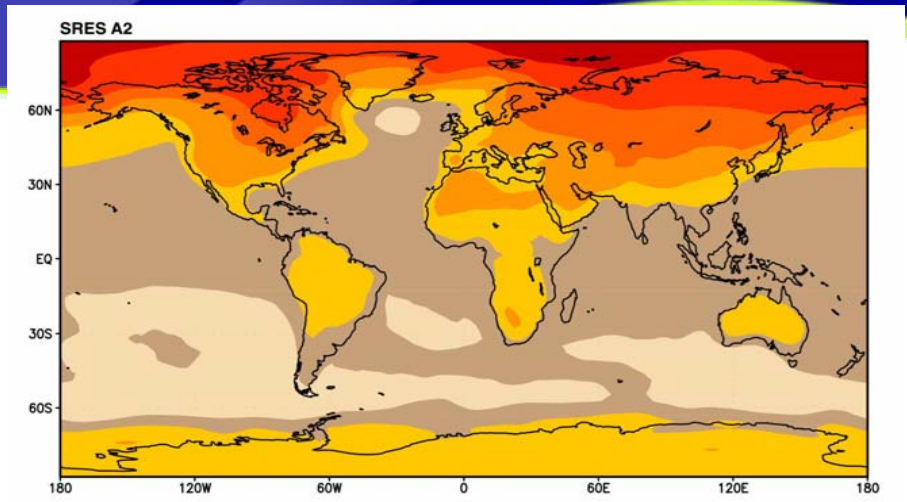
JULES as a framework for impacts modelling

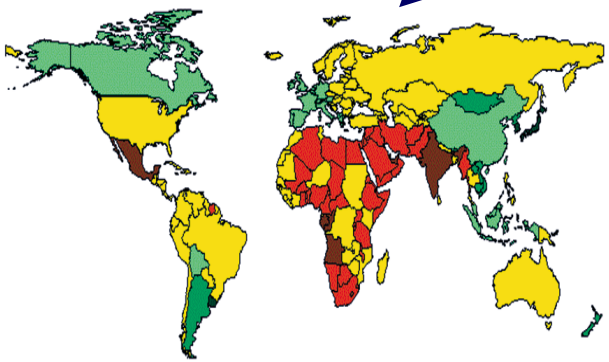
Richard Betts

JULES workshop, 2nd October 2006

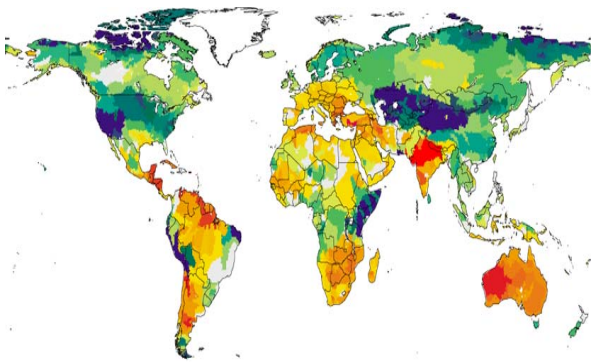
Standard approach to climate impacts modelling



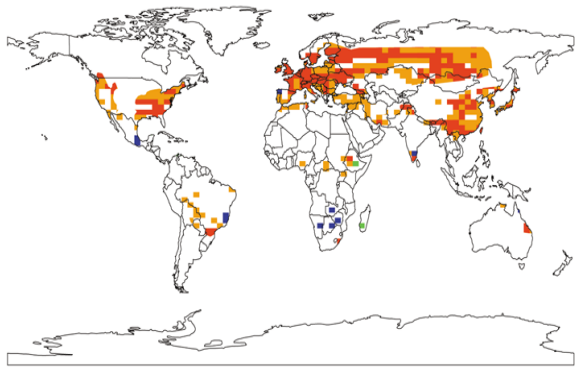
Climate model output



Food supply



Water availability

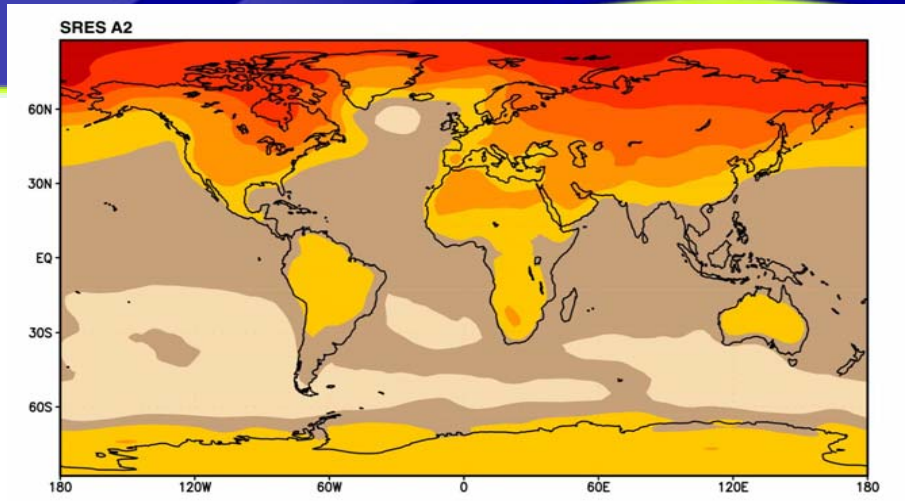


Health risks

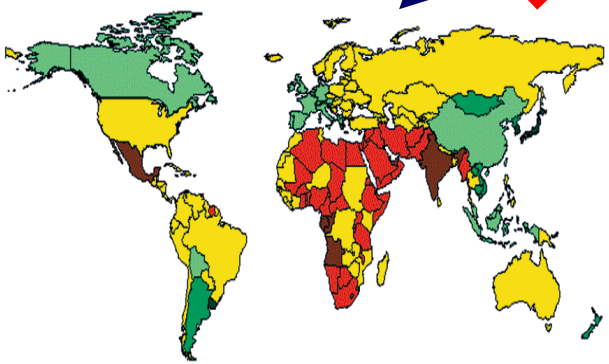
Should we take a more integrated approach?

