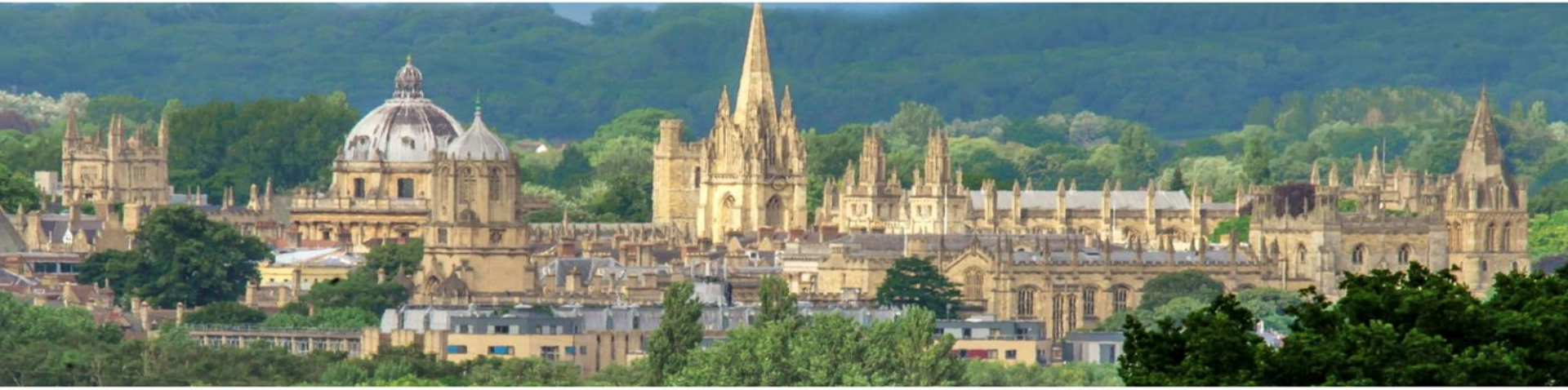
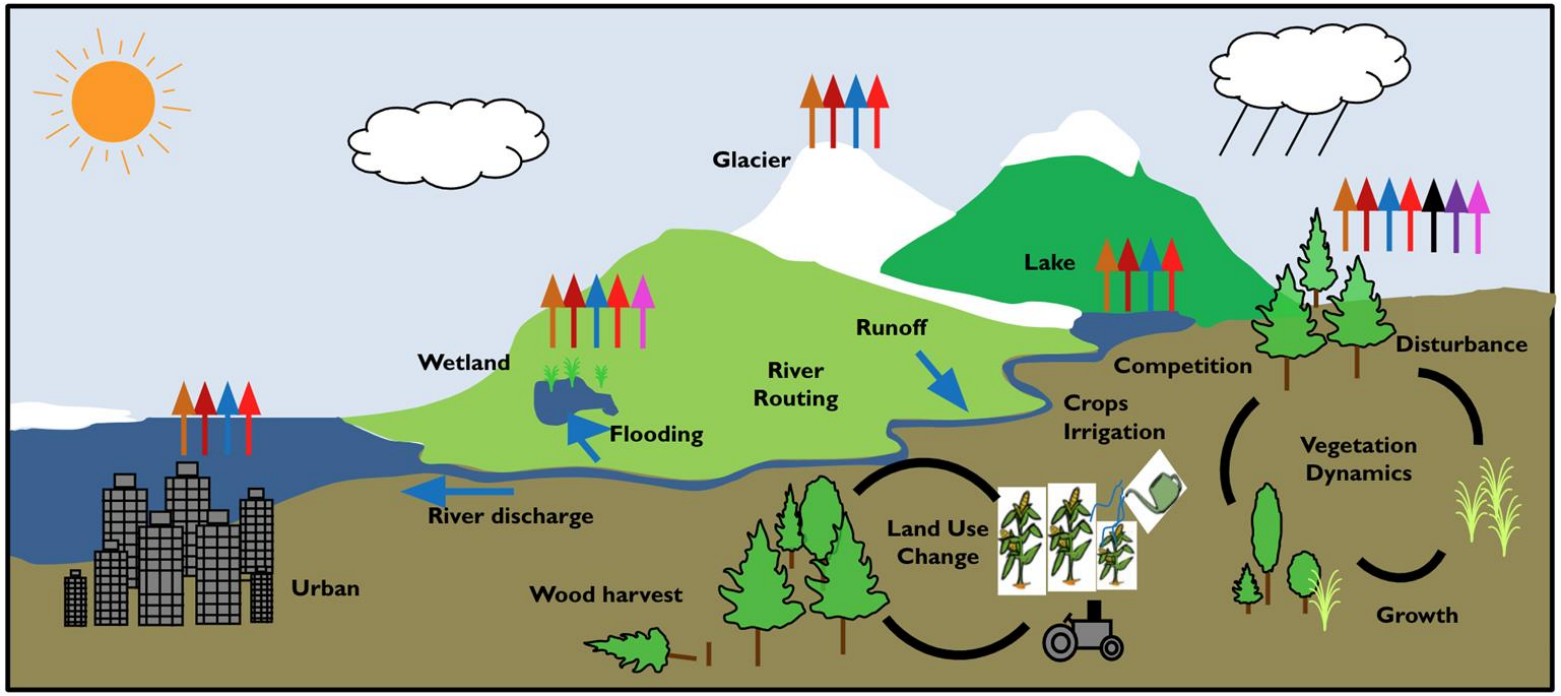
LSMS 2022
LAND SURFACE MODELLING SUMMIT

