



The progress of prognostic land use and land cover change in CESM1

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Objective and science questions

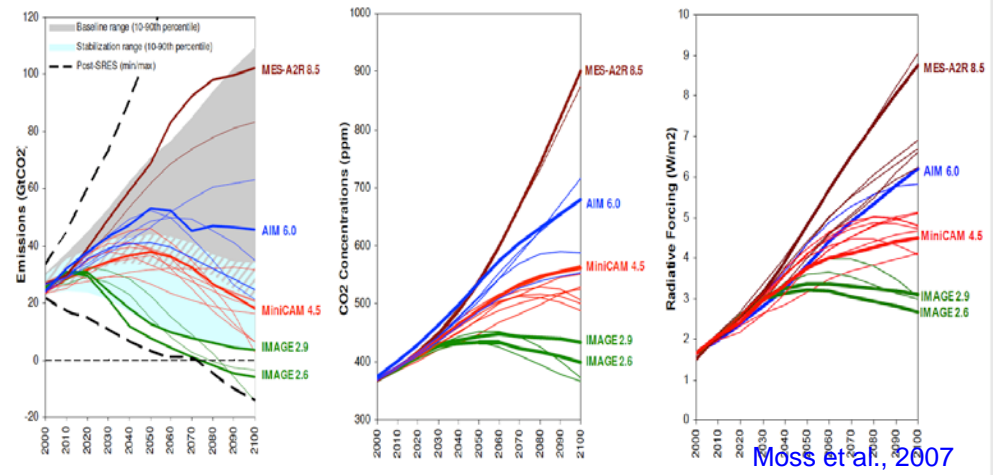
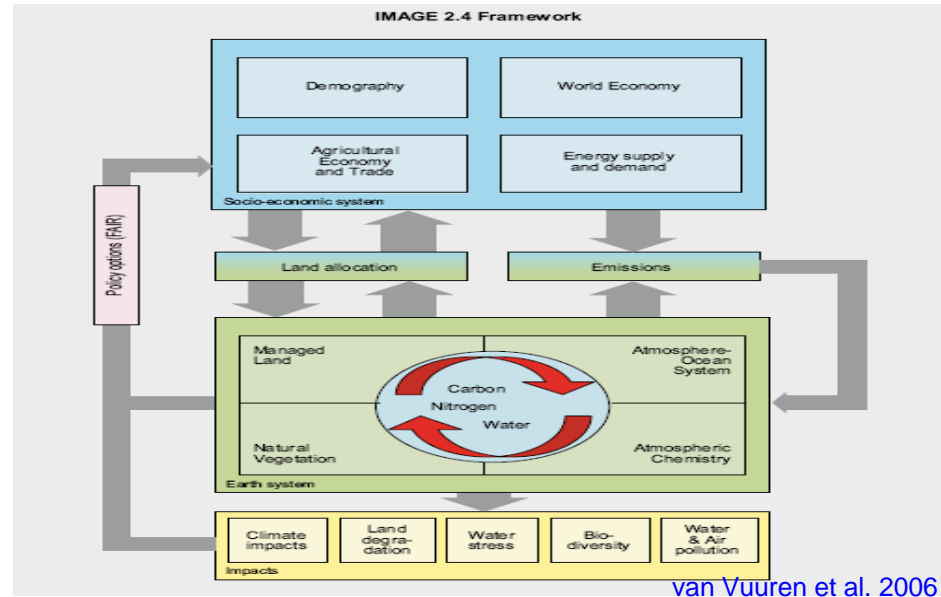


- I.** Improve knowledge of controls on future greenhouse gas concentrations and climate-biosphere feedbacks
- II.** How sensitive are predicted land use change trajectories to inconsistencies in climate and BGC components of IAM & CESM?
- III.** How sensitive are modeled climate-carbon cycle feedbacks to on-line vs. off-line representations of land use and land cover change?

