What's New for CLM5

Hydrology: dry surface layer, variable soil depth with deeper (8.5m) max depth, revised GW and canopy interception, adaptive time stepping, increased soil layer resolution

Snow: canopy snow updates, wind effects, firn model (12 layers), glacier MEC, fresh snow dens.

Rivers: MOSART(hillslope → tributary → main channel)

Nitrogen: flexible leaf C:N ratio, leaf N optimization, C cost for N (FUN)

Carbon: revisions to carbon allocation and soil carbon decomposition

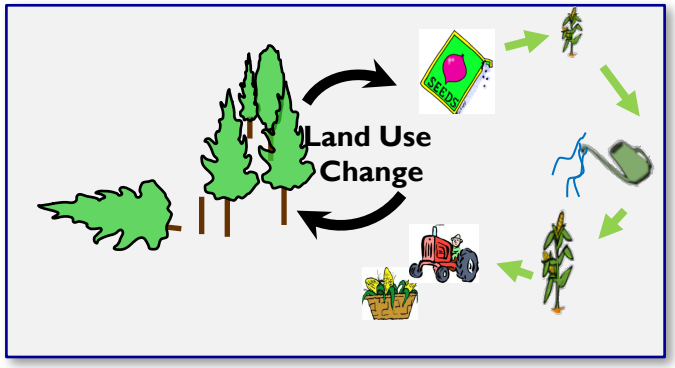
Fire: updates, trace gas and aerosol emissions

Vegetation: plant hydraulics and hydraulic redistribution, deep rooted tropical trees, Ecosystem Demography (FATES), prognostic roots, ozone damage

Crops: global crop model with transient irrigation and fertilization (9 crop types), grain product pool, revised irrigation scheme

Land cover/use: dynamic landunits, revised PFT-distribution, wood harvest by mass, shifting cultivation