Input and Forcing Datasets

David Lawrence and Anne Verhoef



Forcing (T, P, wind, S, L, q, p): e.g., reanalysis or coupled model



Input data (% Lake, % Urban, PFT dist, soil texture, topography, LUC, etc)

Input data requirements to run land models are considerable

Using CLM as an example:

- > 40 ‘raw’ datasets are used to generate > 70 ‘surface dataset’ fields (not all fields used in all simulations)
- Raw datasets are things like %lakes, %glacier, soil texture, urban building properties, canopy height, topographic elevation, population density, irrigation equipped area, isoprene emission factor, etc, etc
- Raw datasets are available at various resolutions and time intervals (static or transient) and can include derived quantities like isoprene emissions factors
- Generation and maintenance of raw and surface datasets across different resolutions, model generations, and ever-changing ‘raw’ data is a significant technical burden and can limit model ease-of-use
- Calculation of fields for surface dataset requires decisions (e.g., soil texture - averaging or dominant?; soil depth - weighted average uplands and lowlands or ???) and tools (e.g., urban properties tool)

Land Use Harmonization Dataset (LUHv2)

Hurtt et al., GMD, 2020

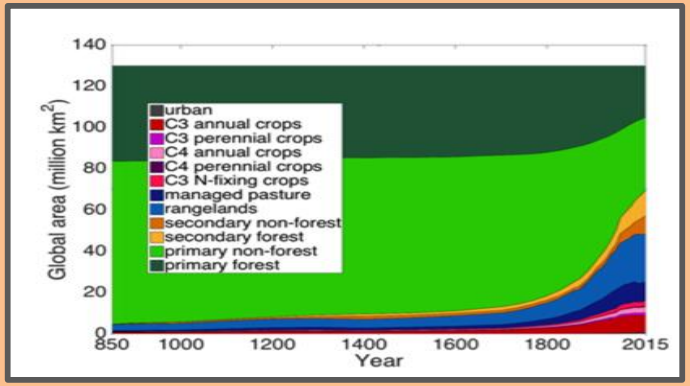
0.25° resolution
850 to 2100

