Blessing and curse of BioClim variables: A comparison of different calculation schemes and datasets for species distribution modeling within the extended Mediterranean area

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Abstract

Bioclimatic variables (BCVs) are the most widely used predictors within the field of ecological niche modeling. However, recent studies indicate that BCVs alone are not sufficient to describe these limits and more (bio)climatological variables should be considered. Unfortunately, the most popular database WorldClim offers only a limited selection of predictors; thus, other gridded station-based observations or reanalysis (GSOR) datasets should be taken into account. In the present study, we investigate how well the BCVs are represented by different GSOR datasets for the extended Mediterranean area within the period 1970-2020, how deviations among the datasets differ regionally and how different calculation schemes affect the representation of BCVs. We consider different calculation schemes for quarters/months, the annual mean temperature and the maximum temperature of the warmest month and show the effects on the respective BCV. Differences resulting from different calculation schemes are presented for ERA5-Land. Selected BCVs are analyzed to show differences between WorldClim, ERA5-Land, E-OBS and CRU. Our results show that (a) deviations between the two calculation schemes for annual mean temperature (maximum temperature of the warmest month) diminish (increase) when the temporal resolution is decreased; (b) with respect to the definition of the respective month/quarter, temporal shifts can have substantially different effects on the BCVs, depending on region; (c) overall, all datasets represent the different BCVs similarly, but with partly large differences in some subregions; (d) the largest differences occur when specific month/quarters are defined by the seasonal cycle of precipitation. In summary, (a) since the definition of BCVs matches different calculation schemes, a transparent communication of the BCVs calculation schemes is inevitable; (b) the calculation, integration or elimination of BCVs has to be examined carefully for each dataset, region, period or species; (c) the GSOR-Data provide, except some subregions, a consistent representation of BCVs within the extended Mediterranean region.

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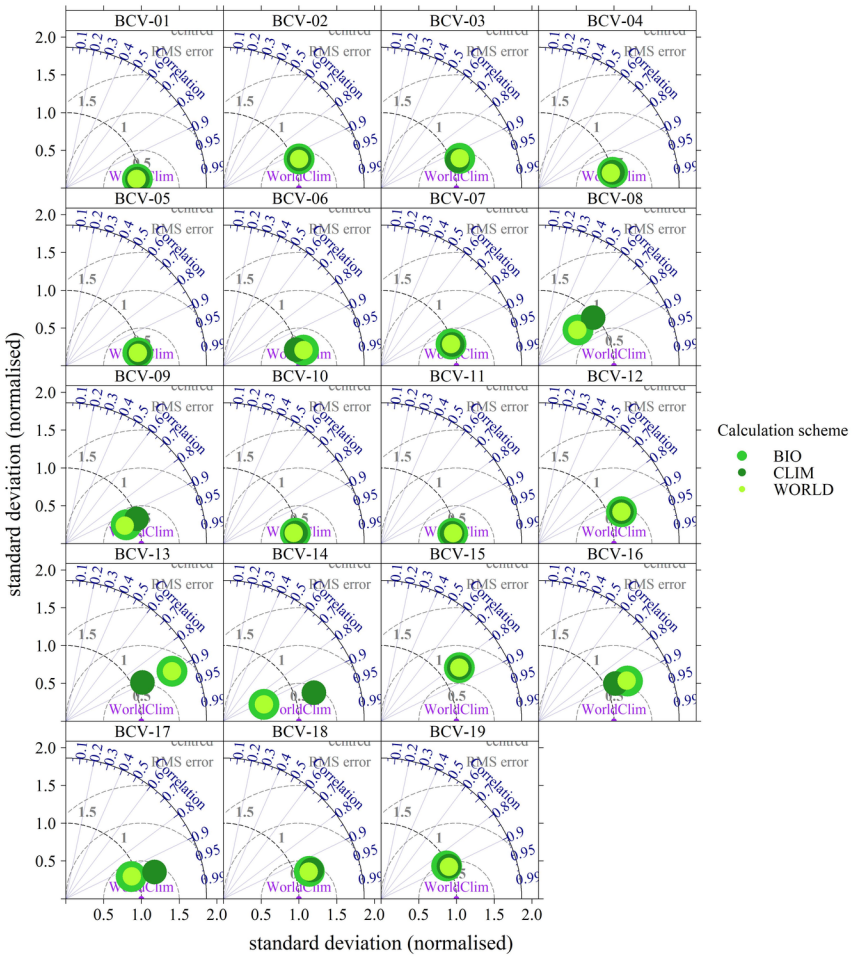
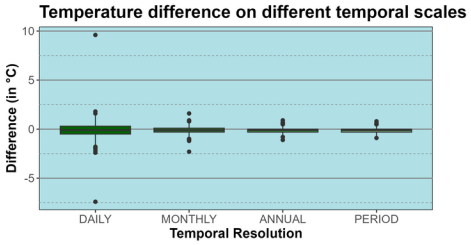
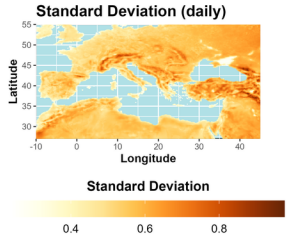
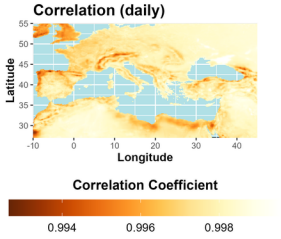
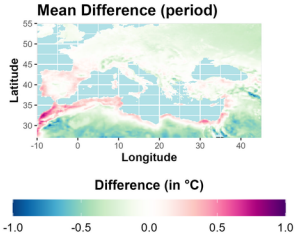
Differences between BioClim variables due to calculation scheme