Should impacts models be incorporated in climate models?

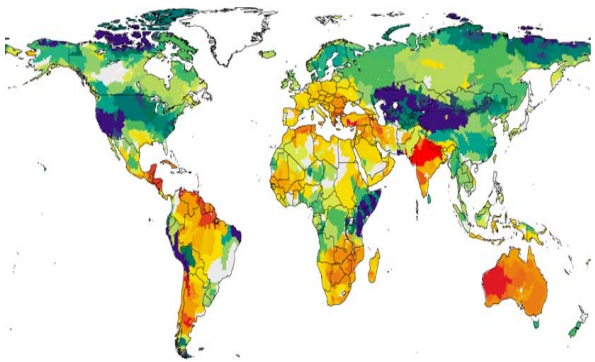
Impacts models in GCMs? (1) Feedbacks



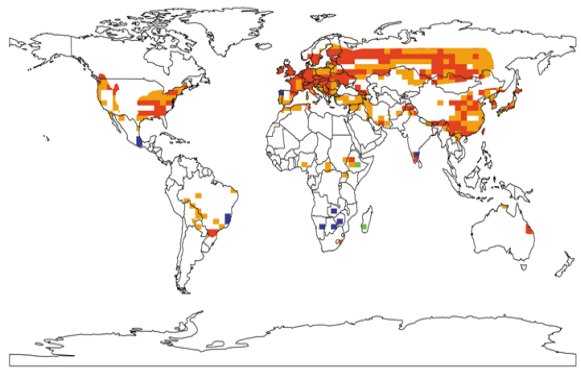
Climate model output



Food supply

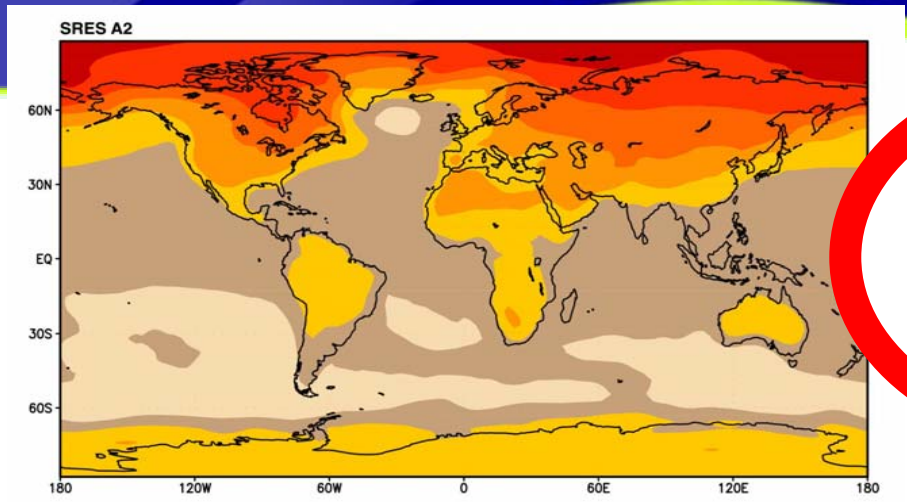


Water availability



Health risks

Impacts models in GCMs? (2) Consistency



Surface water budget

Climate model output

Surface water budget

Food supply

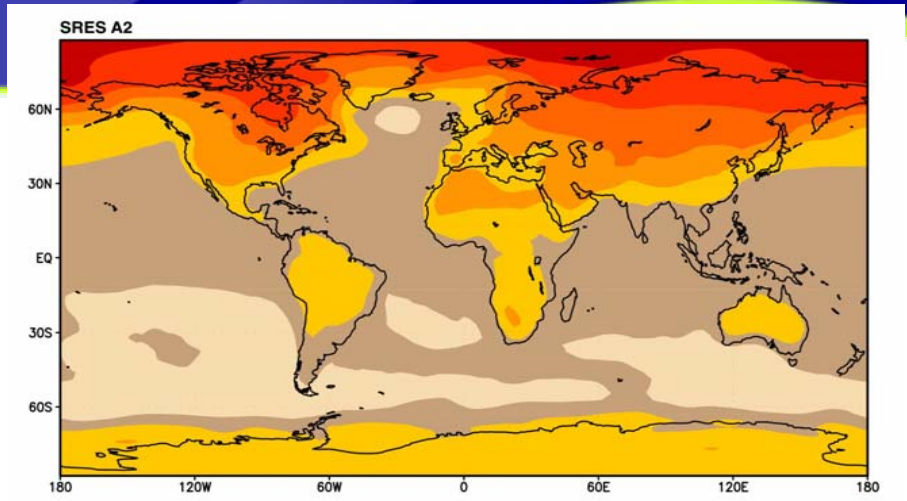
Surface water budget

Water availability

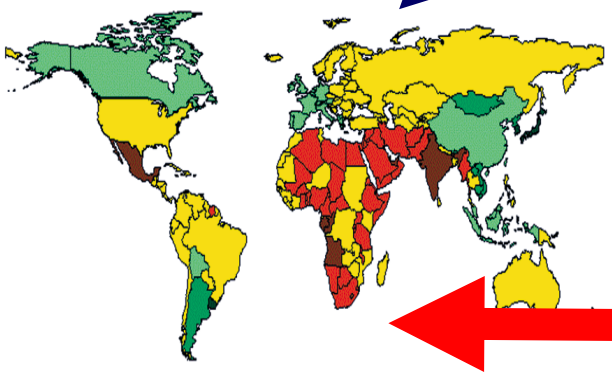
Surface water budget

Health risks

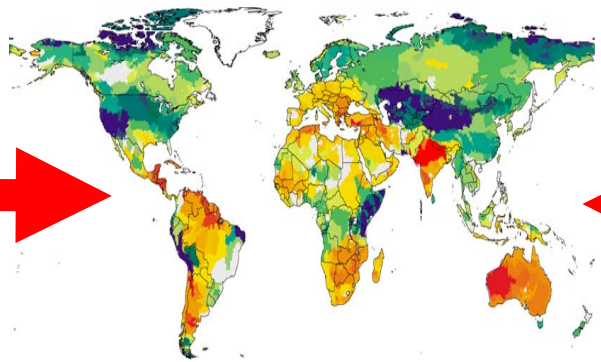
Impacts models in GCMs? (3) Synergistic impacts