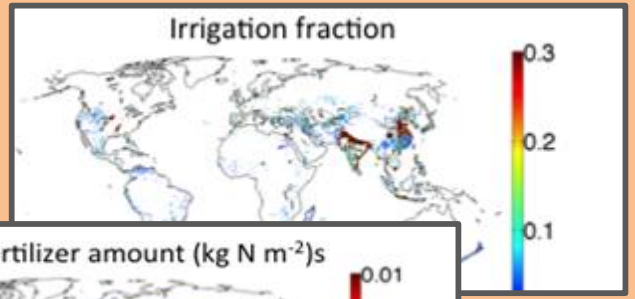
New History

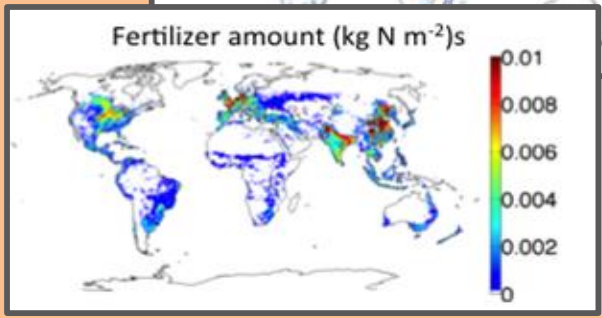
Hyde 4-based
Landsat F/NF constraint
Multiple crop types (5)
Multiple pasture types (2)
Updated forest cover/
biomass
Updated wood harvest
Updated shifting cultivation

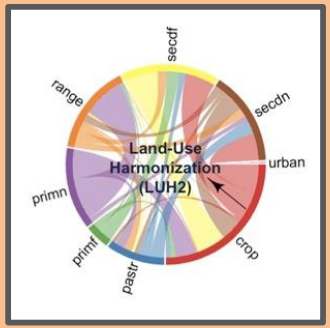
New Management Layers

<u>Agriculture</u>
% cropland irrigated
% cropland flooded
% cropland fertilized (industrial)
Industrial Fertilizer
application rates
%cropland for biofuels
Crop rotations
<u>Wodod Harvest</u>
% used for industrial products
% used for commercial biofuels
% used for fuelwood









Supported by DOE-SciDAC

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- **For discussion today: What are the challenges in creating input datasets for different modeling groups and would it be possible to collaborate to limit the reinventing of wheels?**

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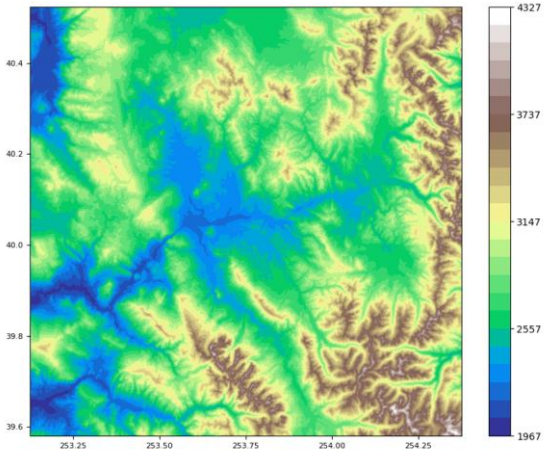
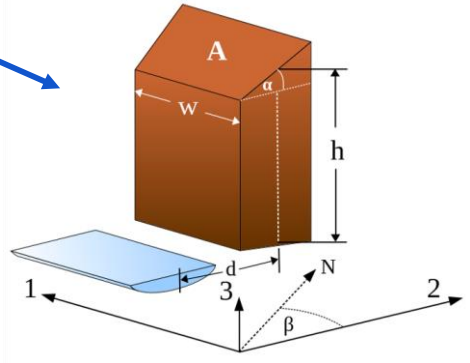
LUH3

- What new fields will be needed (e.g., forest management practice, irrigation methods)?
- What didn't work well (some disagreements between LUH2 crop distributions and)

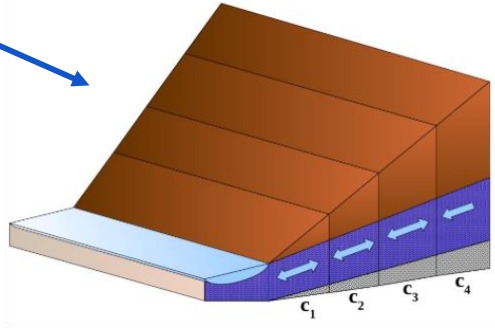
Challenge of enhanced subgrid characterization (Hydroblocks, representative hillslopes, catchment grids, etc)

