Global flood hazard map and exposed GDP inter-comparison for China

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Introduction

We present parts of the study “Global flood hazard map and exposed GDP comparison: a China case study” (Aerts et al.), in which we:

- Compare flood hazard maps from 8 global flood models (GFMs) for the country of China.
- Assess how differences in simulated flood extent between models lead to differences in simulated exposed GDP and expected annual exposed GDP.
- Include industry models, the pluvial flood component, and the role of flood protection on the flood hazard and exposure.

Some of the Key Findings

Figure 1 A-C: Inundated area comparison

- Large spread in predicted inundated area between GFMs.
- The GFMs with the closest resemblance in model structure are the CaMa-UT and ECMWF models (see Table). The results of both models differ up to a factor 2, showing that model resemblance alone does not result in similar results.
- The higher amounts of inundation percentage due to the addition of pluvial floods (2 % points Fathom and 0.9 % points JBA for RP100) highlight the importance of including pluvial floods in flood hazard assessments at a large scale.
- County level defences reduce variation in inundated area percentages at lower RPs. Effect of city level defences negligible.

Figure 1 D-F: Exposed GDP comparison

- The high exposed GDP percentages of the ECMWF model are caused by the inundation of densely populated deltas in eastern China. This illustrates that inundated area alone does not give an adequate representation of the difference between models in terms of their use for assessing the impacts of floods.
- The city level defences reduce the spread of exposed GDP estimates drastically by a flood protection layer that covers only 1.74 % of China.

More in the publication

For more insights and information, please read the publication at:
https://doi.org/10.5194/nhess-2020-1

This includes:

- In-depth analyses of comparison results.
- Model agreement calculated at a gridcell level.
- Expected annual exposed GDP estimates.

Model Components and Characteristics

Model Name	Model Type	Flood Type	Input Dataset	Hydrological Model	River Routing Model	River Routing Type	Minimum Domain	Modeled Resolution	Output Resolution
CaMa-UT	Cascade Model	Fluvial	JRA-25	MATSIRO-GW	CaMa-FLOOD	Complex 2D sub-grid	500 km2	3 arc sec	18 arc sec
CIMA-UNEP	Gauged Flow Model	Fluvial	EC-Earth / GRDC	Continuum Model	Simplefied Hydraulic Flood Model	Simple 1D	1000 km2	3 arc sec	30 arc sec
ECMWF	Cascade Model	Fluvial	ERA-Interim	HTESSEL	CaMa-FLOOD	Complex 2D sub-grid	500 km2	3 arc sec	18 arc sec
FATHOM	Gauged Flow Model	Fluvial + Pluvial	GRDC + USGS	N/A	LISFLOOD-FP	2D Hydrodynamic	50 km2	3 / 30 arc sec	3 arc sec
JRC	Cascade Model	Fluvial	ERA-Interim	HTESSEL	LISFLOOD-Global	2D Hydrodynamic	5000 km2	30 arc sec	30 arc sec
GLOFRIS	Cascade Model	Fluvial	EU-WATCH	PCR-GLOBWB	DynRout	2D Volume	Strahler order >= 6	30 arc sec	30 arc sec
JBA	Gauged Flow Model	Fluvial + Pluvial	CRU TS3.2 + CFSRv2 + Local Data	N/A	Rflow/ Jflow	1D + 2D Simple/ 2D Hydrodynamic	No Minimum	1 arc sec	1 arc sec
KatRisk	Gauged Flow Model	Fluvial + Pluvial	CPC + ERA-Interim	TOPMODEL modified	Unit Hydrographs	2D Hydrodynamic	> 4cm Flood Depth	3 arc sec	3 arc sec

