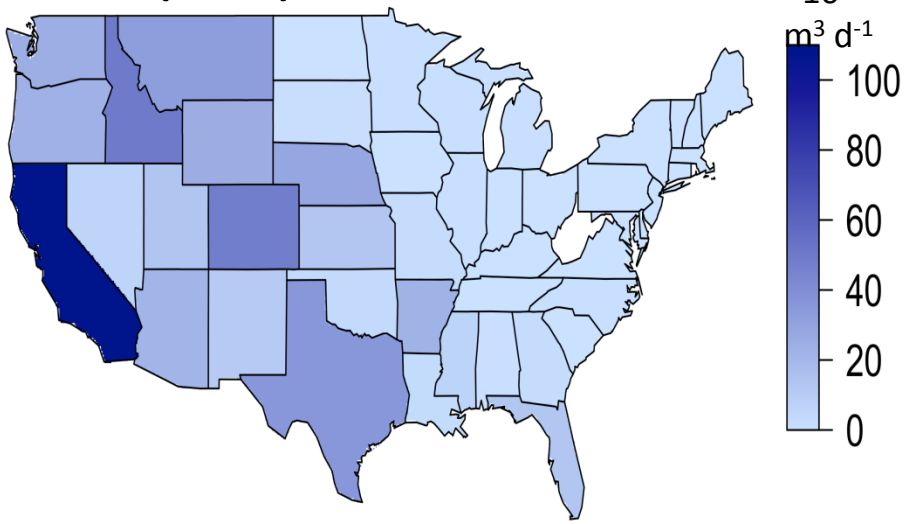
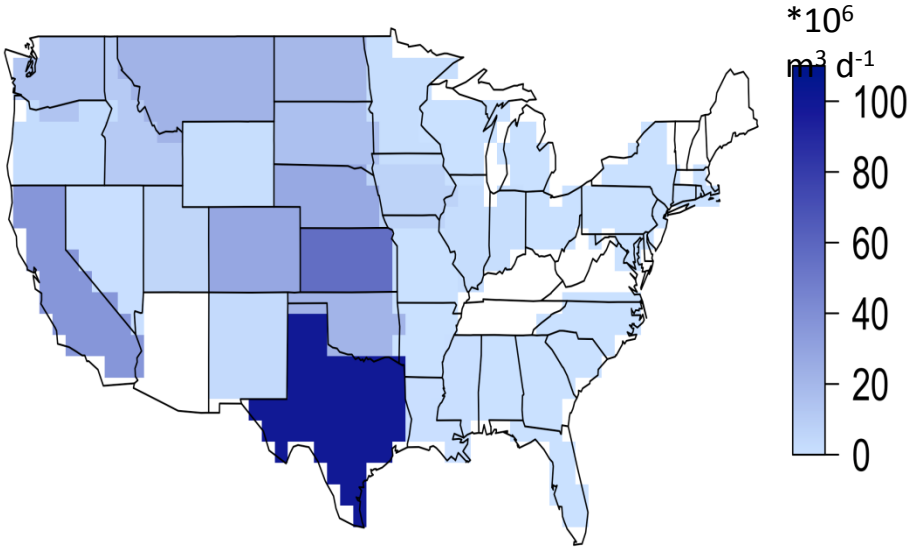
New GFDL land model development

