grid to the

E-OBS dataset."

3. p 8394 lines 9-11: does it means that CRCO and ROYA are constant whatever the model ?

Not constant, but very similar. We refer to figures 13 and 14 in K14.

CRCO (climatological rank correlation) measures if the yearly cycle is captured or not, it is the normalized difference in the 12 ranked area averaged monthly means. For temperature this gives a value very close to 1 for all models, since this is strongly correlated with the yearly cycle of solar forcing. For precipitation the score very much depends on the (in)existence of a clear yearly cycle. When a certain region has a clear annual cycle, the score will be higher. And therefore it does not clearly measure model deficiency.

ROYA (ratio of yearly amplitudes) is the ratio of the amplitude of the yearly cycle based on monthly values (model max- model min)/(observed max – observed min). This score can effectively be read from the BIAS column in figures 3 for temperature. If JJA is cold (warm) biased and DJF warm (cold) biased, this score will be lower (higher) than 1.

For ALARO-0 we found the behavior of the scores to be similar to other models. Therefore, the additional information to K14 that would be provided by discussing these scores would seem minor and we chose not to include them for conciseness.

4. p 8396 last sentence: In fact 20 year is not a short period for such an exercise. When comparing two climate simulations which include interannual variability, even 30 year is short to draw conclusions. But here all simulations and observations follow the same chronology because of the common driving by ERA-interim. So, the signal is not blurred out by the noise of the interannual variability. This is why EURO-CORDEX is limited to the core period of ERA-interim, i.e. 1989-2008.

Indeed, but still the scores could be dependent on the state of the system. For example, a warm period could have a warm bias, while a cold period could have a cold bias. Therefore, it is still relevant to study if the provided scores for the different models are statistically significantly different from one another. Model scores could differ given a different period and model ranking, for example, would not be robust.

5. p 8398 lines 10-12: Indeed ALARO is a new comer in this community. But one should stress that the RCM community has trained his models with a 50 km resolution. A large EURO-CORDEX domain at 12 km resolution was a first attempt for most models, because of the computer cost. I do not believe that ALARO is compared with highly tuned climate models.

We agree and have changed this paragraph: "This is the first time ALARO-0 was used for a climate experiment. Nevertheless, the performance of ALARO-0 on seasonal and yearly scales for both near-surface air temperature and precipitation is satisfactory. Generally ALARO-0 performs well, which is quantified by the large number of white boxes in Figs. 3 and 5 indicating that the ALARO-0 score lies within the existing K14 ensemble. For precipitation, ALARO-0 even outperforms all other models on numerous occasions. These results are encouraging, given that ALARO-0 does not yet have the experience in climate modelling that some of the other models of the K14 ensemble had, but was directly ported from its NWP setup. Although the 12.5-km resolution was also a novelty for the K14 models, their performance undoubtedly benefited from previous optimizations for climate experiments, albeit at a lower resolution of 50 km."

Interactive comment on Geosci. Model Dev. Discuss., 8, 8387, 2015.