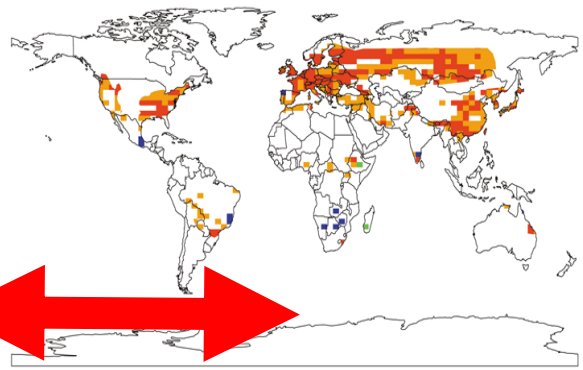
Climate model output



Food supply

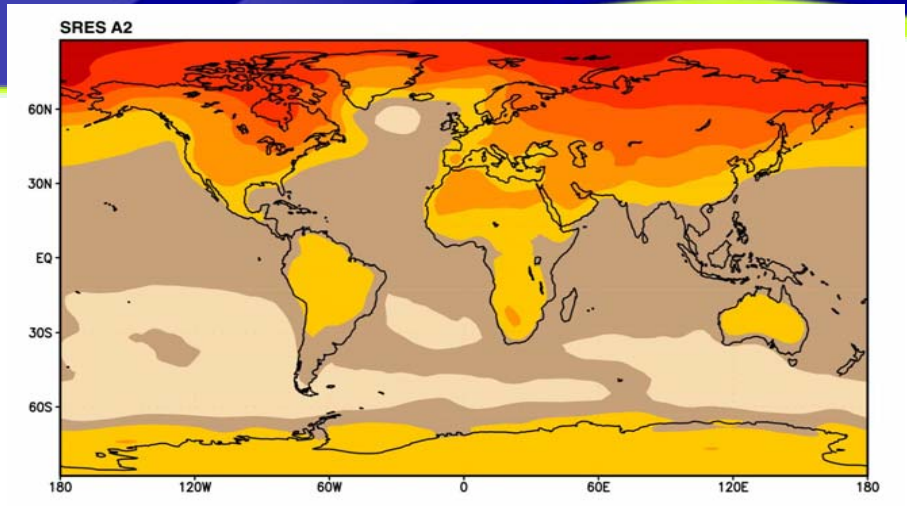


Water availability



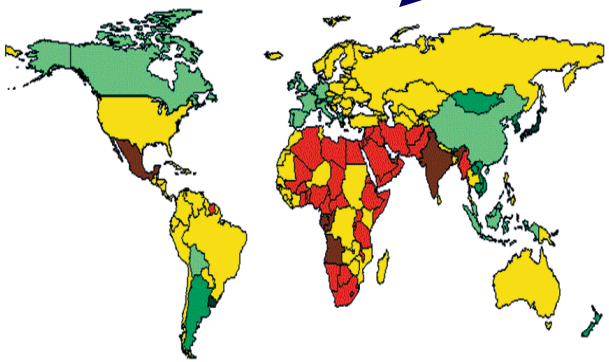
Health risks

Impacts models *not* in GCMs? (1) no feedbacks

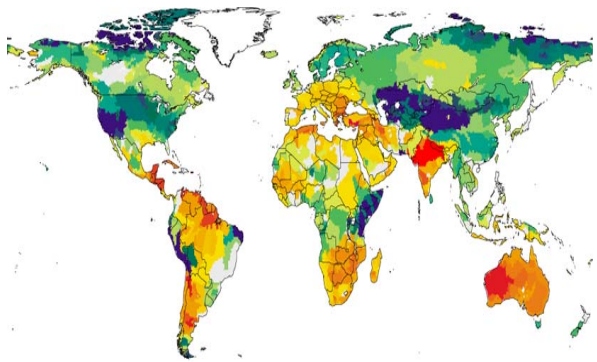


Climate model output

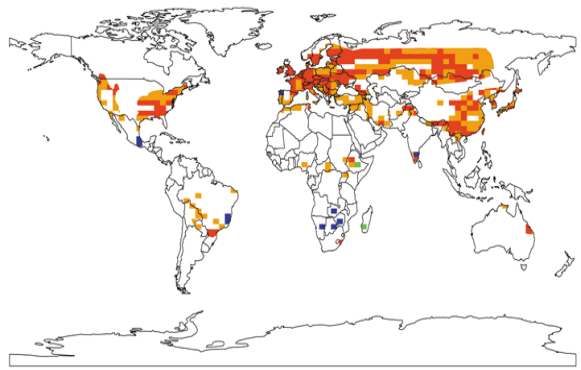
?



