Impacts of climate change on river flows and flooding at 1.5°C, 2°C and 4°C global warming

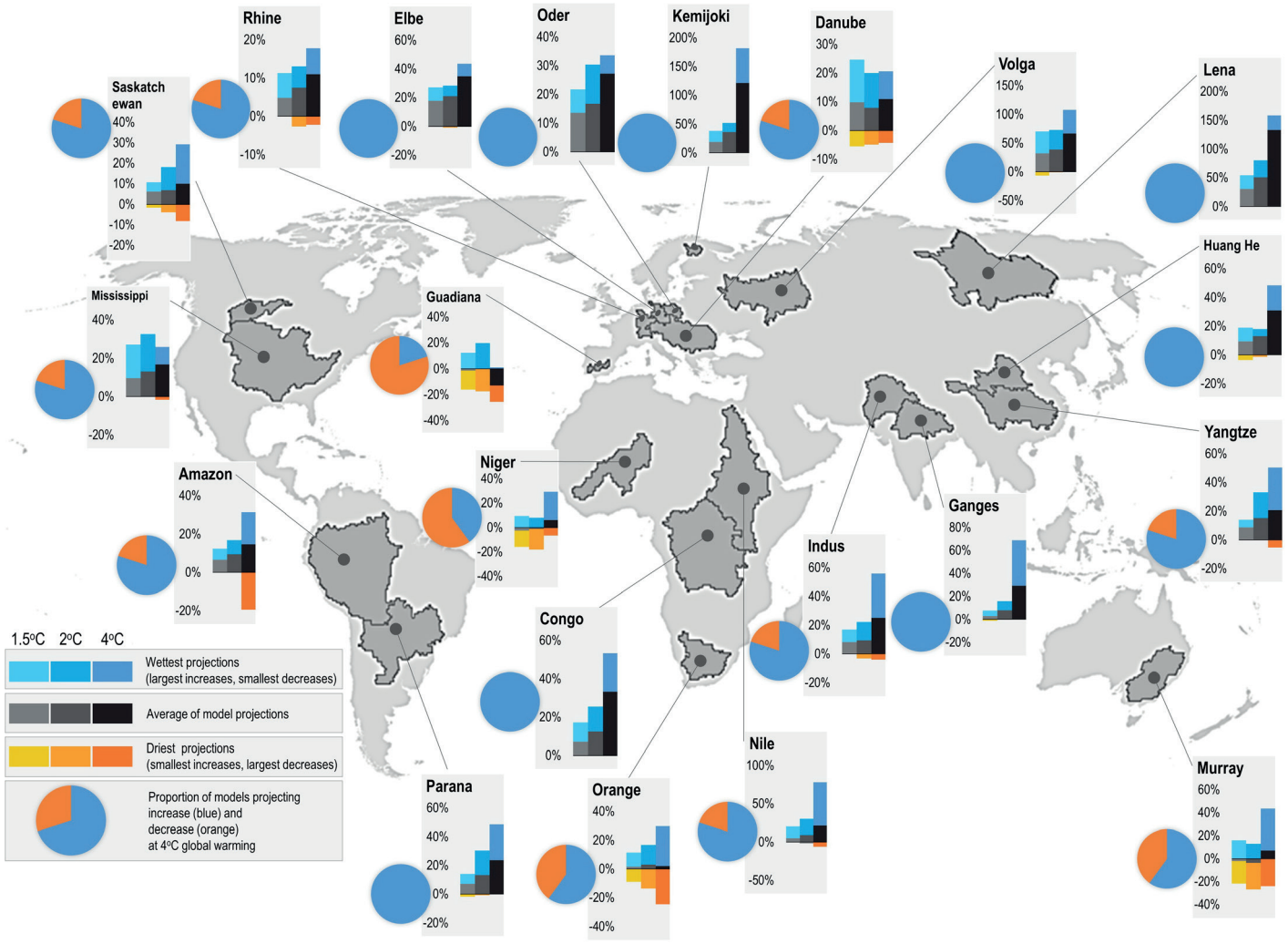

Figure 1 - Ranges of river flows changes projected at 1.5°C, 2°C and 4°C global warming

Climate change projections

We simulated the global climate for the present day and at 1.5°C, 2°C and 4°C global warming using a new version of the EC-Earth model of the global atmosphere at a higher level of detail (40km resolution) than models previously used in reports by the Intergovernmental Panel on Climate Change. We then used these to calculate changes in river flows (this page) and the impacts of river flooding (next page).