High res DEM

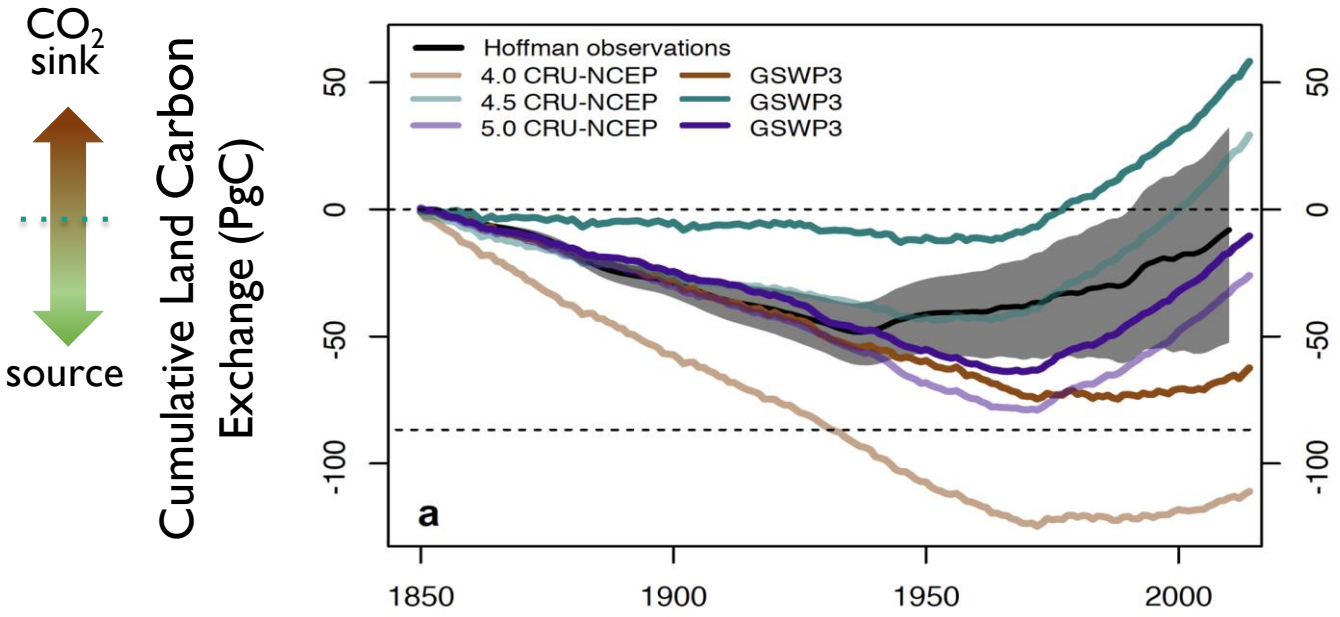




Representative hillslope(s)