Food supply

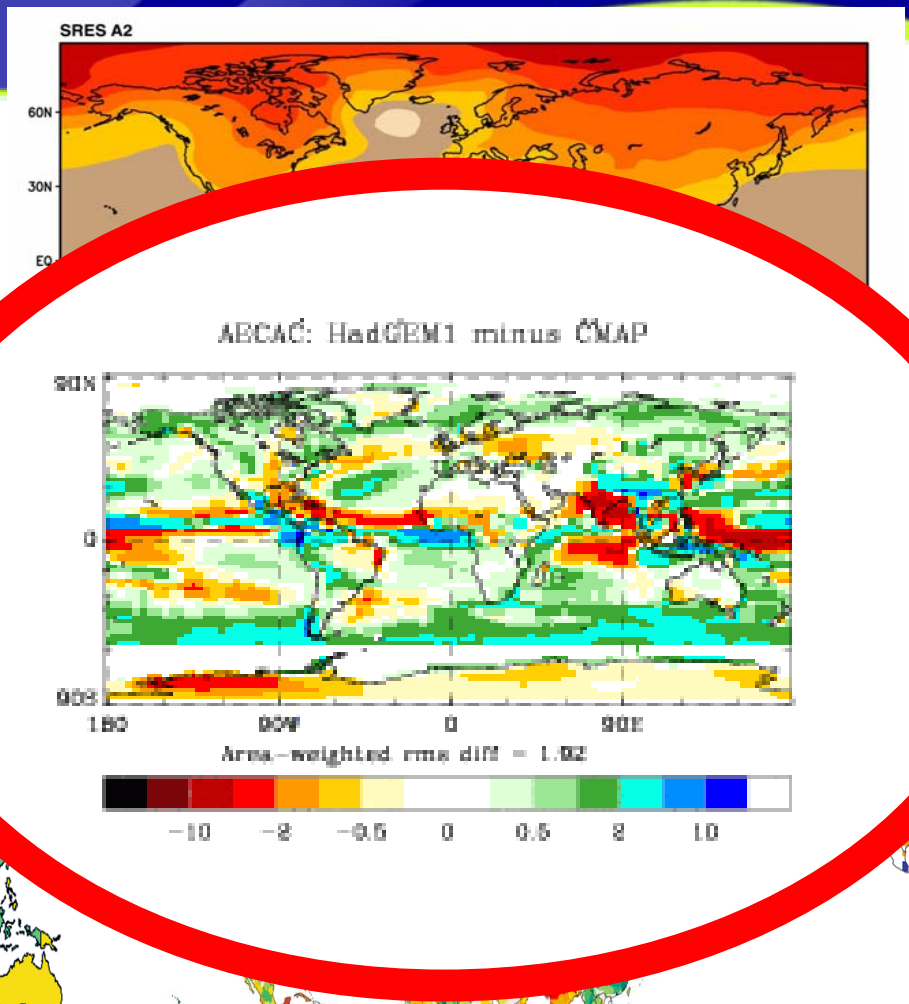


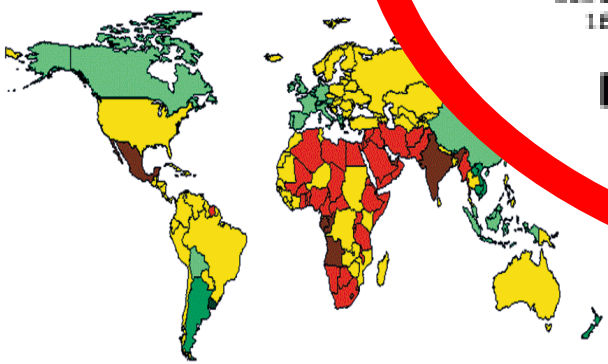
Water availability



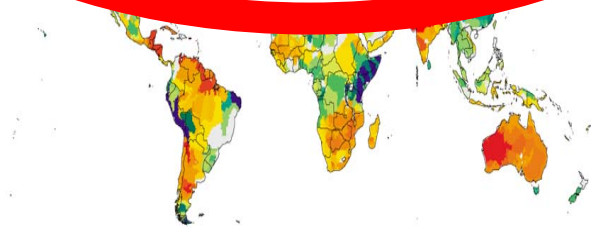
Health risks

Impacts models *not* in GCMs? (2) model biases

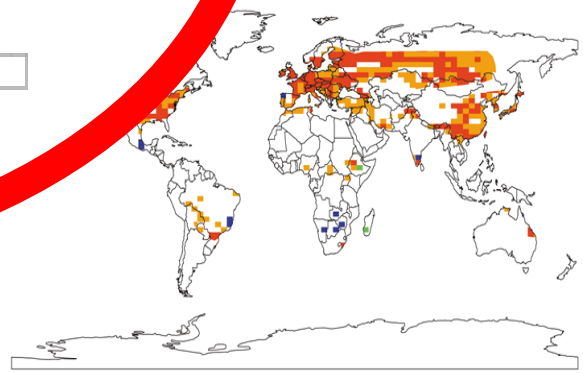




Food supply

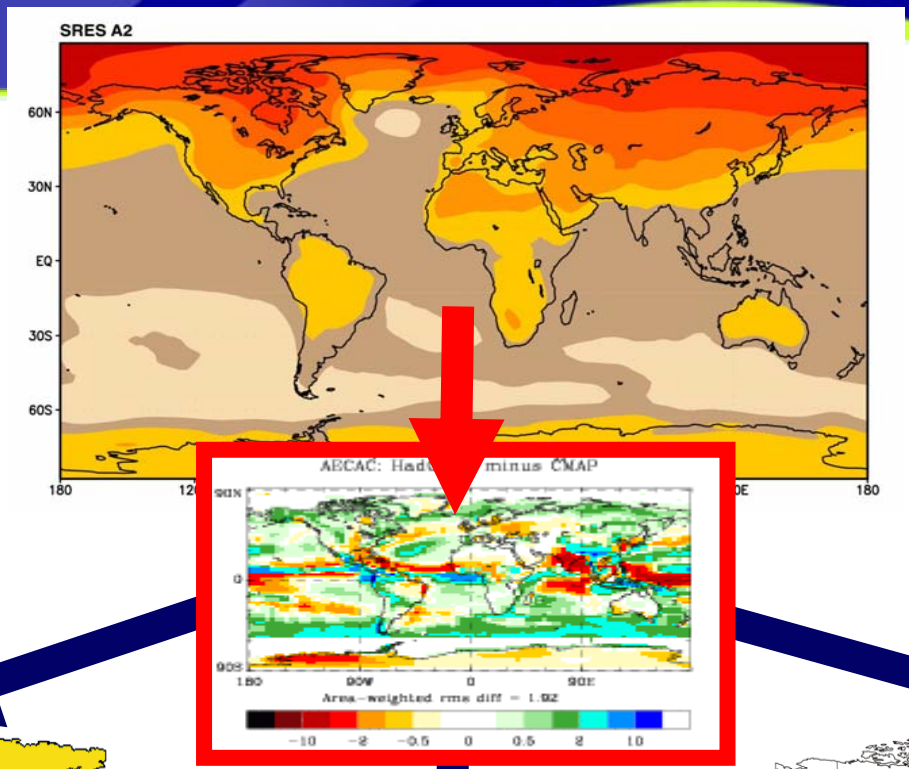


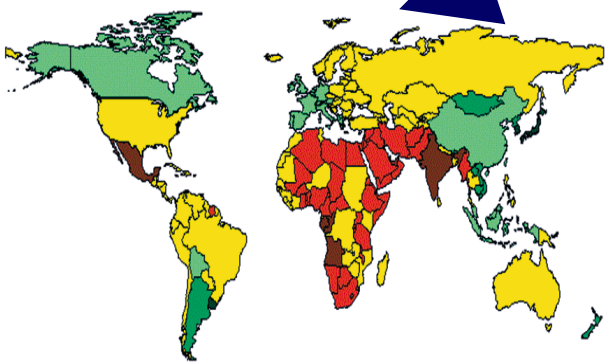
Water availability



