Climate risk-reduction potential of gridded precipitation data for agricultural index-based insurance development

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Motivation

- Index insurance can tackle several challenges of the agricultural insurance sector in developing countries (Fig. 1).
- Low weather station density is challenging for index insurance design and implementation in Central Asia and Mongolia.

Objectives

- Systematic review of gridded precipitation data in terms of availability, accessibility, quantity and quality.
- Determine the best source (in-situ vs satellite vs model) to index insurance design for hedging crop yield.

Methods and materials

- Gridded precipitation data from 11 datasets.
- Reviewed gridded precipitation data:
  - CPC (I)
  - CMOPH (S+I)
  - IMERG (S)
  - GSMaP (S+I)
  - ERA5 (M+S+I)
  - ERA5 Land (M+S+I)
  - PERSIANN (S+I)
  - GLDAS (M+S+I)
  - FLDAS (M+S+I)
  - MERRA2 (M+S+I)
  - MSWEP (S+I)

**note: I: in-situ data, S: satellite data, M: model-based data*

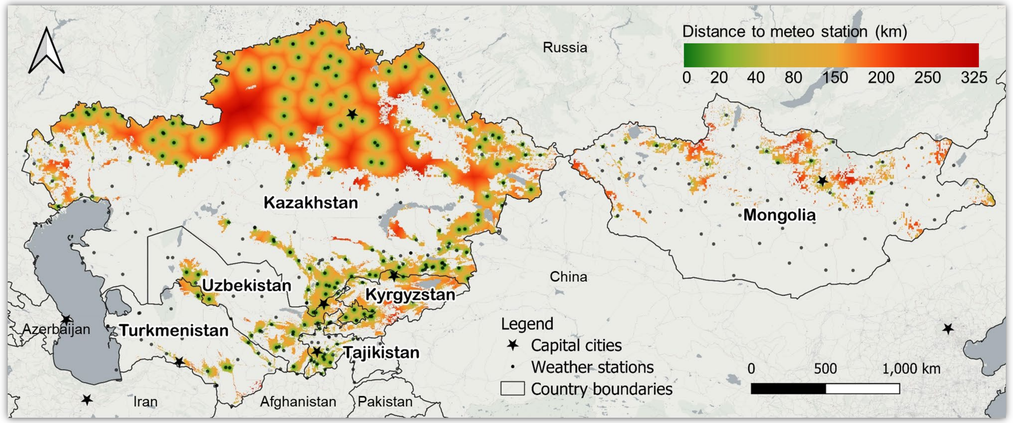

Fig. 1: Geographical distribution of weather stations in the croplands of Central Asia and Mongolia
Source: Own presentation based on data from Teluguntla et al. (2015) and NCEI (2019)

This presentation participates in OSPP

EGU

Outstanding Student & PhD candidate Presentation contest

Abstract

Crop yield data

County-level spring wheat yield data:

- between 1982 and 2018.
- 56 counties in Kazakhstan and Mongolia.

Design of index insurance products

$$PO_{t,i} = \max(S_i - I_{t,i}, 0) \times V_i$$

$$y_i = c_i + \beta_i I_{t,i} + \varepsilon_i$$

Estimation of the hedging effectiveness

$$y_{t,i}^{insured} = y_{t,i} + PO_{t,i} - FP_i$$

$$SV_i = \frac{1}{N}\sum_{t=1}^{N}\left[\min\left(y_{t,i} - \overline{y_i}, 0\right)\right]^2$$

$$HE = 1 - \frac{SV^{insured}}{SV^{uninsured}}$$

Results

- In most counties, the hedging effectiveness is highest for IMERG-based insurance design.
- Following, PERSIANN, GLDAS, and GSMaP-based insurance products showed higher hedging effectiveness than the rest (Fig. 2).

Conclusion

- Satellite- and model-based precipitation products have higher accuracy and potential than in-situ-based precipitation data.

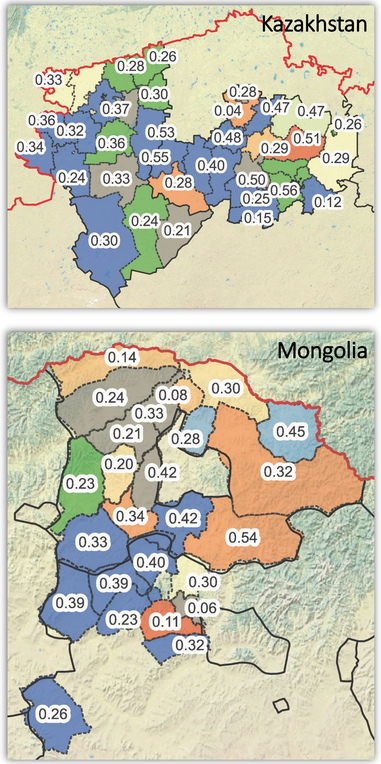

Fig. 2: Hedging effectiveness of the best insurance products

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