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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Modelling a tropical-like cyclone in the Mediterranean Sea under present and warmer climate" *by* Shunya Koseki et al.

Anonymous Referee #1

Received and published: 21 July 2020

General comments:

This article analyzes the single Medicane Rolf in a regional climate model under present and pseudo global warming conditions of the midst of the 21st century. The relative effects of a warming atmosphere and a warming ocean were analyzed separately, which has not been done before for a Medicane. The approach is indeed very interesting and appealing. However, the study would yield more reliable results by applying the same methodology for a small ensemble of simulations instead of just the current case study with single simulations for present day and future conditions. In the concluding remarks the authors emphasize several times that adding more cases would make the study more robust, and I would strongly agree with this statement. As RCM simulated storm tracks, especially of short-lived and small storms such as Medicanes, tend to be

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hard to simulate for a climate model, I doubt that another RCM realization with slightly perturbed conditions (e.g. started with a time lag of one day) would yield similar results. This is e.g. the case for Figure 6, which shows the Medicane track for pseudo-global warming of just the ocean or atmosphere; I think these tracks might look different for ensemble simulations. Differing Medicane tracks and storm developments were already shown in e.g. Cavicchia and von Storch (2012) for small ensembles of Medicane simulations when no large-scale constraint was used. The study would largely benefit from including a mini-ensemble of several realizations for Rolf or alternatively from including one or two additional Medicanes (whereby I would think a small ensemble for the same Medicane would provide more robust results) if the results would be similar.

The advantages of the PWG method and the method itself should be described in more detail; it seems obvious that the effects of a warmer atmosphere or warmer ocean can be examined with it. But please explain why 'a more direct assessment of impacts of future climate change on an extreme weather event' can be achieved with it in comparison to directly using GCM scenarios as forcing data for the RCM.

PGW all is remarkably similar to PBS simulation, there seems to be not much of a climate change effect. Is this statement corresponding to other results in literature? Please put this result better into context of existing articles.

The English is generally o.k., but it could be improved for some parts and formulations.

Due to my concerns with reproducibility of the results for ensemble simulations or other Medicane cases, I suggest major revisions before accepting this article.

Specific comments:

Abstract: What is missing here is the novelty of the work. This is stated later in the concluding remarks: 'The main novelty of this work is the investigation of the relative roles of the atmosphere and ocean, respectively in the medicane's response to projected global warming.' In section 2.2 the following novelty is stated: 'To our knowledge, the

present study is the first investigation to employ the PGW method to a tropical-like cyclone in the Mediterranean Sea.' These novelties should be stated more clearly in the abstract.

Line 107: Do you have a reference for the potential vorticity anomaly statement?

Line 111: Which discrepancies? The importance of air-sea interactions does not exclude the former process, does it?

Line 200: Please state here that PRS stands for present, and not just in the concluding remarks.

Line 214: Why were these periods chosen? Why not e.g. WMO standard periods? Please explain.

Line 216: What happens to greenhouse gases and aerosols in the PWG experiments? Were they changed as well or just the variables described? If not, why weren't they changed and what would the effect be if they were changed as well?

Line 245: Please explain all variables of the equation. The equation is numbered (3), but there is no equation (2). Are all equations starting with equation (3) wrongly numbered?

Line 250 and following: Equation (2) is missing

Line 270: The cyclone tracking method used was not described at all. Please add a subsection the section 2 to describe it in more detail.

Line 507: Wouldn't one expect a warmer atmosphere to inhibit Medicane formation and warmer SSTs to reinforce it? Warmer SSTs would increase the temperature difference between the surface and cold, higher atmospheric layers and thus lead to a decrease in stability, while a warmer atmosphere would increase stability and thus lead to the very effect that was described.

Line 568: What is 'middle future climate adapting PGW technique'? Please rewrite

and explain. I suppose meant is something like applying the PWG method for climate change scenarios according to the middle of the 21st century?

Line 572: The term ‘best track’ is to my understanding reserved for a quality-checked product provided by different weather services for (mostly tropical) cyclones which was derived by a multitude of analysis and measurement data (such as radar and satellite data), and not just a track derived by some kind of tracking algorithm of reanalysis data. Better term it ‘reference track’ if that’s what was meant.

Technical corrections:

Line 55: assesses instead of assess

Line 59: Insert ‘an’ in front of initial and ‘a’ in front of tropical

Line 112: blank is missing after ‘on’

Line 125: insert ‘to’ in front of change

Line 149: southern France

Line 185: Tiedtke misspelled

Line 229: Include ‘by’ before approximately

Line 251: Add ‘a’ in front of deep

Line 255: Insert a blank after 50

Line 258: Add ‘the’ after assess

Line 260: hours

Line 262: Add ‘that’ after low

Line 269: I would rather use ‘simulates’ instead of ‘observes’ for ERA5.

Line 288: ‘still a’ instead if ‘a still’

Line 350: southern France

Line 388: Replace ‘double’ with ‘twice’

Line 401: small what?

Line 422: Insert box after grid

Line 427: through most of the lifecycle

Line 437: defined

Line 455: What does ‘in a moderate value of the space’ mean? Please rewrite.

Line 456: Insert ‘, see’ in front of Fig.

Line 459: Delete ‘to’

Line 462: smaller

Line 466: Delete ‘to’

Line 498: ‘a much larger’ instead of ‘much a larger’

Line 519: Insert ‘the’ in front of increase

Line 577: Insert ‘in’ in front of ERA5.

Line 579: impact instead of impacts

Line 580: replace ‘march over’ with ‘move into a’

Line 595: ‘case studies’ instead of ‘study cases’

Line 598: medicanes instead of medicane; delete ‘the’ in front of global

Line 611: Insert ‘the’ in front of medicane

Line 613: roles instead of role

Figures:

Figure 1: Remove comma in front of Rolf Are the years correct or should they read 2036-2065 and 1976-2005?

Figure 2: Are the years correct or should they read 2036-2065 and 1976-2005? And what domain is shown here? It is bigger than WRF 2nd domain and smaller than the first one. I would suggest showing results for the 1st domain for a) and b). Please add the information that relative humidity is shown in gray and temperature in black for c).

Figure 3: 'ends at' instead of 'is until' Southern France

Figure 5: grid box 'scales' instead of 'labels'

Figure 7: grid box values within 250 km radius

References:

L. Cavicchia and H. von Storch, "The simulation of medicanes in a high-resolution regional climate model," Climate Dynamics, vol. 39, no. 9, pp. 2273–2290, 2012.

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