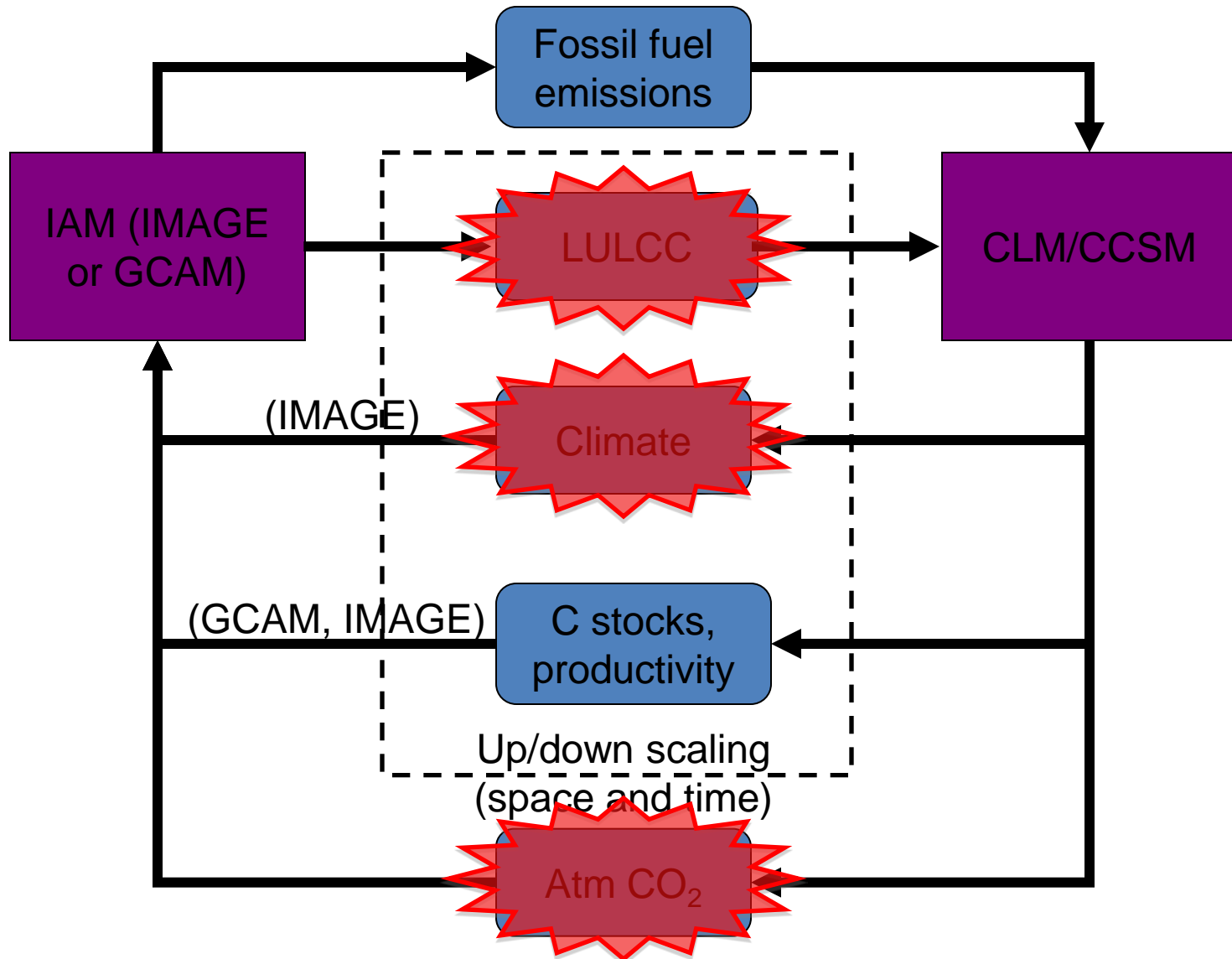


Integrated Model to Assess the Global Environment (IMAGE)

- Global energy model
- LULCC model (Crops (19) and LULCC (20))
- Simple climate model
- Impact models
- Annual time step and 0.5 degree grid
- the IMAGE 2.6 scenario – RCP3-PD for AR5 used as the low pathway