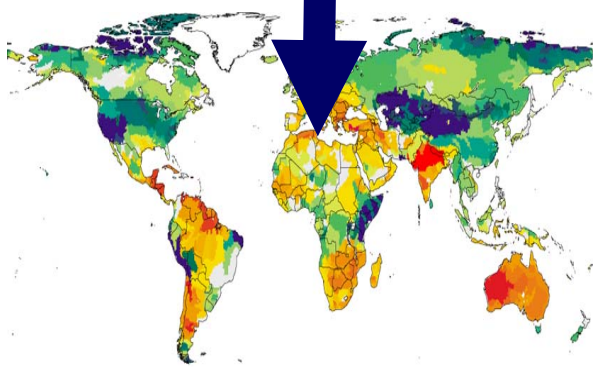
Health risks

Impacts models *not* in GCMs? (2) model biases

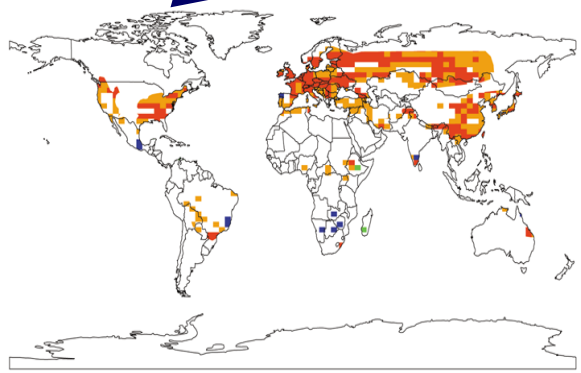




Food supply

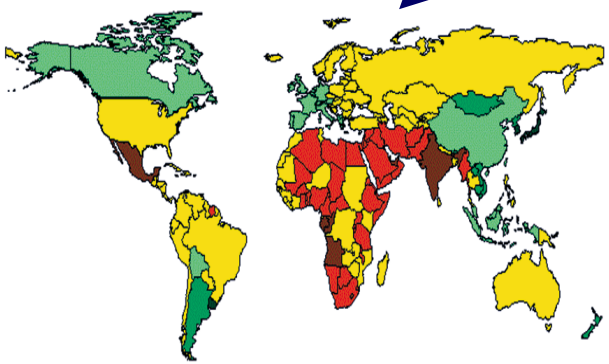


Water availability

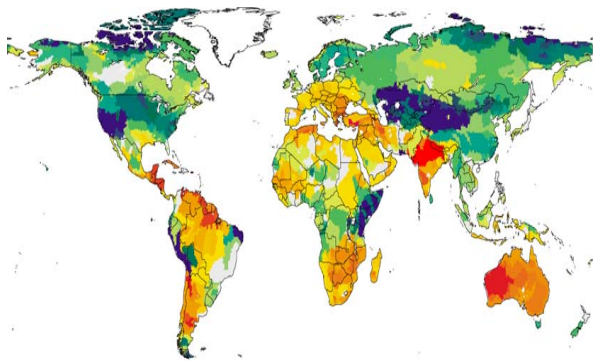


Health risks

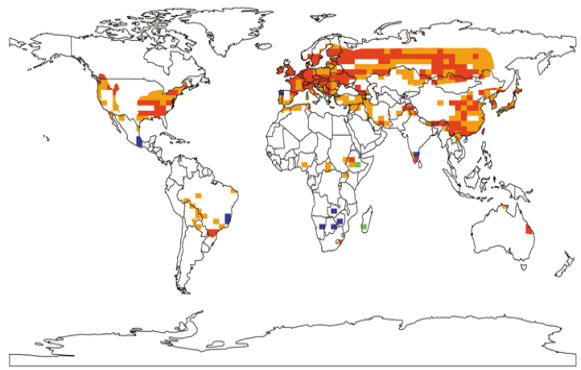
Impacts models *not* in GCMs? (3) slow GCMs!