Isotopes: carbon and water isotope enabled



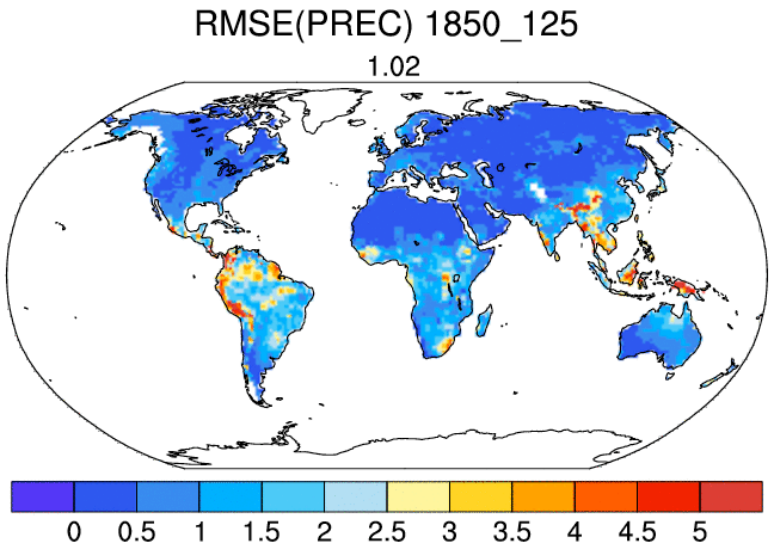
CLM5 default configuration

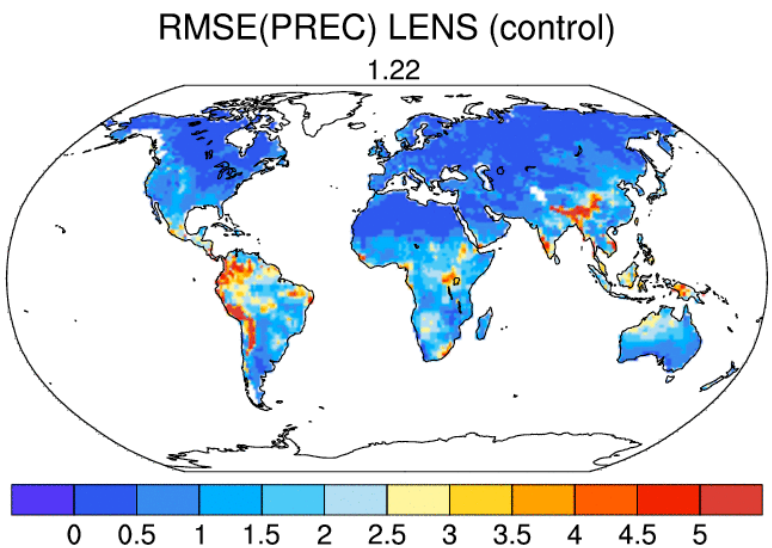
CLM5 optional feature

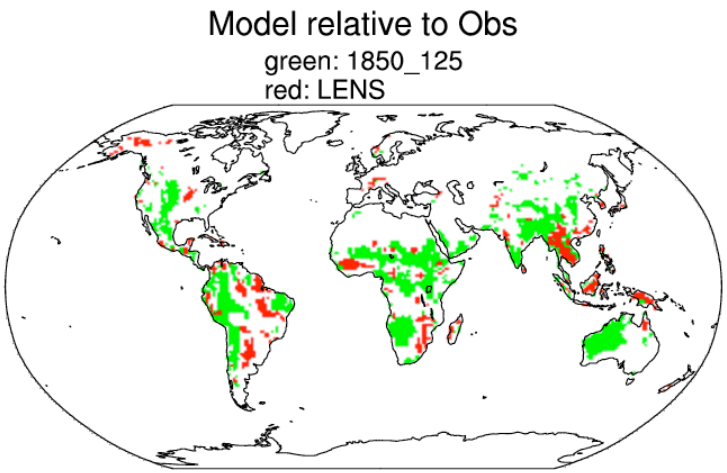
Key new or improved capabilities for CLM since CESM1 (CLM4 → CLM5)

- Permafrost-carbon feedback including wetland methane emissions
- Global crop model with 6 crop types incl. land management practices (irrigation and fertilization) and yield estimates
- More mechanistic nitrogen cycle where plants 'pay' for nitrogen; leaf N, photosynthesis, stomatal conductance varies according to N costs
- Realistic mass balance on ice sheets and simple firn model
- Physically-based river model that represents flow from hillslopes → tributaries → main channel
- Improved photosynthesis scheme and plant hydrodynamics
- Dynamic landunits - allows ice sheet to vegetation transition and transient crop distributions
- …

Improved Precipitation Over Land



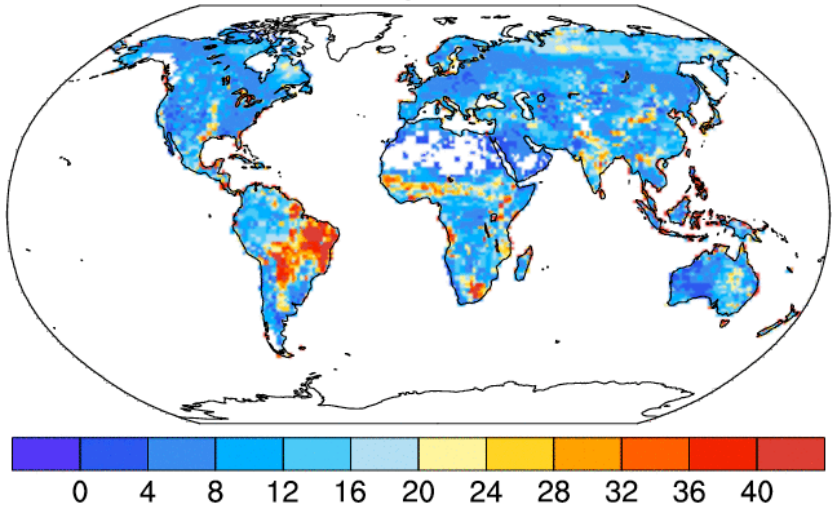




Improved Latent Heat Flux Over Land

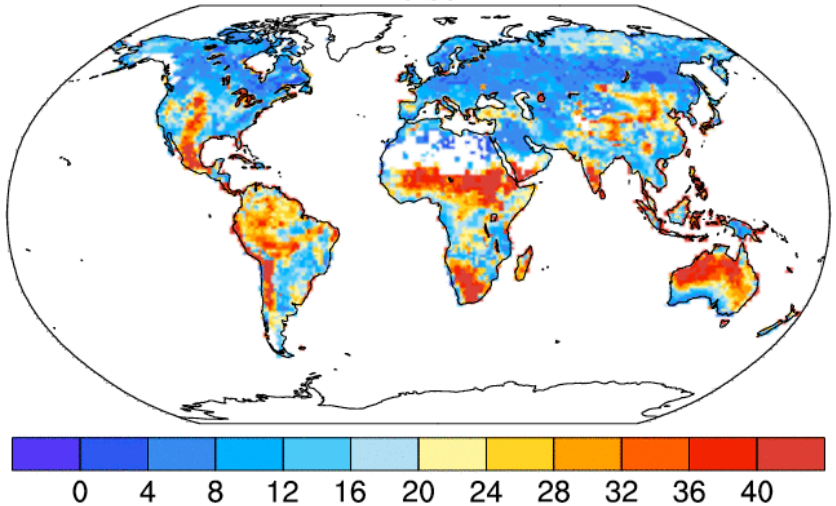
RMSE(LHEAT) 1850_125

13.42



RMSE(LHEAT) LENS (control)