Multi-phase coupling strategy





Standard IMAGE run

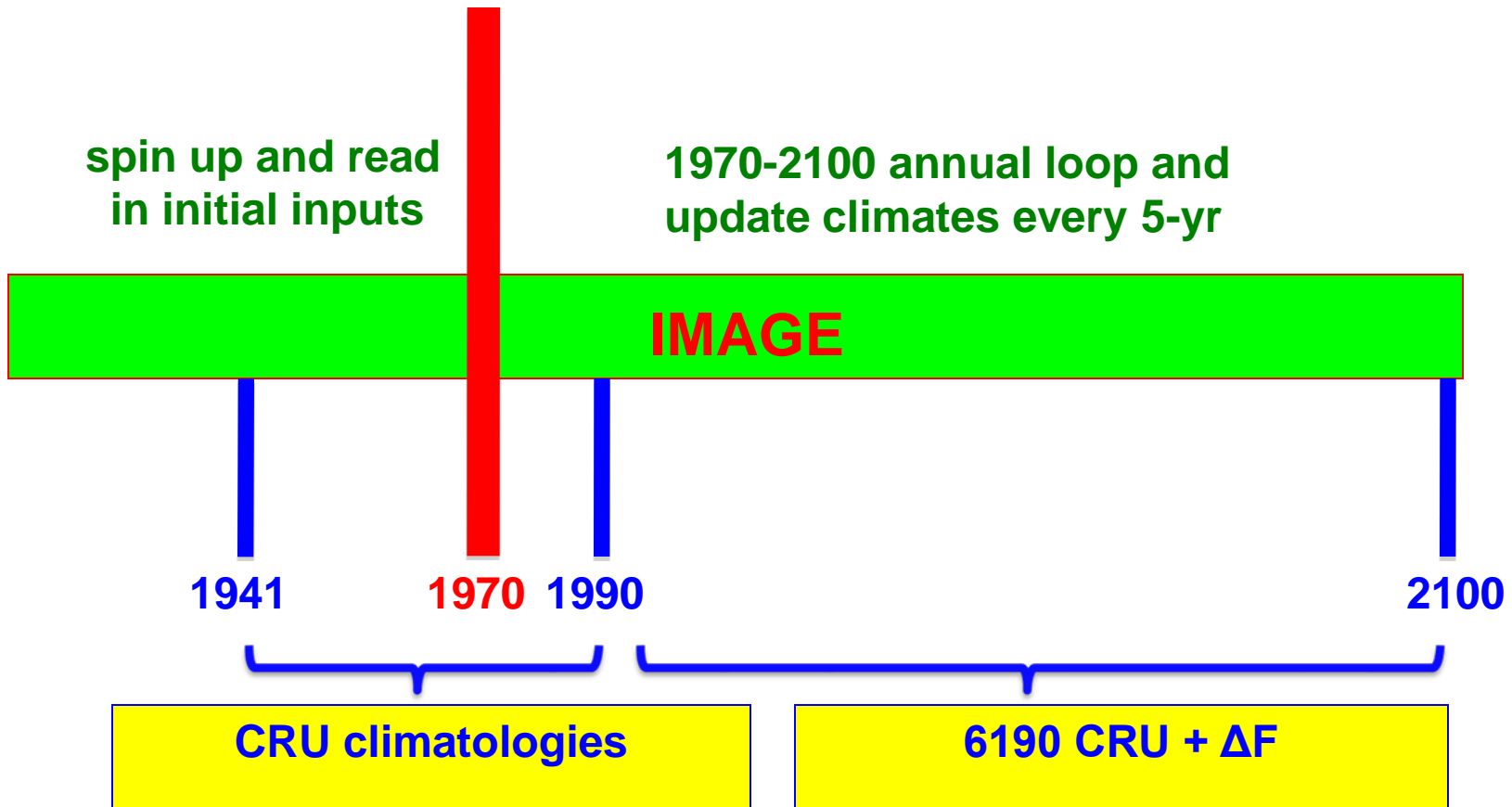