Food supply



Water availability

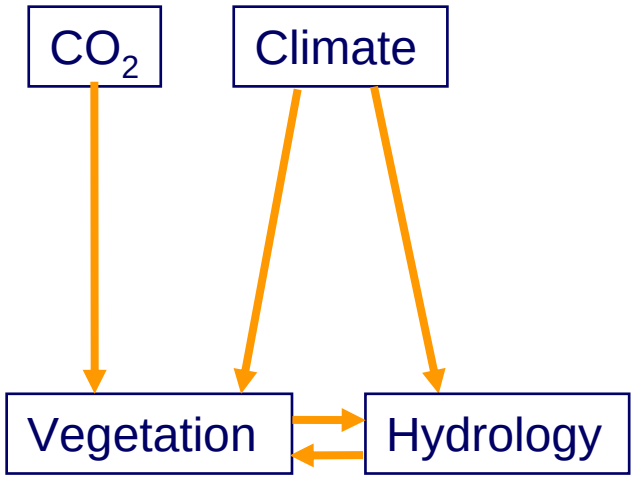


Health risks

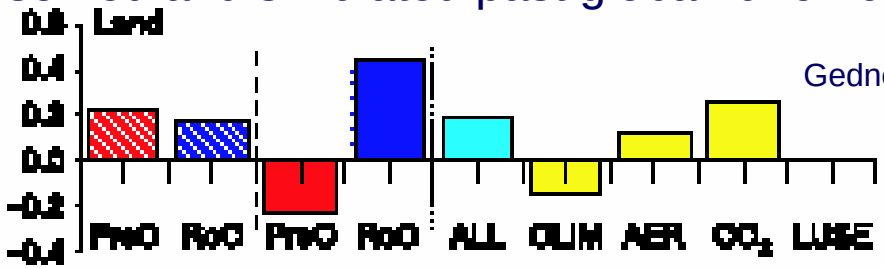
A useful compromise: “integrated offline impacts”

- Land surface model outside of GCM
- Consistency of processes
- Allows interaction between impacts sectors
- Can use “climatology + anomaly” method
- Not constrained by run speed or development overheads of GCM

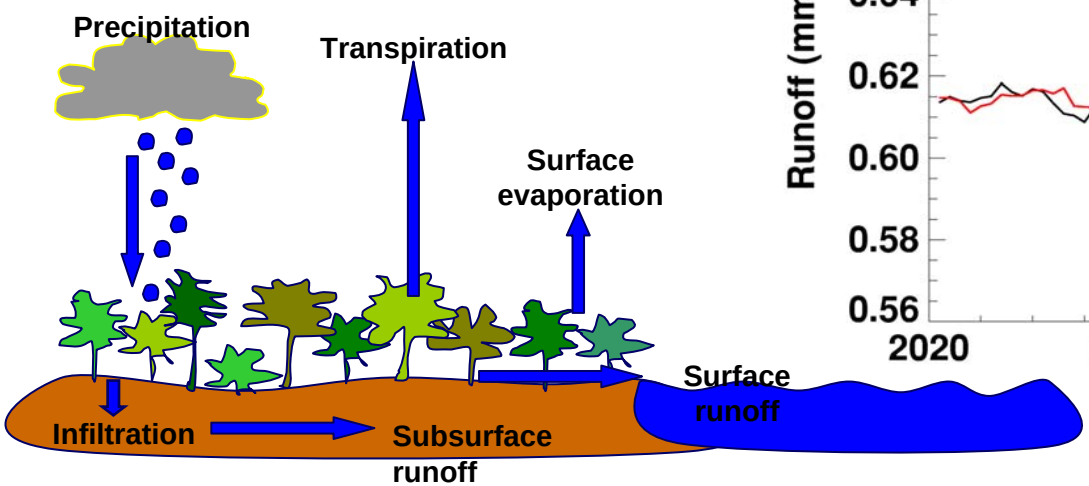
Interactions between ecosystems and hydrology



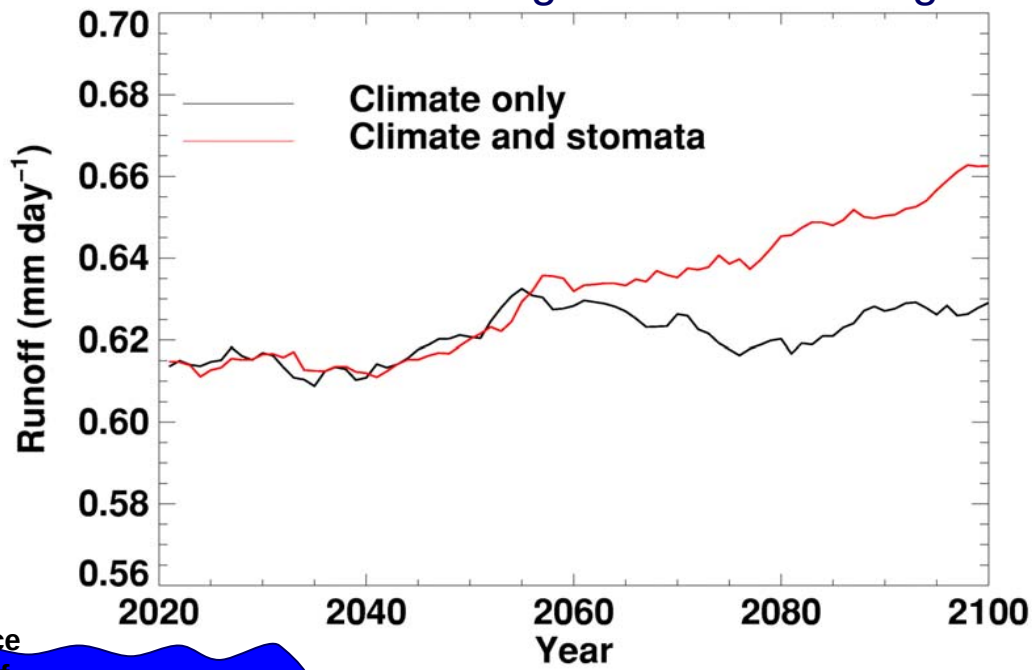
Observed and simulated past global runoff changes



