Geoscientific Model Development Discussions

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Reply on RC2

Cléa Denamiel et al.

Author comment on "Performance of the Adriatic Sea and Coast (AdriSC) climate component – a COAWST V3.3-based coupled atmosphere–ocean modelling suite: atmospheric dataset" by Cléa Denamiel et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-3-AC2, 2021

General/mayor comment:

This paper presents an interesting study about the validation of the coupled atmosphere-ocean Adriatic Sea and Coast (AdriSC) climate model over the Adriatic. The topic is relevant, the paper is well organized and written relatively clearly. However, I suggest some corrections in the manuscript and minor revisions.

Response: Thank you very much for your encouraging comments and helpful review.

Detailed comments in text:

1) Figure 1 Please replace Dinaric Alps with Dinarides

Response: Accepted. Dinaric Alps will be changed with Dinarides in Figure 1.

2) Page 2, line 39; please replace … located in the northeast...into ... along the Adtiatic coast... or delete

Response: Accepted. Located in the northeast will be replaced with "along the northeast coastline"

3) Page 2, line41; please replace … in the northern Adriatic ... into ...mostly from the north-eastern direction

Response: Accepted. In the northern Adriatic will be replaced *with* "from the north-eastern direction"

4) Page 3, line 75: It would need to be better formulated in the introduction the main research question and aims.

Response: The paragraph will re-written and extended in the text as follow:

"The following study solely assesses the skill of the AdriSC atmospheric kilometre-scale

model while the evaluation of the AdriSC ocean coastal model is done separately. It also is, as suggested by Massonnet et al. (2016), a bidirectional exercise evaluating both the kilometre-scale AdriSC atmospheric model and the freely available observations retrieved, in the Adriatic basin, from in situ measurements, gridded datasets and remote-sensing products. The presented work thus aims at answering the following questions: What are the strengths and shortcomings of the AdriSC atmospheric model depending on the evaluated essential climate variables and how are they related to the physical set-up of the model? Are the skills of the newly developed climate model similar at the daily and hourly time-scales? How the performance of the kilometre-scale atmospheric model compare to the RCMs set-up within the CORDEX community? What is the quality and the reliability of the freely available observations in the Adriatic region?"

5) Page 7, line 199: Please correct or explain a part of the sentence due to repetition...such as median (or mean for the rain) and Median (Mean for rain).

Response: The paragraph will be reformulated as follow:

"The biases are analysed in space with statistical quantities such as median and Median Absolute Deviation (MAD) as well as 1st, 25th, 75th and 99th percentiles. In this study, in order to obtain more robust statistics for the chosen geophysical quantities which are likely to be heavy tailed due to extreme conditions, the use of median and MAD is preferred to the mean and standard deviation preconized for normal distributions. However, despite having a heavy tailed distribution, the rain is not a continuous quantity – i.e. occurrences of rain in the Adriatic region are low and the median is likely to be close to zero. Consequently, the mean and Mean Absolute Deviation (also MAD) are used for the statistical analysis of the rain instead of the median and Median Absolute Deviation."

6) Page 8, lines 222, 224, 229 & Page 9, line 258... (and further in the text): Please replace the Dinaric Alps with the Dinarides

Response: Dinaric Alps will be changed with Dinarides for the 10 occurrences used in the text.

7) Page 8, line 240; How was done a comparison between radiosondes with the model? On lines 193-194 it can be understood that the model data from the sigma level were interpolated to each radiosonde with a different number of levels and comparisons were made on all isobaric surfaces/levels (standard and significant). Do you have some explanation about the the best statistics for the UWYO soundings?

Presumably, since the comparison is made by height and the influence of the lowest layer is less represented in relation to the middle and higher troposphere where synoptic forcing dominates (and climate models better), the matching is good.

Response: Yes, the vertical model results on sigma layers were indeed interpolated on the exact heights of the radiosonde measurements which are having different heights for each time of the measurements, as explained in lines 193-194. For the Taylor plot the comparisons were made for all heights without distinction. It can be argued that an interpolation of the measurements and results could have been made on the regular heights (as done later for the bias comparison). However, the Taylor plot is "only" used to provide a rough estimate of the model performances and, as pointed by the reviewer, the main reason for doing the comparison between model and radiosonde measurements is the fact that climate models do better on the higher troposphere where synoptic forcing dominates than in the surface layers. This is discussed during the analysis of Figure 19. The following sentence will be added in order to clarify the interpretation of the Taylor plot:

"However, it should be noted that most of the sounding measurements are taken in the higher troposphere (i.e. about 90% are above 1 km of height) where synoptic forcing dominates and, hence, where climate models generally perform better than in the surface layer."

8) Page 10, line 300; The comment is related to the maximium over the mountainous part near the northern edge of the domain. How is this deviation up to 8.5 hPa (just an inaccuracy of the E-OBS base?) interpreted with the assumption that the positive bias is relatively uniform occurred over teh continent/lan area of the northeastern part of the domain.

Response: The positive bias of about 8.5 hPa in the north-eastern part of the domain is in fact mostly covering the Pannonian plain. The authors do not believe it is a problem with the E-OBS product as the same bias is seen on the QC NOAA stations for the median. As seen on the daily climatology extracted from the NOAA stations, the underestimation of the summer 2 m temperatures with the AdriSC model is accompanied by an overestimation of the mean sea-level pressure. As the worst underestimation of the temperatures occur in the Pannonian plain, it makes sense that it is accompanied with the worst overestimation of the mean sea-level pressure while comparing E-OBS and AdriSC climate model. The following sentence will be added:

"It should be noted that the largest mean sea-level pressure positive biases (about 7 hPa for the 75th percentile) occur in the Pannonian plain (i.e. north-eastern edge of the domain), where the largest 2 m temperature negative biases (about -8 °C for the 25th percentile) are also located."