IMAGE runs with other climatologies

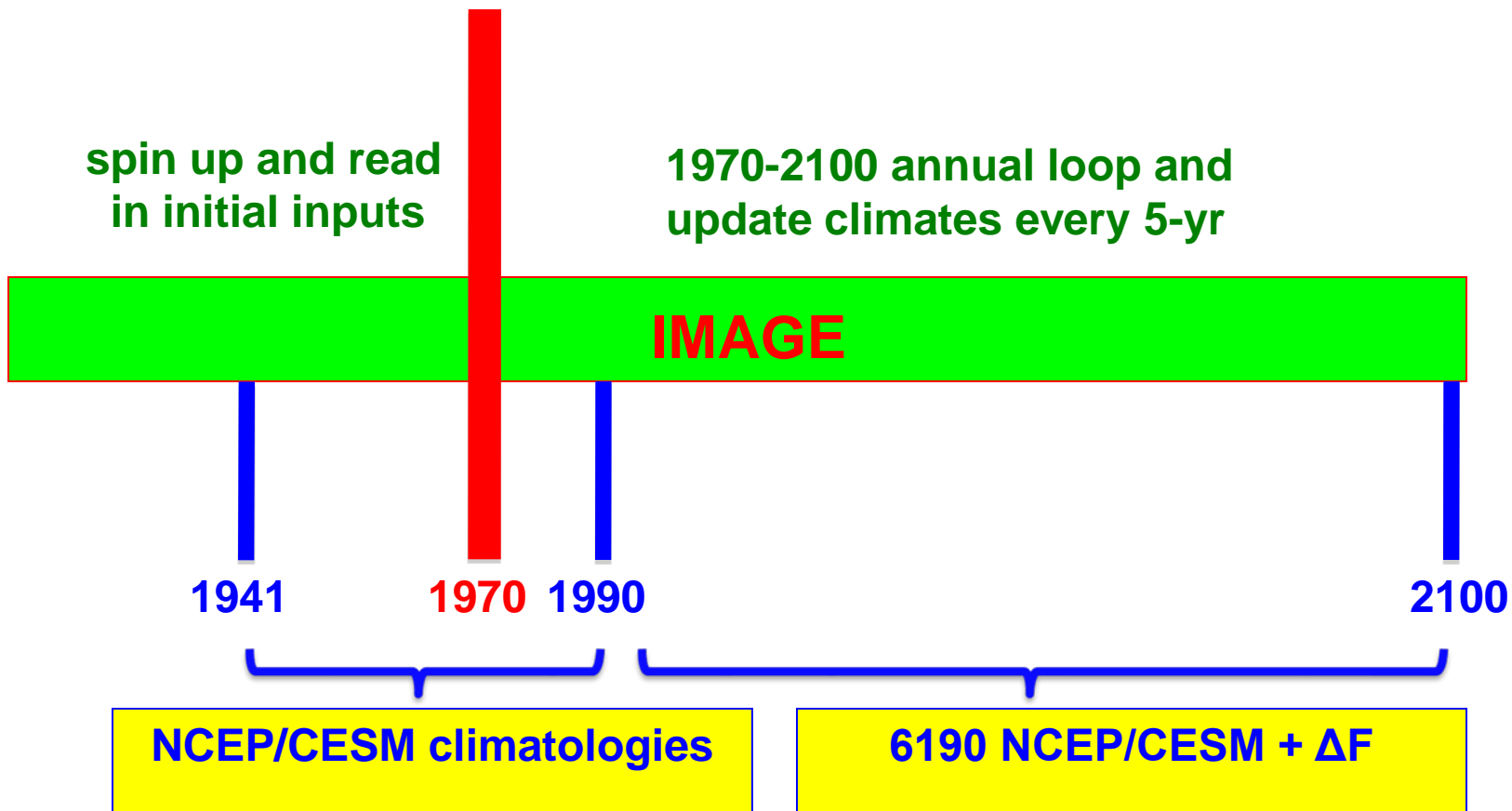




IMAGE and CESM coupling

