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Climate change projections of heat stress in Europe: From meteorological variables to impacts on productivity

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Future climate change is likely to have important impacts in many socio-economic sectors. In particular, higher summer temperatures or more prolonged heat waves may be responsible for health problems and productivity losses related to heat stress, especially affecting people exposed to such situations (e.g. working under outside settings or in non-acclimatized workplaces). Heat stress on the body under work load and consequently their productivity loss can be described through heat stress indices that are based on multiple meteorological parameters such as temperature, humidity, wind and radiation. Exploring the changes of these variables under a warmer climate is of prime importance for the Impacts, Adaptation and Vulnerability communities. In particular, the H2020 project HEAT-SHIELD aims at analyzing the impact of climate change on heat stress in strategic industries in Europe (manufacturing, construction, transportation, tourism and agriculture) within an inter-sectoral framework (climate scientists, biometeorologists, physiologists and stakeholders).

In the present work we explore present and future heat stress over Europe using an ensemble of the state-of-the-art RCMs from the EURO-CORDEX initiative. Since RCMs cannot be directly used in impact studies due to their partly substantial biases, a standard bias correction method (empirical quantile mapping) is applied to correct the individual variables that are then used to derive heat stress indices. 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. We use the wet bulb globe temperature (WBGT) as primary heat stress index, considering two different versions for indoor (or in the shade, based on temperature and humidity conditions) and outdoor settings (including also wind and radiation). The WBGT is the most widely used heat stress index for working people and can be easily interpreted by means of ISO standards. Within the HEAT-SHIELD project, climate change projections of the WBGT will be used to assess the impact of climate change on workers' health and productivity.