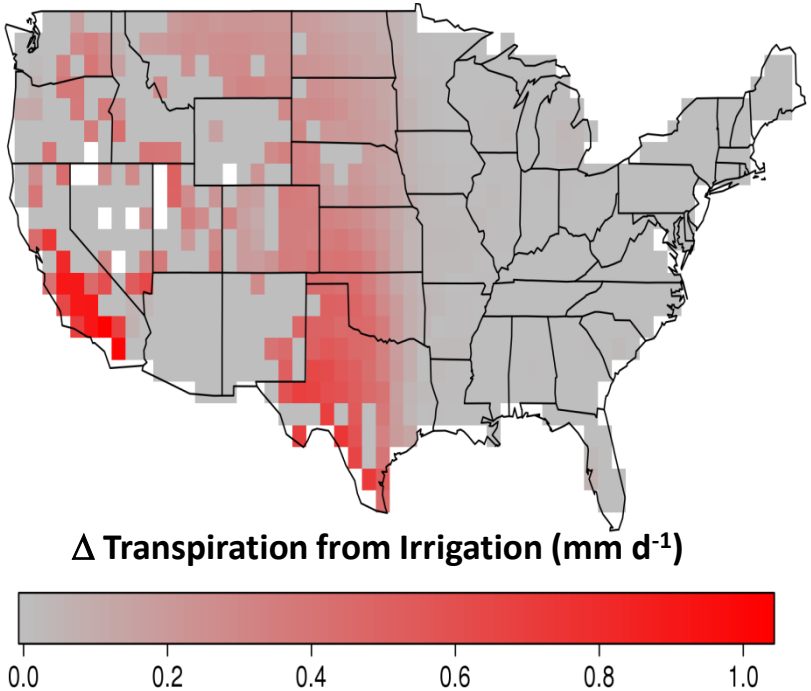
- LM3 – new ecosystems and hydrology
  - Dynamic vegetation, land use, C cycle (Shevliakova et al. 2009)
  - Liquid and frozen H_2O, rivers & lakes, dynamic H_2O table (Milly et al 2014)
  - Coupled C-N in veg, soils & rivers (Gerber et al 2010, Lee et al 2014)
- LM4 - ongoing developments for CM4/ESM4
  - Urban tiles (Li et al., 2016, JAMES)
  - *Comprehensive* biogeochemistry vegetation & soil (Sulman et al., 2014)
  - Sub-grid hill-slope *heterogeneity.* prognostic wetlands (Subin et al., 2014)
  - River biogeochemistry, including N, P and C (Lee et al., 2016, GRL)
  - Land-use management with fertilizer for water quality (Kanter et al., 2016)
  - Prognostic aerosol emissions: dust, biomass burning, BVOC (Evans et al., 2016)
  - New age-height vegetation succession model LM3-PPA (Purves et al., 2008)
  - New fire model + biomass burning aerosol interactions (Ward et al., 2016)
  - Irrigation and hydrological-vegetation interactions
  - Model-data fusion of initialized veg and land carbon at 1 km for N America
  - Incorporation of N, CH_4, P, etc.

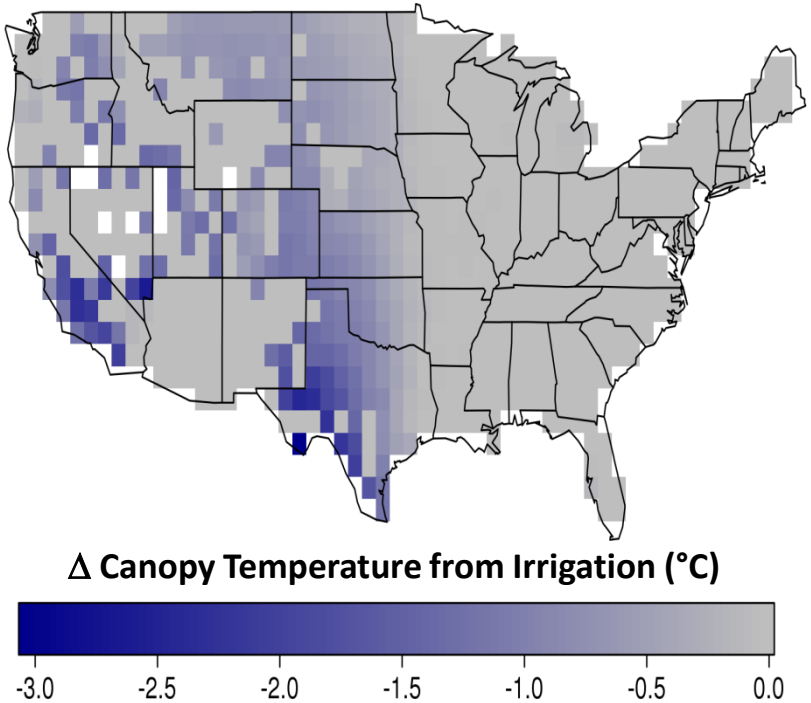
Fresh water withdrawals for irrigation for 1995 (USGS)