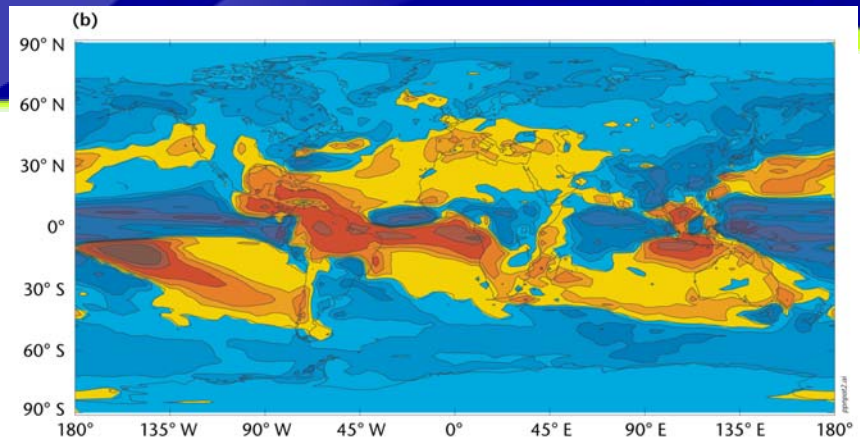
Gedney et al 2006



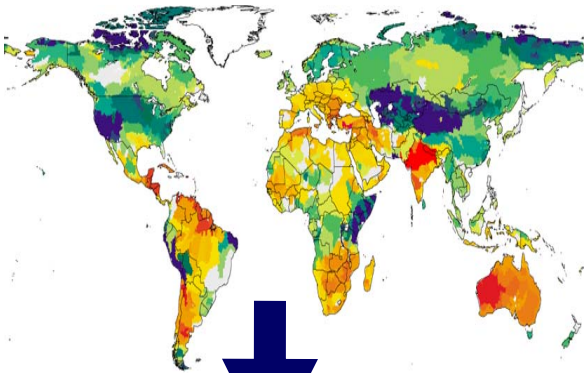
Simulated future global runoff changes



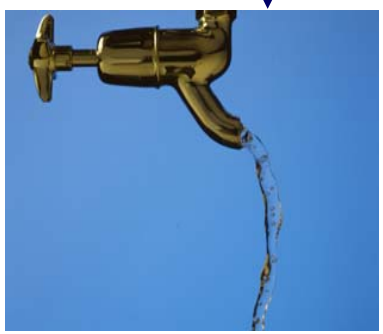
Interactions between water resources and crops