Inundated Area and Exposed GDP

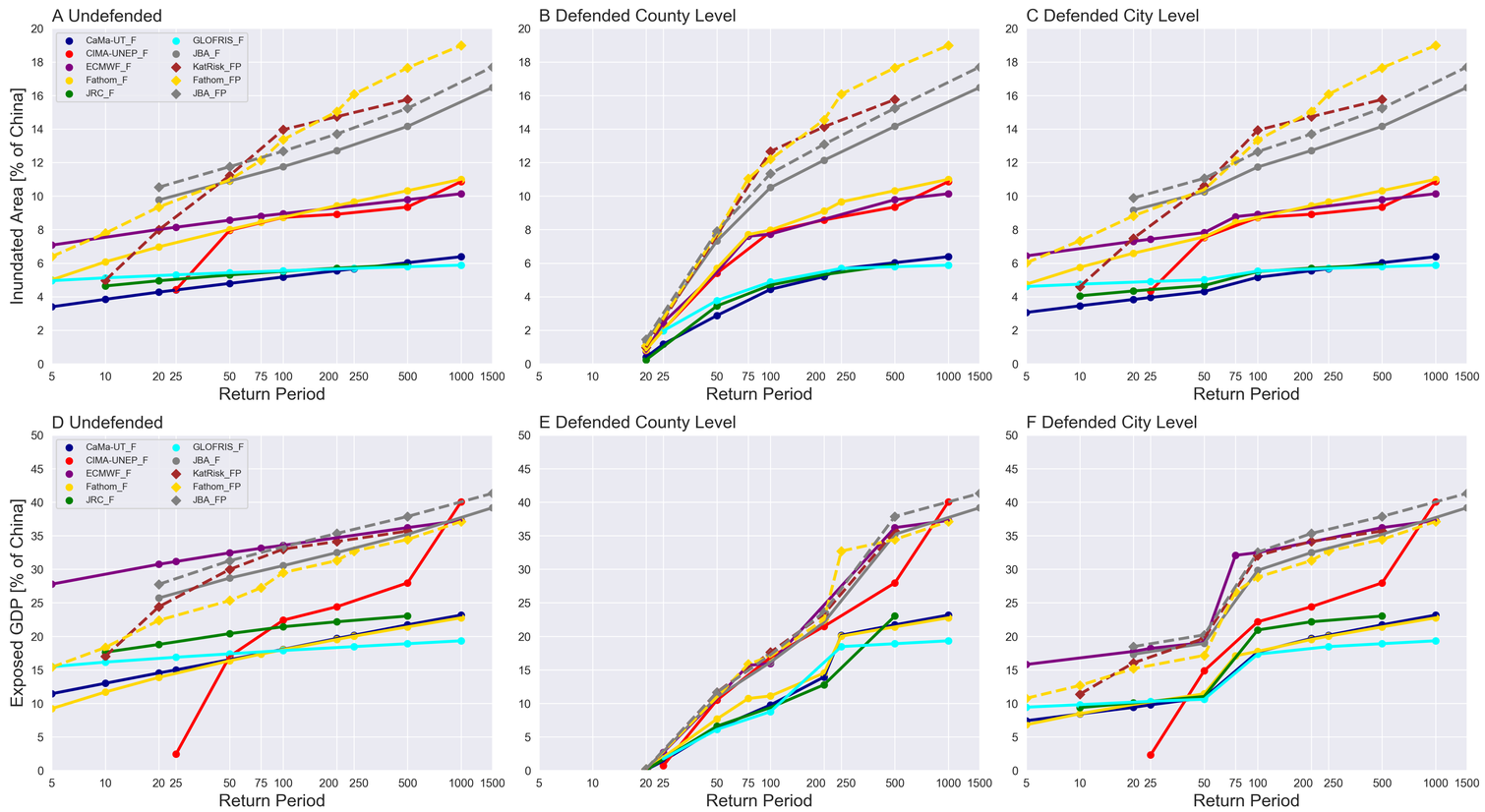

Figure 1: Results of multiple return period fluvial and combined hazard maps of 8 GFMs. The results of the fluvial hazard maps (_F) are represented by a continuous line and those of the combined hazard maps (_FP) by an interrupted line. The RPs range from 5 to 1500 and are displayed on a logarithmic horizontal axis.

Undefended, flood hazard maps without incorporated flood defences.
County level defended, includes a policy based flood defence layer at a county administrative level.
City level defended, refers to a national layer defence layer with a focus on urban areas on a city-scale that delineates defences only in areas of highest exposure.