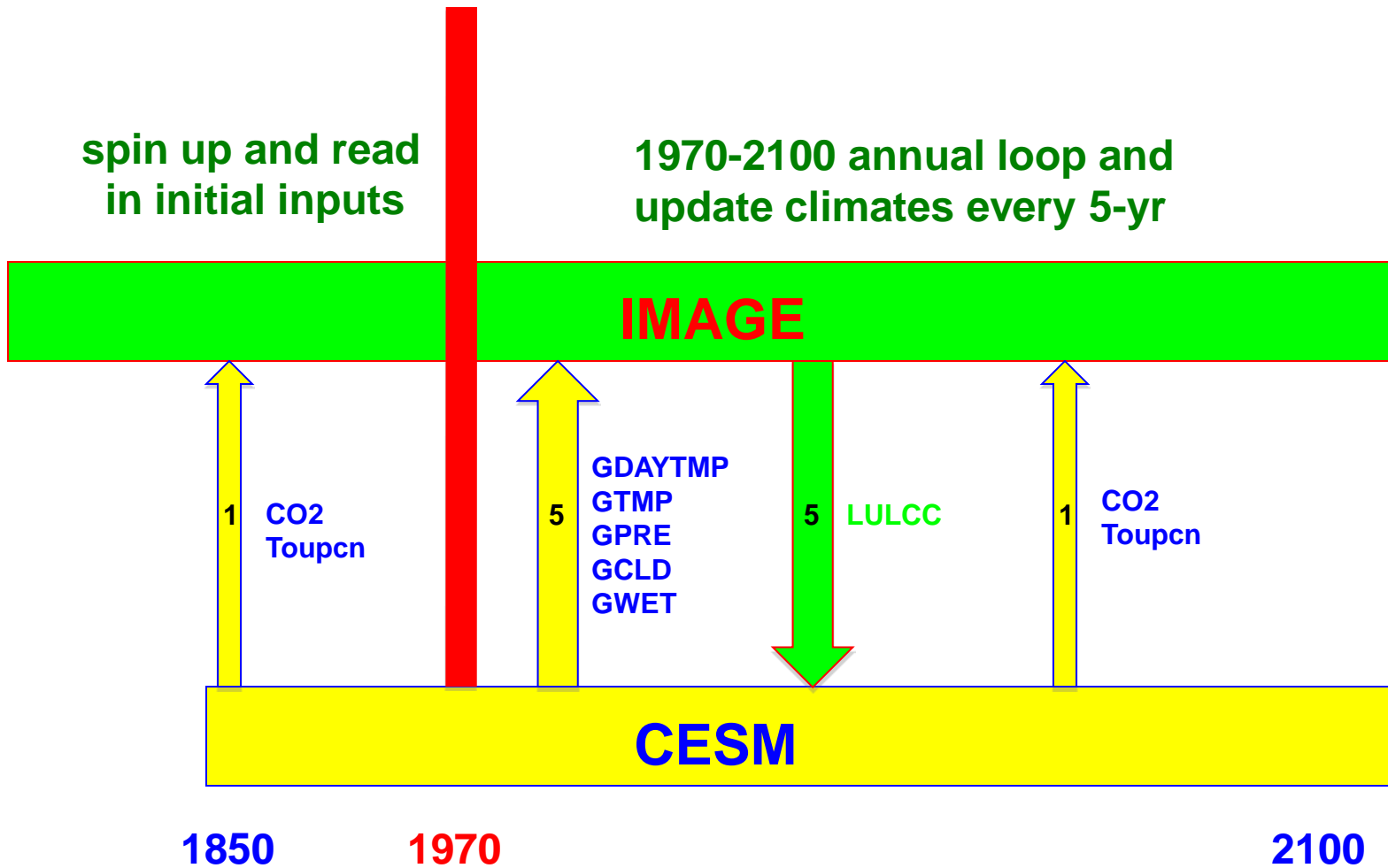
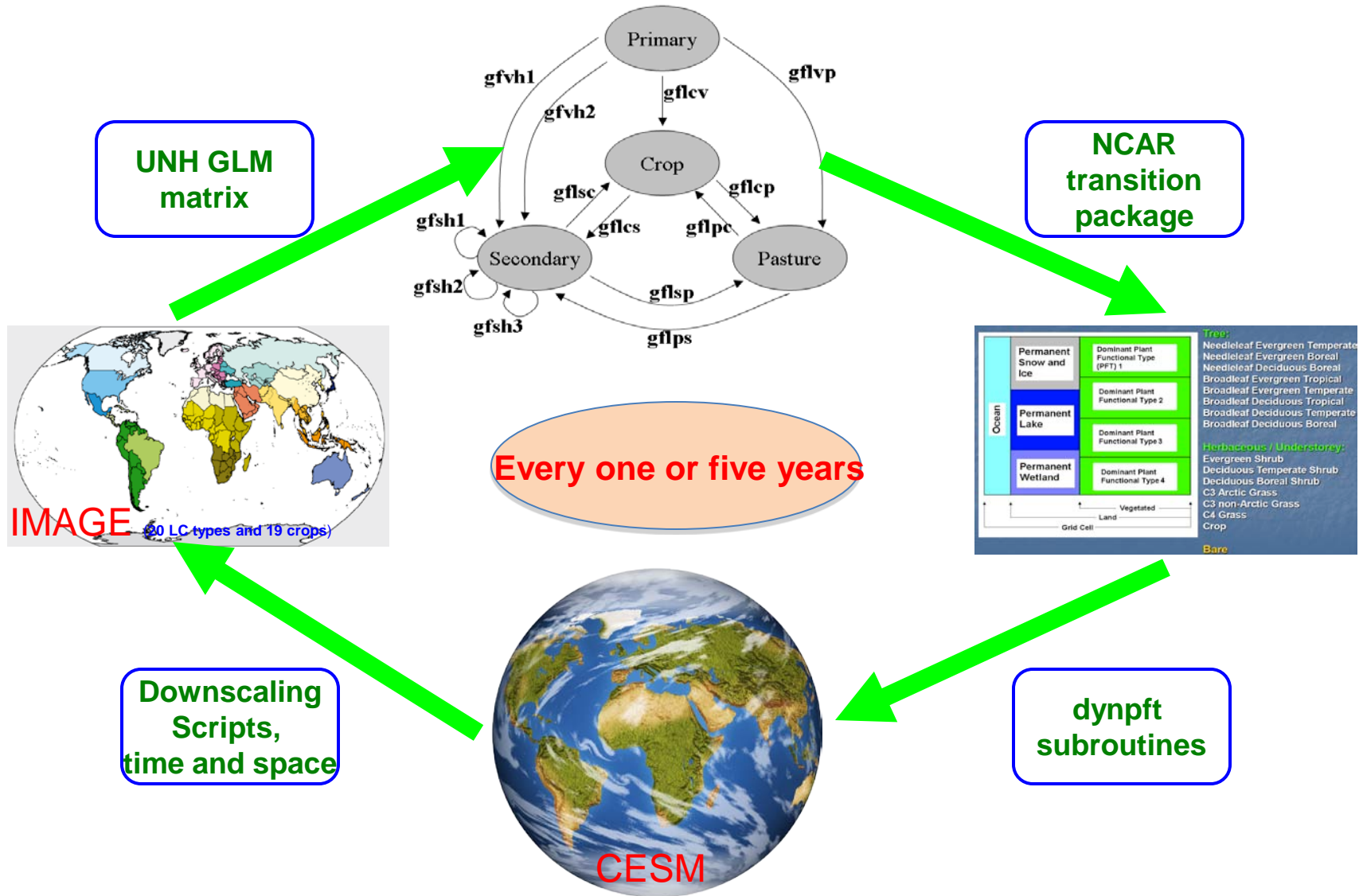




