

## Atmospheric Fluxes

- Updated [PFT optical properties](#) [Keith]
- New [urban datasets](#) & building property parameterization [Keith]
- [Biomass heat storage](#) [Sean]
- [Snow burial](#) of vegetation [Danica]
- Multilayer canopy [Gordon & Ned]

## Hydrology

- [Irrigation](#) [Bill & Sean]
- Representative hillslope hydrology [Sean & others]
- [mizuRoute](#) [Naoki, Erik]
- [Reservoir operations](#) and dynamic lakes [Inne Vanderkelen]
- Water isotopes [Bill Sacks]

## Ecosystems and Biogeochemistry

- **[Fire Model](#)**: bug fixes, improvements, & re-tuning. Focus on improving deforestation and degradation fires [Fang Li]
- **[Arctic/Boreal phenology & allocation](#)** changes [Leah Birch]
- [CN-Matrix](#) calculations for ecosystem biogeochemistry [Chris Lu & Yiqi Luo]
- [Aerosols: FAN](#) (NH3 emissions) [Julius Vira & Peter Hess]
- FATES [Rosie, Charlie, Jackie, Ryan & many more] Including [FATESsp](#), [no competition](#), and other simplified configurations

## Crop Model

- **[Bioenergy crop](#)** [Yanyan Cheng & Maoyi Huang]
- **Winter wheat** [Yaqiong Lu], implemented but not currently used
- [Shifting cultivation](#) [Peter]
- APSIM crop phenology [Bin Peng]
- Tillage and crop residue management [Mike Graham & Danica]
- Soil degradation with Land Use [Johann Feddema, Pei-Ling]
- Additional Crop model features (e.g.; specified gridded planting windows, Cover crops, Tree crops. Managed pasture & forestry?)

## Features

- **[WRF-CTSM beta](#)** release [Dave & more]
- **[No anthro compsets](#)**: turn off irrigation, crop, urban, LULCC, fire
- **[Prescribed soil moisture](#)** [Sean]
- Soil and [snow](#) layer flexibility + trimming [land units](#) & [PFTs](#) [Sam Levis & Bill]
- Moving [hard coded parameters](#) to parameter file [Keith]
- SSP-RCP anomaly forcing compsets for land only simulations
- Simple Land Model [Marysa Lague]
- Improved single point workflow for PLUMBER2 & NEON simulations [Keith, Sean, Will, Danica]

- **Bold items** have been merged into [CTSM5.1\\_main](#)
- [Linked items](#) point to github pull requests.