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Quantifying avoided impacts of 1.5°C and targeting risk reduction in climate risk hotspots

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Chapter 3 of the IPCC Special Report on Global Warming of 1.5°C was unequivocal in its findings of substantial avoided impacts of a 1.5°C world, compared to warmer temperatures of 2 and 3.0°C, for example. Multiple studies, across multiple sectors found substantial and, in many cases, unexpectedly large differences between 1.5 and 2 °C, for populations across the world. A number of studies have sought to identify 'hotspots' of climate impacts, locations where multiple impacts can be expected – with low-latitude locations in south and southeast Asia, west and east Africa particularly at exposed.
The use of socioeconomic scenarios, such as the Shared Socioeconomic Pathways (SSPs), further allows assessments to include vulnerability of populations and thus the identification of hotspots of climate risk.
One recently published hotspots study, led by IIASA in collaboration with the global Environment Facility and UNIDO, took such an approach with an ensemble of global climate, hydrological and integrated assessment models to develop 14 indicators across the water, energy and land sectors. In addition to the substantial benefits of keeping global mean temperature change as low as possible, a key finding and recommendation was that delivering targeted vulnerability reduction specifically in the hotspots would be most effective for reducing the risk burden to potentially hundreds of millions of people.
We find that locations in South Asia, including India, Pakistan, and Bangladesh, many in Africa, including Nigeria, top the charts for locations where socioeconomic development that reduces vulnerability has the greatest potential to deliver risk reduction for populations exposed to hazards in multiple sectors.
Building upon the original analysis, key locations (and countries) are identified where sustainable socioeconomic development (e.g. SSP1) is likely most effective for reducing risks. Furthermore, we can show for each country how the uncertainty across socioeconomic development scenarios (SSPs1-3) compares to the climate scenario uncertainty (1.5 vs 3.0 °C) or the climate model uncertainty.
In addition to this scenario uncertainty analysis, we use the hotspots framework to identify for selected countries the key sectors and climate hazards that contribute to high risks in these locations. For example, in China and Turkey, exposure is dominated by land-water impacts, whereas in most southeast Asian countries, exposure is more driven by land-energy challenges (even if water-related challenges still exist). For South Asian, and West and East African countries, reducing vulnerability to heat stress events, and for the latter two reducing vulnerability to water stress and agricultural pollution from nitrate leaching are effective, potentially affecting 1-2 billion. Similarly, in the Mediterranean and across most of Asia, unsustainable use of groundwater, water stress and excessive agricultural water demands all correlate.
Building on our previous regionally aggregated assessments, this decomposition at the country level, through sectors and indicators will provide targeted information (with associated climate and scenario uncertainties) to assist adaptation planners and development funders prioritize activities for climate-resilient development.