IMAGE and CESM coupling

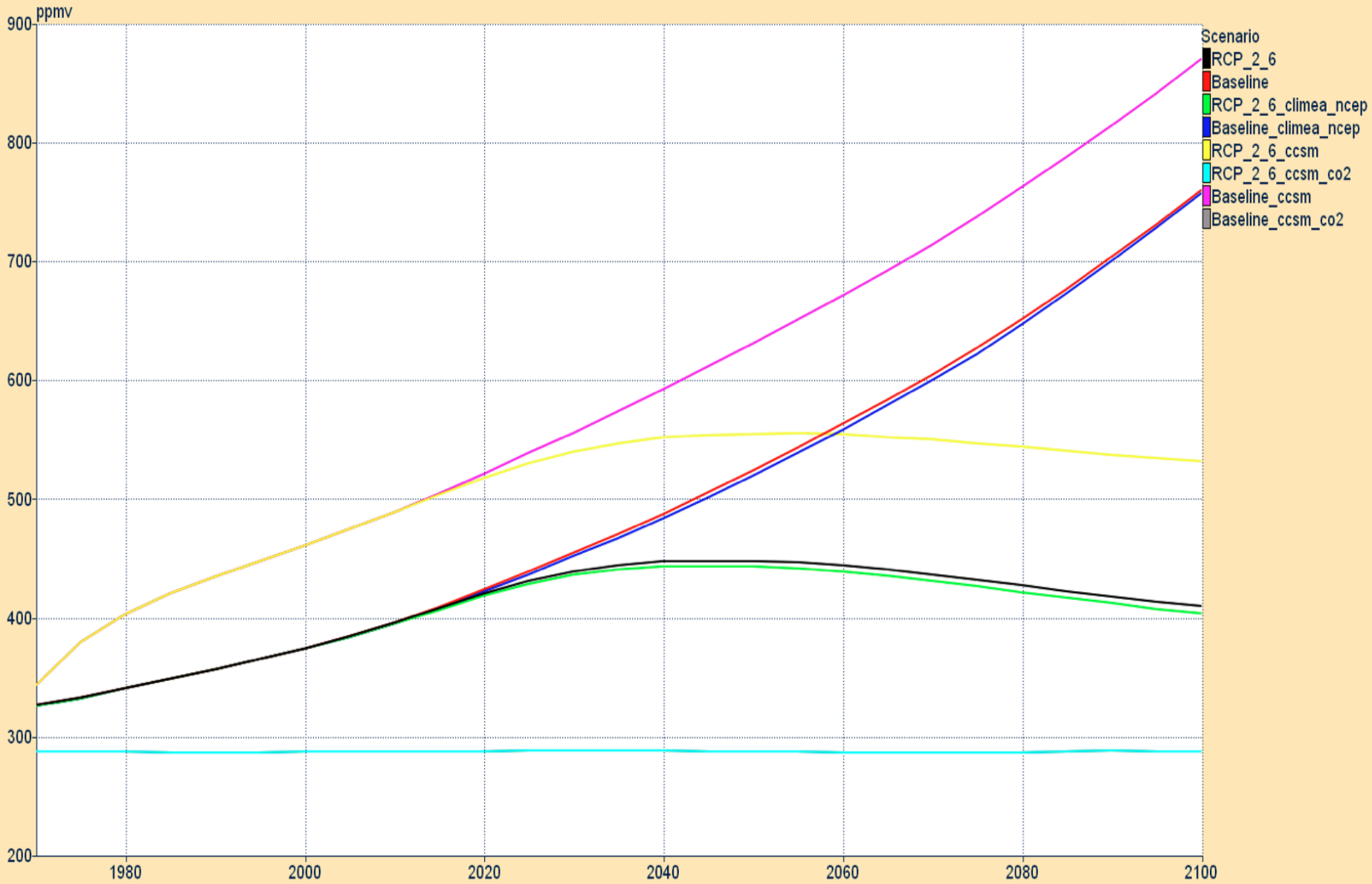




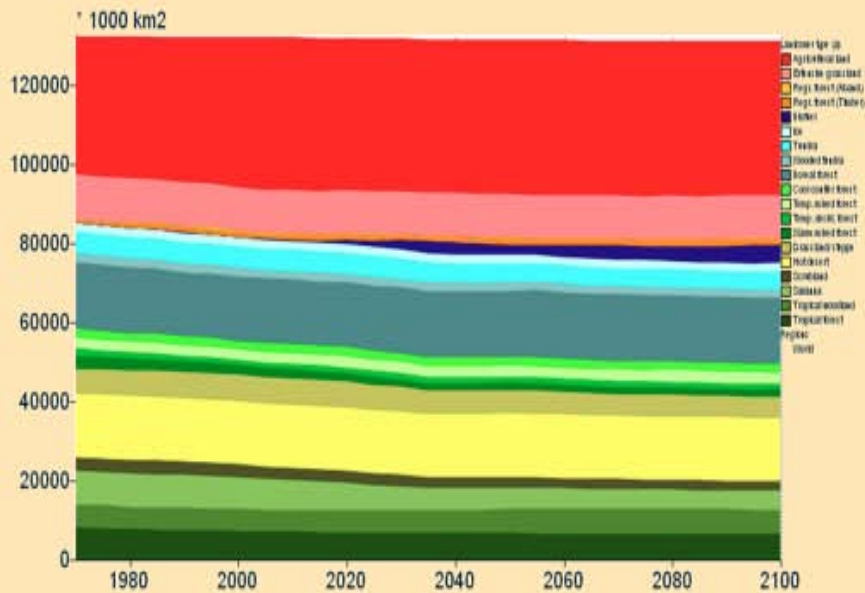
Present coupling status

- ✓ **IMAGE RCP 2.6 and baseline runs (1970 - 2100)**
 - ✧ **With CRU every 30-yr climatologies (1941 - 1990) (complete)**
 - ✧ **With NCEP every 30-yr climatologies (1948 - 1990) (complete)**
 - ✧ **With CESM1 every 30-yr climatologies (1941 - 1990) (ongoing)**
- ✓ **RCP 2.6 and baseline runs using modified IMAGE with CESM1 control outputs (0301-0435 for 1970-2100) (complete)**
- ✓ **1850 CESM1 control (ccsm4_0_beta46, 218 yrs; ccsm4_0_beta50, 165 yrs)**
- ✓ **1850–2005 CESM1 historical transient (ccsm4_0_beta55, ongoing)**
- ✓ **1970–2100 IMAGE-CESM1 RCP 2.6 runs**