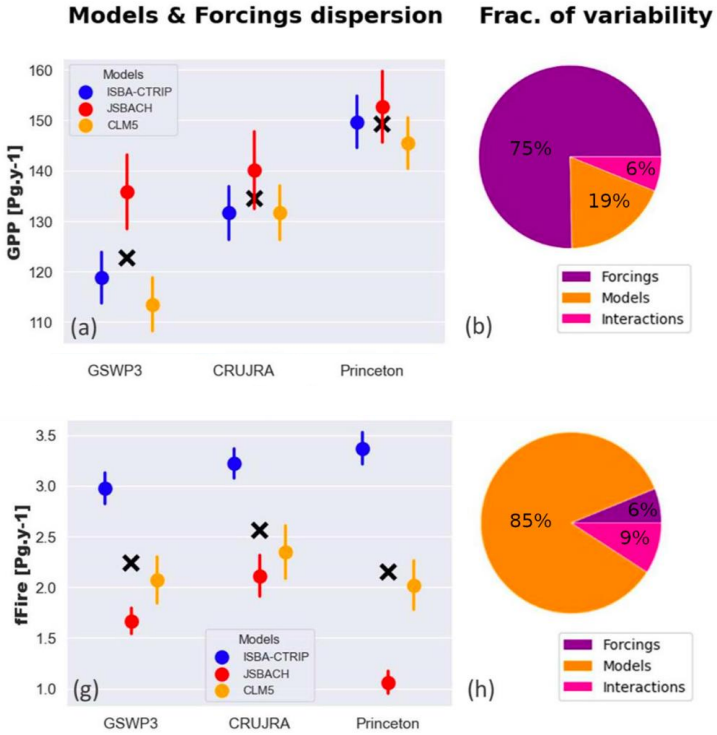
Forcing Uncertainty

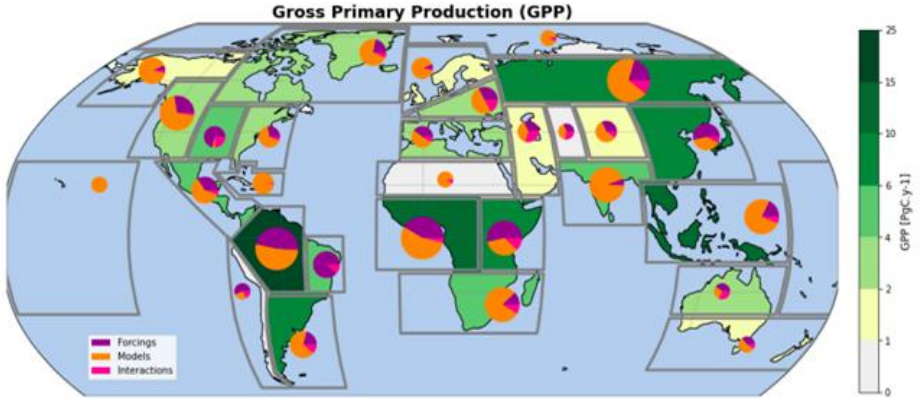


Lawrence et al., 2019; Bonan et al., 2019

Forcing Uncertainty

To explore forcing uncertainty, LMIP within LS3MIP requested land-only simulations with alternative historical reanalysis-based forcing datasets (GSWP3, CRUJRA, Princeton, Watch-WFDEI)





Hardouin, Delire, et al., ERL, 2022

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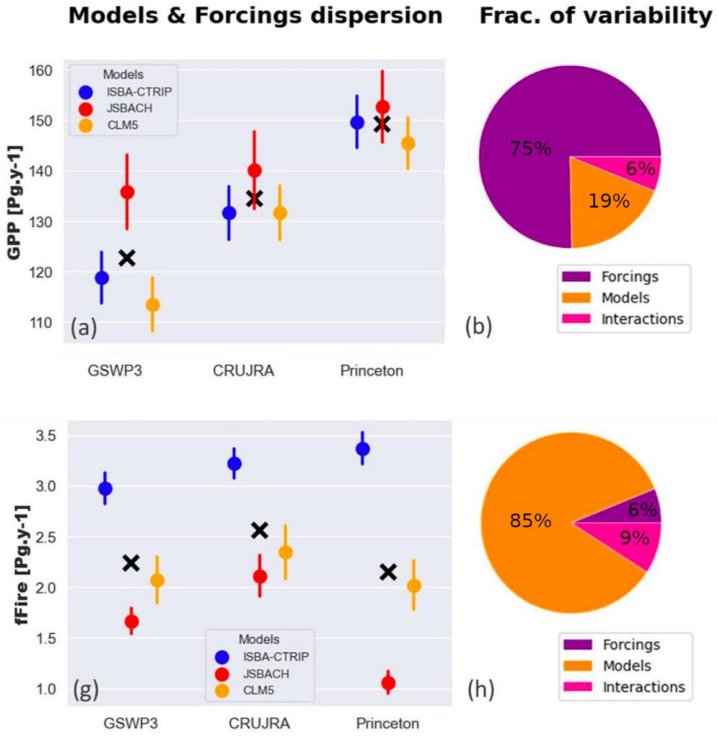

- For full time period historical products, only CRUJRA being regularly updated (?) for Global Carbon Project
- Having only one product means we are effectively ignoring forcing uncertainty in much of our work
- Ensemble forcing datasets are available for present day (see Martyn's work)
- Path forward?

Hardouin, Delire, et al., ERL, 2022