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Earth System Dynamics Discussions

Interactive comment on "Sensitivity Experiments on the Response of Vb Cyclones to Ocean Temperature and Soil Moisture Changes" *by* Martina Messmer et al.

Anonymous Referee #1

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General comments:

Messmer et al. examine the influence of sea surface temperature (SST) and soil moisture on precipitation and cyclone characteristics for 5 selected historical Vb cyclones. They conclude that the main factor influencing cyclone strength and the amount of precipitation is the Mediterranean SST. The subject is is of scientific interest and the chosen methodology is suitable for the analysis.

My main concern for this paper is that a very similar study already exists, that the authors don't seem to be aware of: Volosciuk, C. et al. Rising Mediterranean Sea Surface Temperatures Amplify Extreme Summer Precipitation in Central Europe. Sci. Rep. 6, 32450; doi: 10.1038/srep32450 (2016). It is important that the authors cite this

study and highlight how their study differs from the one of Volosciuk et al. They need to compare the results and discuss similarities and differences.

Another point they should address is the following: In their last paper "Climatology of Vb cyclones, physical mechanisms and their impact on extreme precipitation over Central Europe" they conclude that heavy precipitation related to Vb events is mainly related to large-scale dynamics rather than to thermodynamic processes, yet they decide to analyse the effect of changes in SSTs. This needs some motivation.

Specific comments:

Introduction: The only uplifting process mentioned is that at the northern side of the Alps. The Central European part of the precipitation that caused the Central European floods of 2002 and 2013 also involved uplifting at low mountain ranges such as the "Erzgebirge". Reading the paper one gets the impression that only the Alps are important.

p.4 line 21: "2-way basis" are you speaking about 2-way nesting in which the higher resolution results feed back on the lower resolution? Please explain further.

p.5 line 4: Does each domain has a time lag of 6 hours for initialization compared to the next bigger domain, thus an accumulated initialization of 18 hours to ERA-Interim?

p.6 line 6: For which scenario(s)? How do SSTs relate to surface air temperature?

p 6 line 18: Please explain in more detail. Do you interpolate both values to the same grid? Do you show the mean rate over the entire area? E-OBS doesn't have values over the ocean, however, domain D3 for which you compare precipitation includes ocean areas. How do you handle this? The cyclones don't remain in the area of interest for 5 days. How and why did you select a 5-day period?

p.6 line 19: If you compare precipitation rates for extreme events you expect that you get different values if you use different grids. You expect lower values for a lower resolution data set as it represents the average over a larger area. (see for example

Göber et al.: Could a perfect model ever satisfy a naiive forecaster? Meteorol. Appl., 15, 359 – 365, 2008)

p.6 line 27: Later you show that there is no indication of a positive bias for WRF for extreme events. With respect to biases you need to distinguish between mean and extreme precipitation.

p.7 line 29: Averaging CAPE and precipitation over the entire domain D3 obscures the signal that can be attributed to the Vb cyclones. How much do your results differ if you average over a smaller domain close to the location of the cyclone?

p.10 line 29-30: Can you confirm the results of Sodemann et al. if you look only at the 2002 case?

p.11 line 30: The statistical basis is too small for this statement.

p.12 line 6: You selected the 5 strongest events, so "average" does not seem to be the appropriate term.

p.13 line 30: Some information on "maximum energy" concept for cyclones is needed here. What does it mean? How is the energy of a cyclone determined? Do you want to imply that no cyclones stronger than the selected one can appear in this region? This is a strong statement that you should check for the ERA-Interim resolution cyclones in that region.

p.13 line 31: "strong cyclones are strongly steered by the atmospheric conditions" (This sentence is also included in the abstract). I don't understand what you are trying to say here and how it is a consequence of the previous statement. You need to explain this in more detail.

Technical corrections:

p.2 line 4: Vb cyclones are not characterized as cyclones they are cyclones.

p.2 line 5-6: As they reach .... they turn ....

P.4 line 30: "The increase of the Atlantic Ocean SSTs is guided by the expected changes in the Mediterranean SSTs described in Sect. 2.4.3." I don't understand this sentence. Which changes did you expect for the Mediterranean SSTs in response to the Atlantic SSTs?

p.5 line 4: "The SSTs that are deviant compared to the control simulation are then prescribed after the vertical interpolation step of 5 meteorological data onto the domain grid." I don't understand what was done. I am surprised vertical interpolation is needed as all regionalizations use the same 50 vertical levels. I thought were adding a constant to the control SSTs. Why do you need to determine anomalies from the control? Please rephrase.

p.11 line 13: Analysis and discussion of changes in cyclone (and) characteristics

p.13 line 33: consistency not inconsistency

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