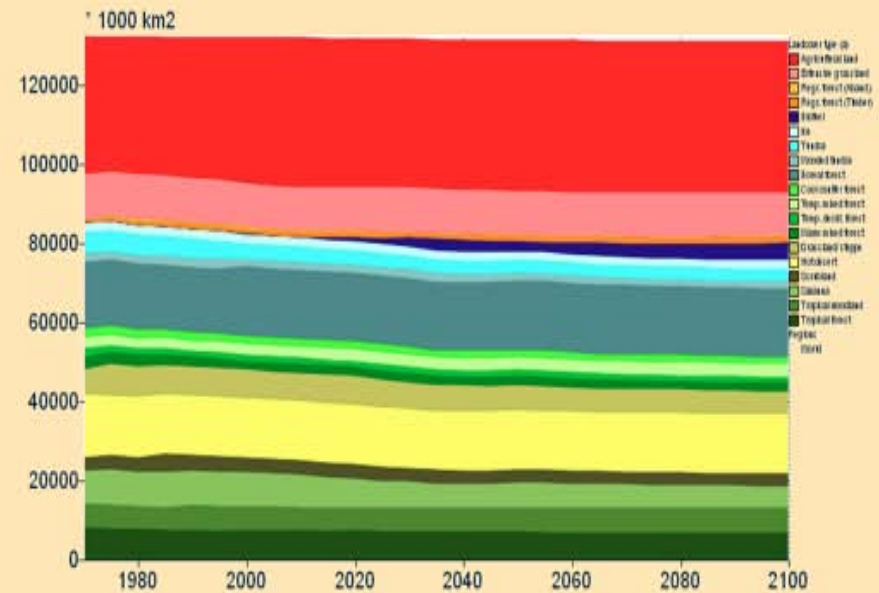
Atmospheric CO2 Concentration



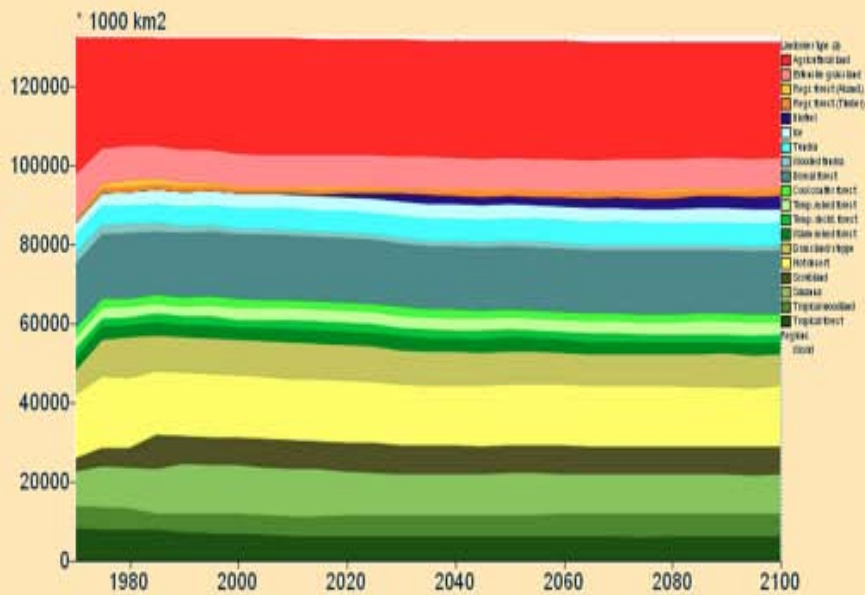
Land-cover Area - RCP_2_6