Since a range of regional climate changes are possible at any level of global warming, we made calculations with 6 different climate model simulations and checked how well they agreed. The 6 simulations used different patterns of changes in sea surface temperatures, which are an important influence on regional climate in many areas.

Simulating changes in river flows

We calculated the streamflows in major river basins[1] using the JULES land surface model which takes meteorological factors such as precipitation, temperature and humidity as inputs.

Figure 1 show the ranges of river flow changes (%) projected for each level of global warming, and the extent of agreement between the simulations on whether flows increased (blue) or decreased (orange).

Simulating impacts of river flooding

We estimated the number of people affected by river flooding using the model LISFLOOD[2]. Figure 2 shows the percentage change number of people affected by flooding in each country, averaged over all simulations, for 2°C, 1.5°C and 4°C global warming relative to present day. The tables show global totals averaged over all simulations (bold) and the minimum and maximum.

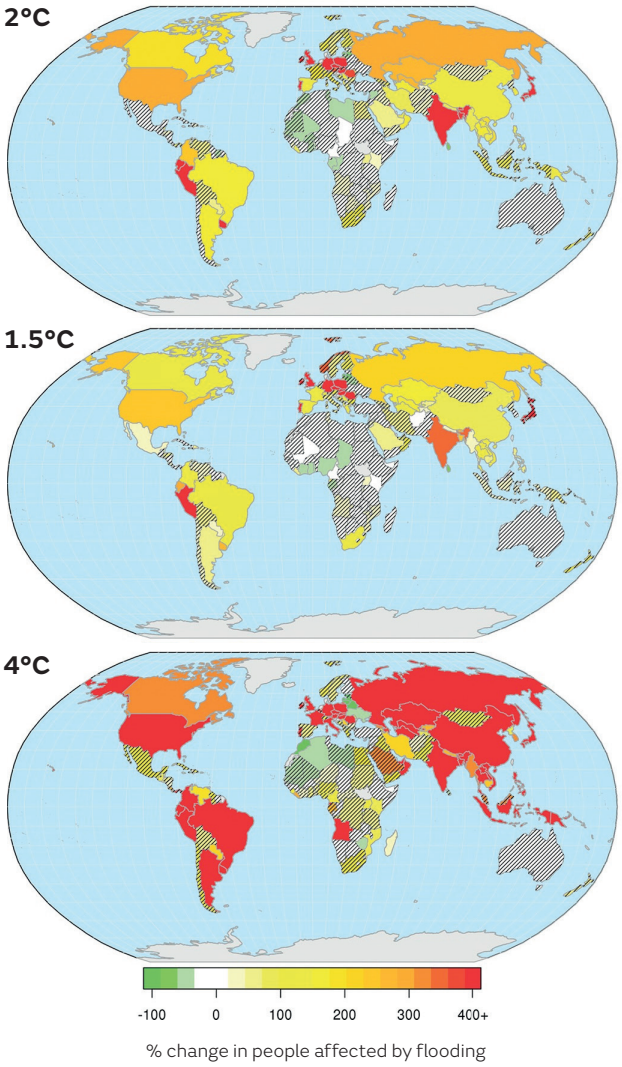

Figure 2 - % change in number of people flooded per country at different global warming levels

Number of people affected by flooding at present day	**54 million** (42 to 66 million)

Flooding impact at 2°C

Number of people affected	Change from present day	% change from present day
97 million (42 to 148 million)	**+43 million** (4 to 82 million)	**+80%** (10% to 125%)

Reduced impact at 1.5°C

Number of people affected	Change from present day	% change from present day
78 million (39 to 122 million)	**+24 million** (-3 to +56 million)	**+44%** (-7% to 85%)

Even greater impact at 4°C

Number of people affected	Change from present day	% change from present day
211 million (111 to 335 million)	**+157 million** (69 to 269 million)	**+291%** (164% to 408%)

Conclusions

- Projected changes in river flows are highly uncertain and for many major basins the possibilities include both increased and decreased flows. Either way, changes are larger for higher levels of global warming.
- Increased river flows are more common in our set of simulations.
- At 2°C global warming, without adaptation, between 10% and 125% more people are affected by river flooding worldwide.
- Limiting global warming to 1.5°C approximately halves the increase in flooding impact.
- Global warming of 4°C more than triples the increase in flooding impact compared to 2°C.

1. Koutroulis, A.G. et al (2018) Water, 10, 1331; doi.org/10.3390/w10101331
2. Alfieri, L., et al (2017) Earth's Future doi: 10.1002/2016EF000485