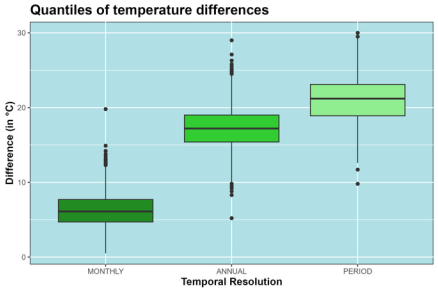


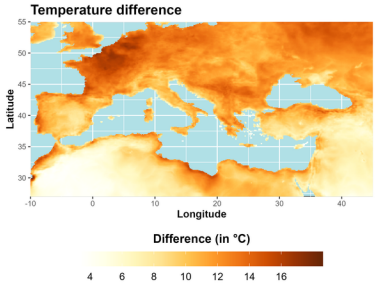


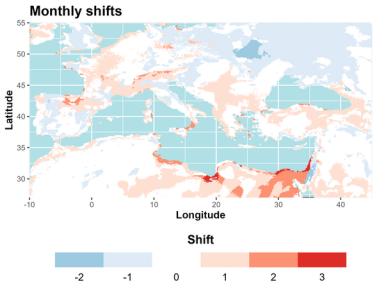


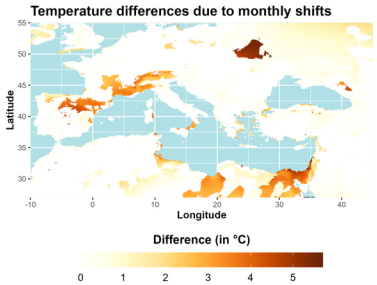


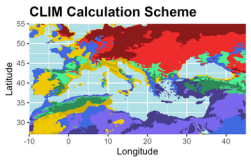


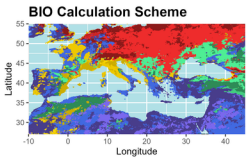


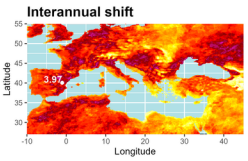


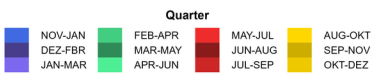


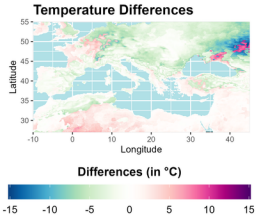


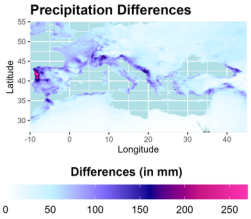












Differences between BioClim variables due to reanalysis data