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Emergence of multisectoral impacts of the global warming during the 21st century.

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The current observed global warming is projected to intensify by the end of the 21st century. According to simulations of the climate system and its impacts on populations, previous studies show significant projected impacts on four main sectors: water, health, energy and agriculture. Concurrent analyses have also focused on the time of emergence (ToE) of future climate modifications to assess when new climate regimes will emerge from a prior reference. Here we propose to investigate the timing and the emergence of global warming impacts on populations over three main vulnerable regions: Western Africa (WAF), Eastern Africa (EAF) and South-eastern Asia (SEA). We propose to analyse multi-sectoral impacts that may affect human being by accounting for (but not limited to) 6 fields: crop failure, water scarcity, health, droughts, floods, and heatwaves. The ISIMIP2b protocol (phase 2b of the Intersectoral Impact Model Intercomparison Project), which provides simulated impacts from 1 to 8 sectoral impact models and four CMIP5 (5th phase of the Coupled Model Intercomparison Project) climate models, is used in this study.

Preliminary results under the RCP8.5 future climate scenario show a strong acceleration of the decrease of the annual maize yields before 2048 in WAF and EAF according to the CLM45 impact model, suggesting a significant emergence at this time. No particular fluctuation from the long-term trend is shown in SEA. CMIP5 climate forcing (i.e. GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR and MIROC5) responses in maize yields exhibit larger uncertainties over EAF than over WAF and SEA. Drought metrics such as the annual number of consecutive dry days (i.e. daily precipitations < 1mm) and the annual number of periods with more than 5 consecutive dry days show an acceleration of their increases around 2052 in WAF with large climate forcing uncertainties, but no significant emergence over EAF and SEA. Flood metrics from the ORCHIDEE impact model simulations do not exhibit particular fluctuation nor acceleration of the change during the 21st century in the three regions. The next step of our study is to quantify the ToE of the significant fluctuations compared to the long-term trends of the different metrics that cover every impact sectors. The Kolmogorov-Smirnov test ('KS-test') method will be applied as the statistical approach to quantify the ToE independently from the signal shape. Impact models uncertainties will also be quantified compared to the climate model uncertainties, in order to assess whether impact or climate modelings is the main driver of the total uncertainties when studying the emergence of the impacts of global warming.