



Downscaling of heat stress indices in Europe: evaluation and climate change projections

Ana Casanueva, Sven Kotlarski, Andreas Fischer, and Mark Liniger

Federal Office of Meteorology and Climatology, MeteoSwiss, Zurich Airport, Switzerland (ana.casanueva@meteoswiss.ch)

Dynamical and statistical downscaling techniques have been continuously applied to provide climate change projections for variables such as temperature and precipitation, but also for derived indices that can be directly relevant for various climate impact sectors. Within the Horizon 2020 project Heat-Shield, we evaluate and analyse climate change projections for heat stress in Europe, focusing on the impact of heat on strategic industries (manufacturing, construction, transportation, tourism and agriculture). For this purpose, temperature, humidity, wind and radiation from the EURO-CORDEX regional climate models (RCMs) are combined into a single heat-stress index: the wet bulb globe temperature (WBGT). This index is the most widely used for working people and can be calculated directly from meteorological data, considering two different implementations for indoors and outdoors settings. Moreover, it can be easily interpreted by ISO standards and adjusted depending on the clothing and activity type of the workers.

Since heat stress occurs at a very local scale beyond the RCM resolution and, furthermore, RCMs are prone to systematic biases, a statistical downscaling and bias adjustment step is established by means of empirical quantile mapping (QM) of the input variables of the WBGT. The corrections of the QM are calibrated considering station data at European scale from different data sources.

The objectives of this study are twofold, 1) to test the ability of the separately bias corrected variables to reproduce the main characteristics of heat stress indices in present climate conditions and 2) to explore climate change projections of heat stress indices on a European scale. The evaluation of QM in the historical simulations shows that the inter-variable consistency is maintained by the univariate correction. Regarding climate change projections, the WBGT is expected to increase over the whole continent, and actions are advised to protect European workers and industries from heat-related health and productivity impacts. We further discuss the possible effect of QM on the WBGT climate change signal and the dependency of projected WBGT increases on changes of the underlying meteorological variables.