9) Page 11, lines 309-325; Apart from the distribution of numbers itself, how it is possible to interpret the distribution of median values of wind direction along the Adriatic (Fig. 8) in terms of the flow regime? The bora flow could be typical near the coast which changes to the sirocco over the middle of the Adriatic, or not? Wind speed can be treated as a temperature, but wind direction has a problem with a circular wind rose, so e.g. 240-280 ± 40-80 ° can very easily mean both bora (0-90° & 330-360°) and sirocco (90-180°). I suggest that you consider the vector mean as a possible representation of the mean flow field.

Be also careful with the way of writing the wind direction 240-280±40-80 °North; It is unclear whether it is referring - to the azimuth or the directions according to the wind rose (also in the Fig. S2). In the later case, this is not correct.

Response: The authors agree that their original analysis of the wind direction was not appropriate. They decided to switch the analysis from quantitative to qualitative and now compare the median, 25th and 75th percentiles for both CCMP and WRF 3-km model separately and not as a bias. Vectors will be also added to the plots in order to clarify the direction of the wind. Finally, the MAD analysis of the wind direction will be removed for both CCMP and NOAA stations analyses. The following description of the new analysis will be added to the text:

"Concerning the wind direction, a qualitative comparison shows that median as well as 25th and 75th percentiles are similar for the CCMP products and the AdriSC WRF 3-km model within the Adriatic Sea, while the biggest differences are seen within the Ionian and Tyrrhenian seas where the AdriSC WRF 3-km model systematically shifts the directions by 40-120° anticlockwise. In more detail, in the Adriatic Sea, the wind is blowing from: (a) 220-280 °North along the Italian coast and 80-120 °North along the eastern coast for the median, (b) 40-60 °North in the northern Adriatic as well as along the eastern coast and 140-180 °North along the southern Italian coast for the 25th percentile, and, finally, (c) 200-240 °N in the northern Adriatic as well as along the eastern coast and 300-360

°North in the rest of the Adriatic Sea for the 75th percentile. However, it should be noted that the wind directions are much more homogeneous for the CCMP product than for the AdriSC WRF 3-km results mostly due to both the low spatial resolution and the lack of accuracy along the coasts of the remote sensing data. As an example, the bora – a northern to north-eastern downslope wind associated with speeds of 20.0-30.0 m/s (Grisogono and Belušić, 2009) – is regularly blowing along the northern Adriatic and Croatian littoral areas mostly during winter and spring. The different known bora jets (e.g. Trieste in the northern Adriatic and Senj at about 44.5 °N of latitude) represented by directions lower than 60 °North in the 25th percentile can be clearly seen with the WRF 3-km model but not with the CCMP products, which uniformly see directions typical of bora storms along the entire northern Adriatic and eastern coast. Therefore, the differences in directions associated with an overestimation of the wind speeds in the northern Adriatic, may be linked to the CCMP product and not the inaccuracy of the AdriSC WRF 3-km model."

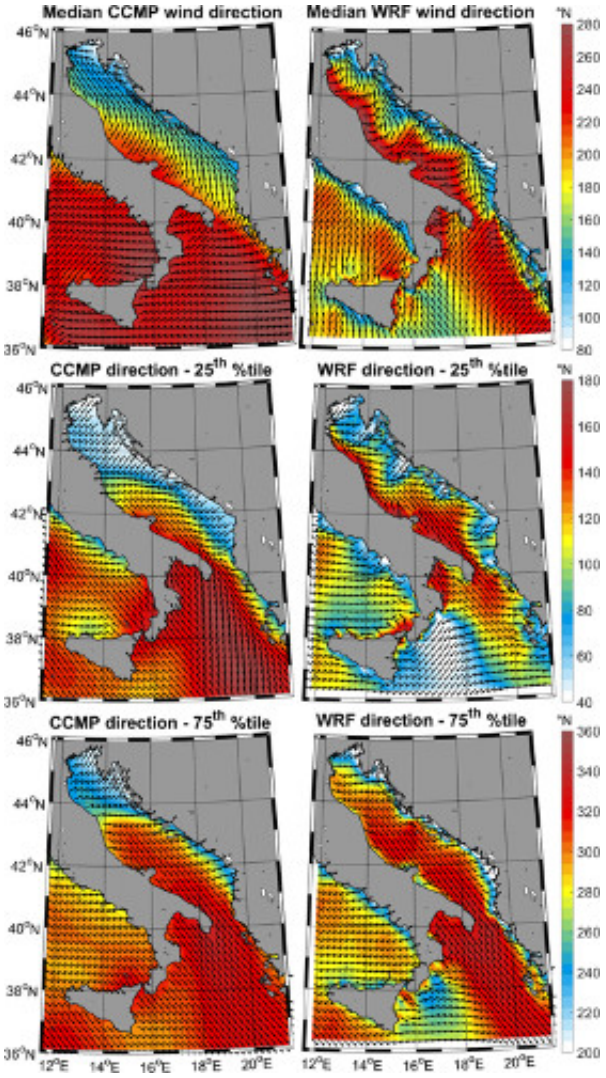

Figure 8: Median as well as the 25th and 75th percentiles of the 6-hourly wind direction (as colour fields and black vectors) over the sea for both CCMP remote sensing data (left panels) and AdriSC WRF 3-km results (right panels) during the 1987-2017 period.

10) Page 15, lines 434-435; This argument is completely correct due to the MYJ PBL scheme.

Response: The authors agree.