



Impact of Climate Change on the Climatology of Vb Cyclones

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Extratropical cyclones of type Vb develop over the western Mediterranean and move north-eastward, leading to heavy precipitation over central Europe and posing a major natural hazard. Thus, this study aims at assessing their sensitivity to climate change and deepens the understanding of the underlying processes of Vb-type cyclones. The analysis is based on global climate model output, which is dynamically downscaled for extreme Vb cyclones. Thereby two periods are compared: the reference period 1979 to 2013, and the future period 2070 to 2099 under the representative concentration pathway RCP8.5. The results show a reduction of Vb cyclones from 3.2 events per year during the reference period to only 2.1 Vb cyclones per year at the end of the 21st century. This reduction is induced by a northward shift of cyclone track over Europe in the future. To gain insight into the impact of Vb cyclones, 10 Vb cyclones with the most intense precipitation over the Alps are selected and dynamically downscaled for each period, separately. Although the overall precipitation in the innermost domain stays the same in the two periods, results indicate that future Vb events tend to affect more strongly the eastern coasts of the Mediterranean Sea, while the impact in the Alpine region becomes slightly ameliorated compared to the current conditions. Furthermore, the dynamical downscaling exhibits an increased temperature contrast between the Mediterranean Sea and the European land for these 10 events in future. This contrast leads to a higher instability at coastal areas and thus explains the changed precipitation pattern. Additionally, backward trajectories show a more zonal behaviour of the air parcels reaching the Alpine region during Vb cyclones in the future climate, which might further explain the shift in precipitation patterns.