Closing the Global Irrigation Yield Gap alongside SSPs

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• Adaptation and adaptive capacity is currently largely absent from quantitative climate impact assessments
• We aim to build a first indicator of adaptive capacity (for the agricultural sector) that is consistent with the SSP framework and in line with the framing of the AR5
• By linking this indicator to variables from the SSPs we can derive scenarios for sectoral adaptive capacity
• These scenarios (e.g. for the agricultural sector) would allow for an improved understanding of possible climate change impacts and residual loss and damage
• Scenarios of sectoral adaptive capacity could be used in Integrated Assessment Models and climate impact models

Adapted from Table 16-3 in AR5 Chapter 16 (Schleussner and Andrijevic, 2020)
Application in the Agricultural Sector

- The global yield gap (from Rosa et al, 2018) assesses the difference between the actual yield and the maximum potential yield (that can be achieved through irrigation)

- We create a sustainable irrigation adaptation index (SIAI) that describes how much of it’s potential a country is currently using

- The irrigation yield gap is related to the socio-economic conditions that form adaptive capacity

- We run regressions to deduce what those factors are (in this case: GDP and Governance)

- We use GDP and Governance to project the future closure of the irrigation yield gap alongside the Shared-Socioeconomic Pathways (SSPs)

- Projecting the closure of the yield gap for different SSPs allows for a first quantification of adaptive capacity in the agricultural sector
Sustainable Irrigation Adaptation Index (SIAI) = Current sustainable calorie production

Potential gain through irrigation + Current sustainable calorie production

Total irrigation calories produced (YGC) – unsustainable intensification – unsustainable expansion

Projection of sustainable irrigation expansion

SIAI = 1 -> using full irrigation potential
SIAI = 0 -> no sustainable irrigation despite potential

Formula for projections: \( SIAI_{i,t} = \beta_0 + \beta_1 GDP_{i,t} + \beta_2 Governance_{i,t} + \epsilon_{i,t} \)
Projection of calories gained through sustainable irrigation expansion

Calories (kcal) as annual average per country in region
Results

• Even under the most optimistic scenario (SSP1) the irrigation yield gap does not close for any of the regions (indicating a substantial scenario dependence)

• For example: in SSP1 Sub-Saharan Africa can improve their calorie production by 36% until the end of the century, whereas in SSP3 the region will only improve by 13%

• Overcoming economic and institutional burdens will support countries to reach their SDGs (e.g. zero hunger)

• There is a strong need to incorporate socio-economic projections into projections of future agricultural impacts
THANK YOU!

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