Model irrigation demand for 1995



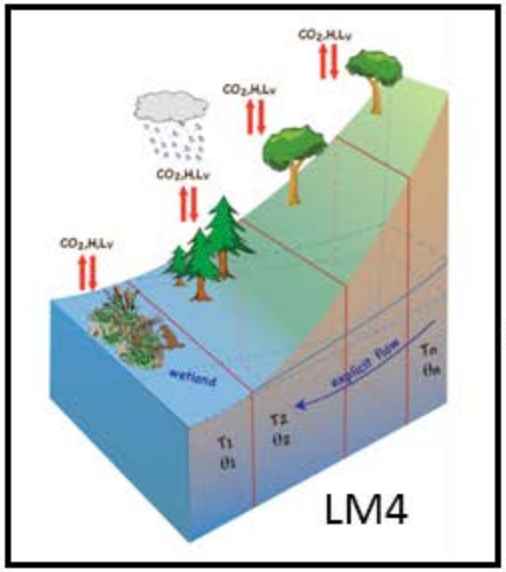




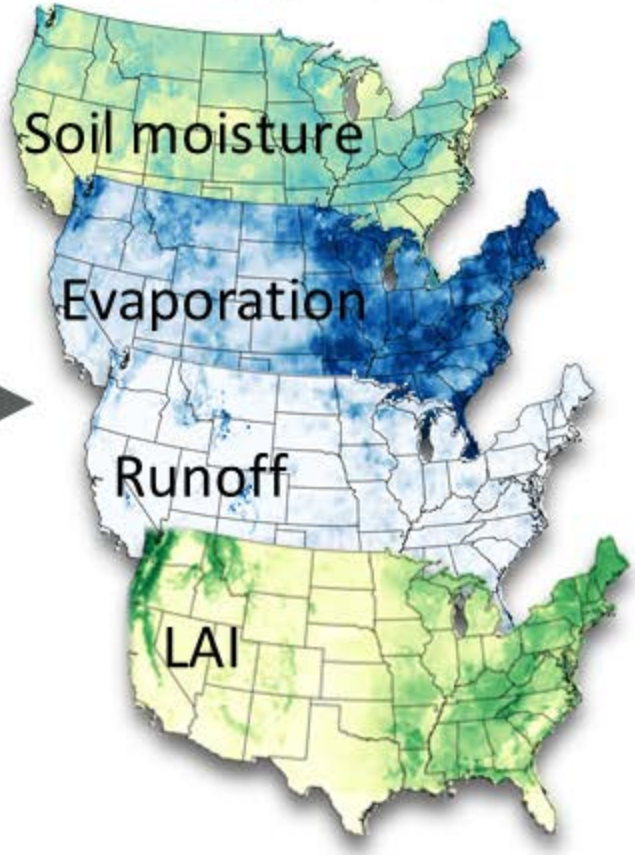
Marjolein van Huijgevoort et al (in prep)

GFDL LM4 CONUS Simulations

Environmental data



Simulations



- Land model run on a ¼° grid over CONUS
- 100 tiles per ¼° grid cell (~13000 cells)
  - 1.5 million different tiles over CONUS
  - Each 30 meter grid cell belongs to a tile
- Simulations of 2002-2014 (Spin-up 1974-2001)

Nathaniel Chaney et al (in prep)