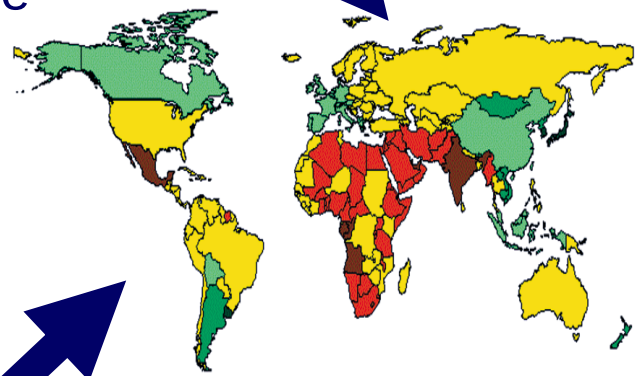


Precipitation change



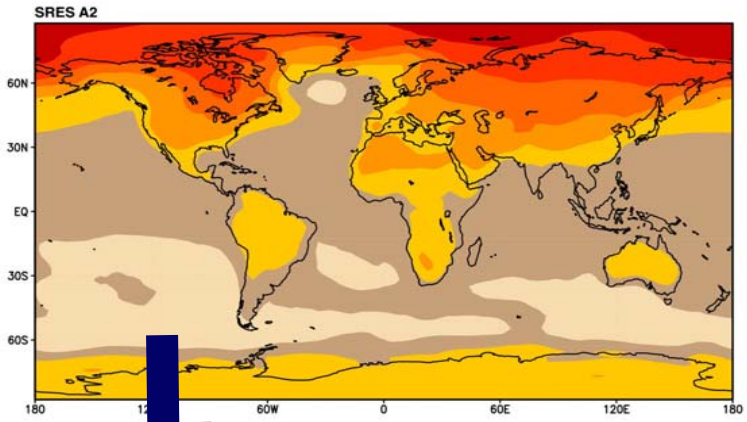
Water availability



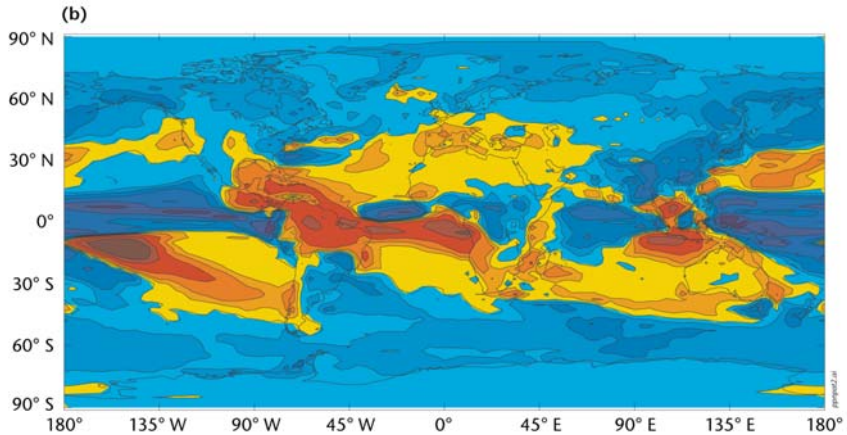


Food supply

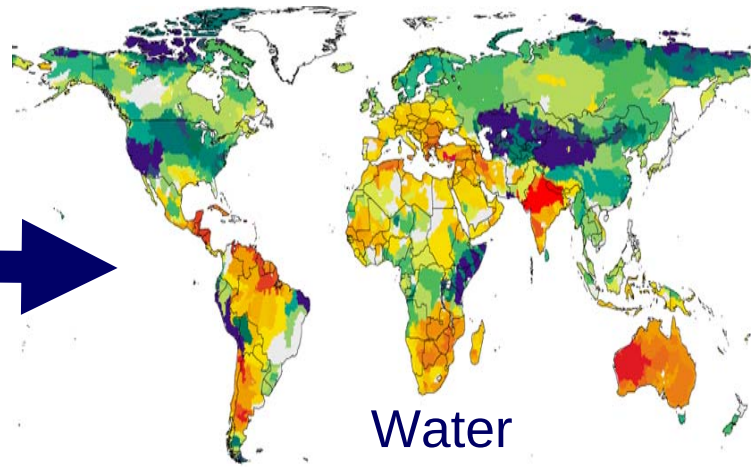
Interactions between ice melt and hydrology



Warming

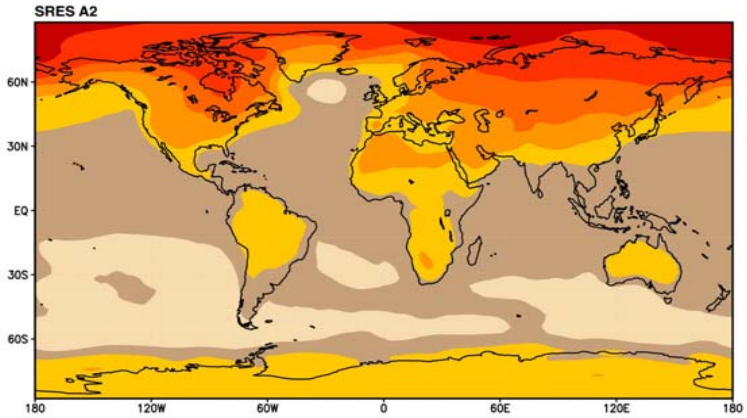


Precipitation change

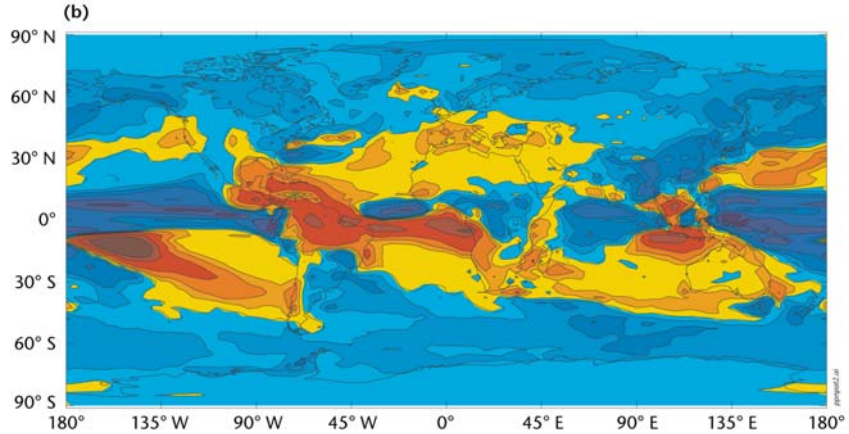


Water availability

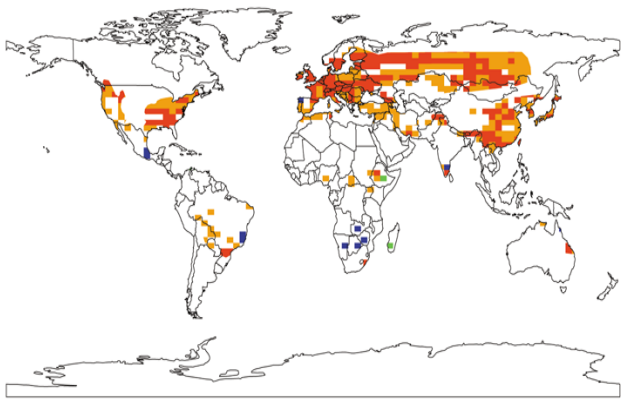
Interactions hydrology and vector-borne diseases



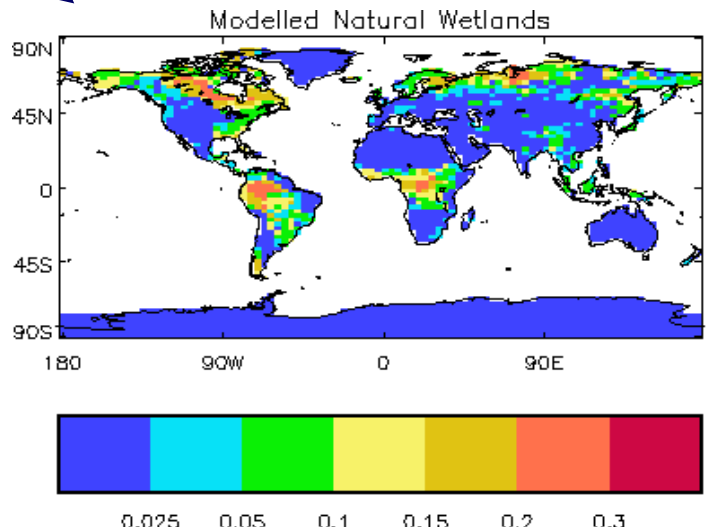
Warming



Precipitation change



Malaria transmission



Summary

- Many impacts of climate change cannot be considered in isolation
- Incorporation of impacts within Earth System Models would be the most complete solution
- BUT … there are a number of practical problems to overcome
- JULES offers an opportunity to model terrestrial impacts within a common framework
  - Consistency between models
  - Interactions between impacts sectors
  - Still allow “climatology+anomaly” methods to reduce GCM biases
  - No constraint on speed of model development or experiments