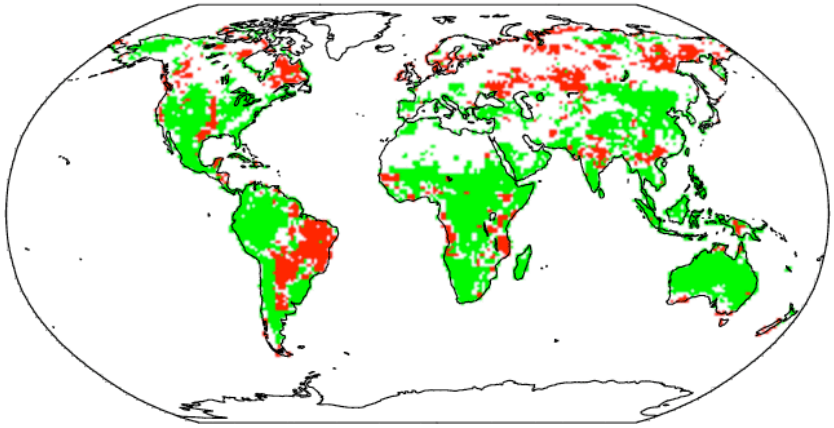
19.66

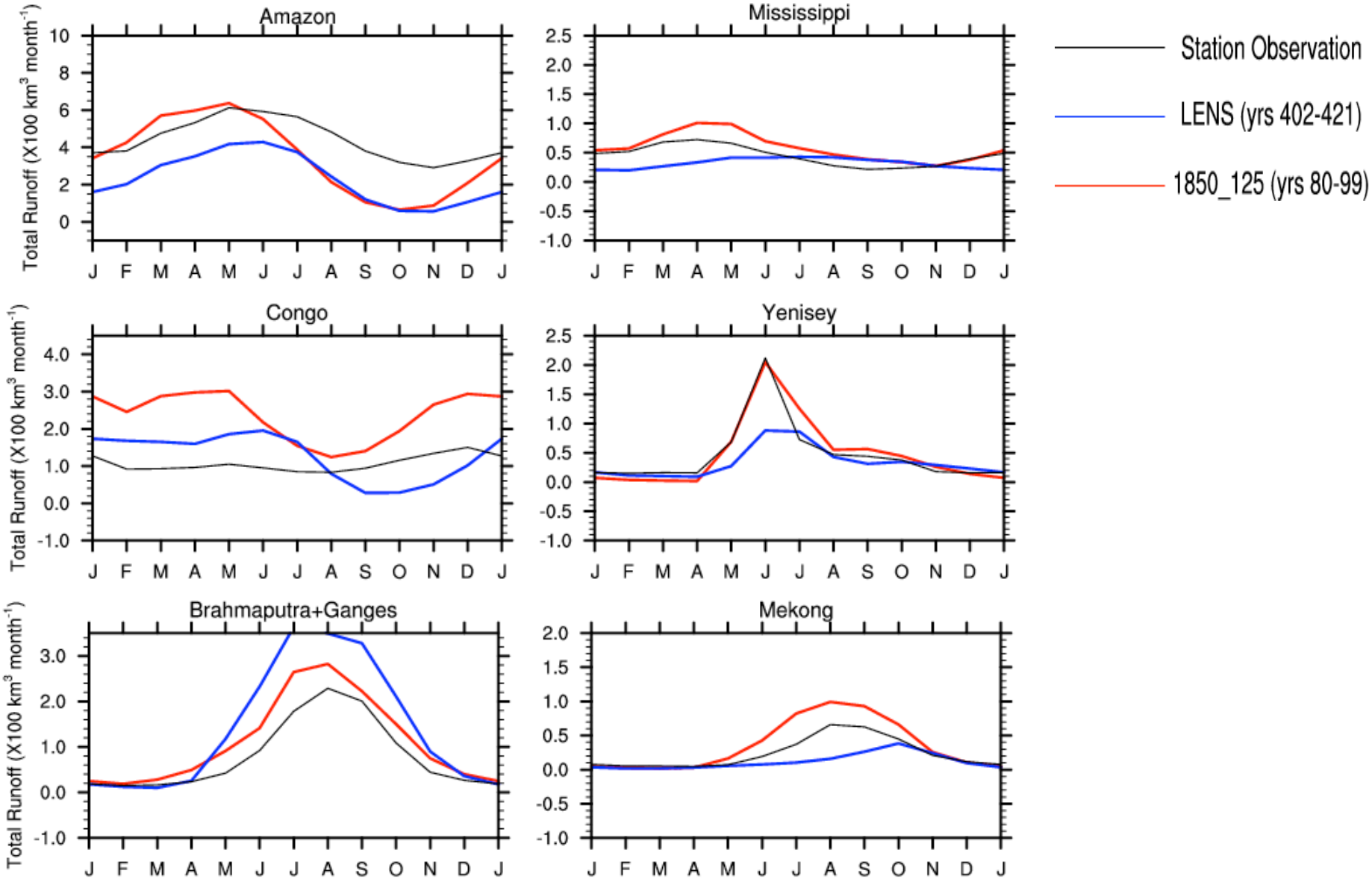


Model relative to Obs

green: 1850_125

red: LENS



Improvements due to combined impact of better precipitation and land evapotranspiration

Improved river discharge for some major rivers