Earth Syst. Dynam. Discuss.,
doi:10.5194/esd-2016-67-AC2, 2017

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.

Martina Messmer et al.

messmer@climate.unibe.ch

Received and published: 25 January 2017

We would like to thank the Anonymous Referee #2 for his careful review of our manuscript on "Sensitivity Experiments on the Response of Vb Cyclones to Ocean Temperature and Soil Moisture Changes". Please note that this is just a short and first reply to the referee's comments. A point-by-point reply will follow with a reviewed manuscript after the decision of the editor.

The study aims to give a general view on the moisture sources of Vb events, but only focuses on 5 selected events from summer, which were all connected to heavy precipitation. The extreme cases are indeed interesting, but the study should underline it

more that these are not typical Vb events, since even their previous study (Messmer et al. 2015) concluded that only 23 % of all Vb events are associated with extreme precipitation. Also their conclusions are valid mainly for summer, due to the event selection. This should be mentioned, since previous studies have shown that moisture sources in the Alpine region is influenced by seasonality, and for example the North Atlantic region is a more pronounced source during winter (Sodemann and Zubler, 2010). Thus the low sensitivity to the changes of North Atlantic SST might not be valid for the whole year.

The first comment on the characteristics of our chosen Vb events is an important point. Apparently we did not state clearly enough that the study focuses on summer and on extreme events only. This is somewhat a limitation that we will certainly emphasis further in the reviewed manuscript. Still, we note that the emphasis in these cases is not arbitrary. Vb events are frequently associated to high impact events that cause important economical and personal damage in central Europe, being this an important motivation to focus on those events. We will also discuss the point that the reviewer makes on the sensitivity to changes in the North Atlantic SST.

I found the 6 hour spin-up time rather short. I would expect that the water vapour fluxes do not have enough time to adjust to the altered boundary conditions. Also Winschall et al. (2014) found that for heavy precipitation events over a slightly different domain, the time of maximum moisture uptake varies between a few hours to more than a week before the precipitation event. So with 6 hours spin up time the moisture uptake is probably already occurred, and included in the initial and boundary conditions (SST and soil moisture). So the changed boundary values and thus moisture fluxes have less effect on the cyclonic precipitation. The authors already analysed the sensitivity for the spin-up time in case of the SST experiments, but I would like to ask for more details about those analysis, and also the a revision of the above mentioned moisture uptake "problem". Also I do not see if they have investigated the spin up effect during

the soil moisture experiments. I would like to see some results regarding this, because the 6 hour spin-up time also seems to be rather short for the soil experiments.

We understand the second concern of the referee on the relatively short spin-up of 6 hours. Indeed, this is the reason why we carried out an extensive analysis on this regard, and also included some paragraphs on this issue in our study. In short, our analysis allows us to conclude that this period is long enough, although we perhaps have to describe more profoundly how we came to this conclusion. Therefore, we will further discuss to include an additional figure addressing the spin-up time.

Nevertheless, we did not use longer spin-up times for the soil moisture experiments for a certain reason. This is, we would like to see if reduced soil moisture, as this might happen in a future climate, does influence the precipitation during Vb events. To get a strong enough signal we decided to run two extreme experiments, where we removed and saturated the soil moisture completely in all four model layers. Increasing the spin-up time would lead to a filling of the soil moisture volume and thus the sensitivity of Vb cyclone to soil moisture cannot be analyzed. This is at least true for the first model soil layer, which is the most weather-relevant layer. Maybe the experimental design of the soil moisture sensitivity simulation was not presented in a clear way, so we will clarify this in a revised version.

We will certainly address the specific comments throughout the review process, as these will help to increase the readability and consistency of our study. In a point-to-point response we will show how these suggestions and comments will be implemented.

Interactive comment on Earth Syst. Dynam. Discuss., doi:10.5194/esd-2016-67, 2016.