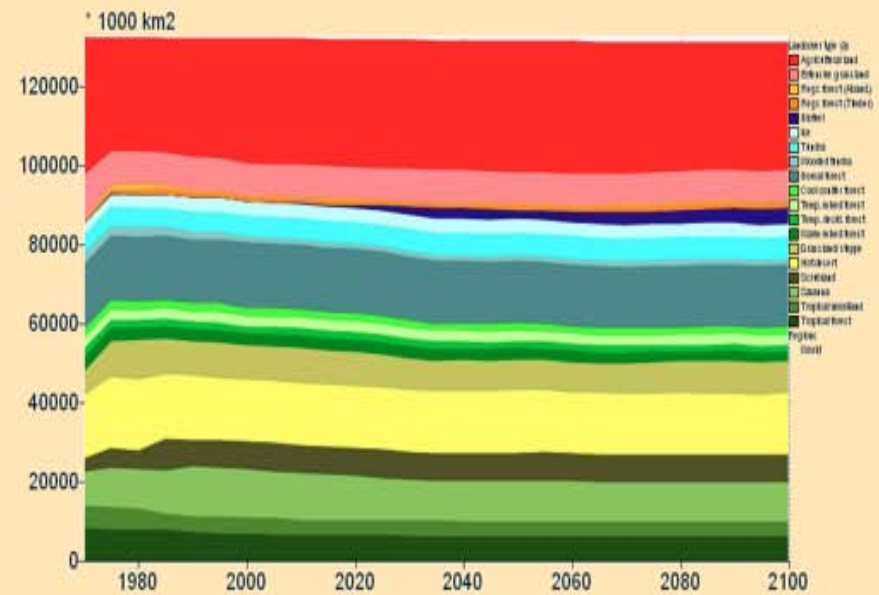
Land-cover Area - RCP_2_6_climea_ncep



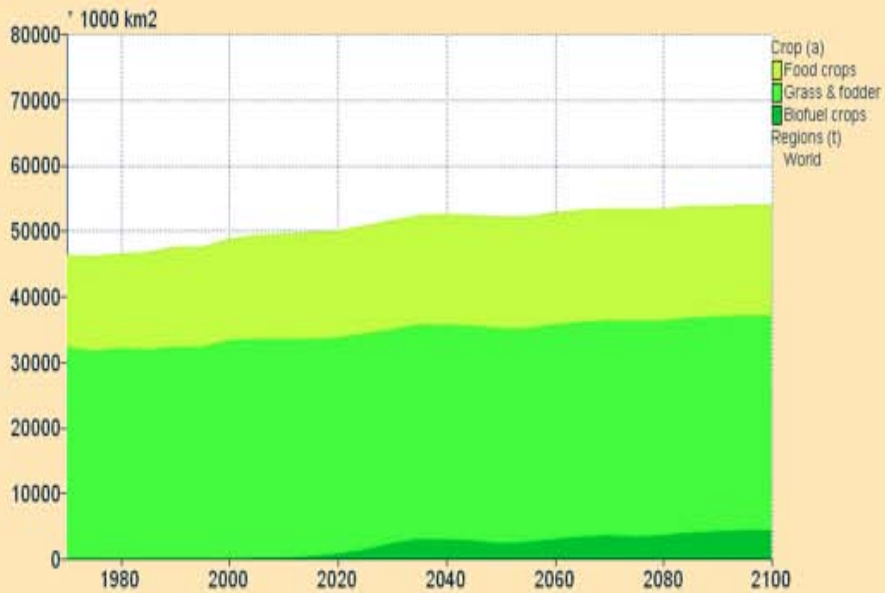
Land-cover Area - RCP_2_6_ccsm



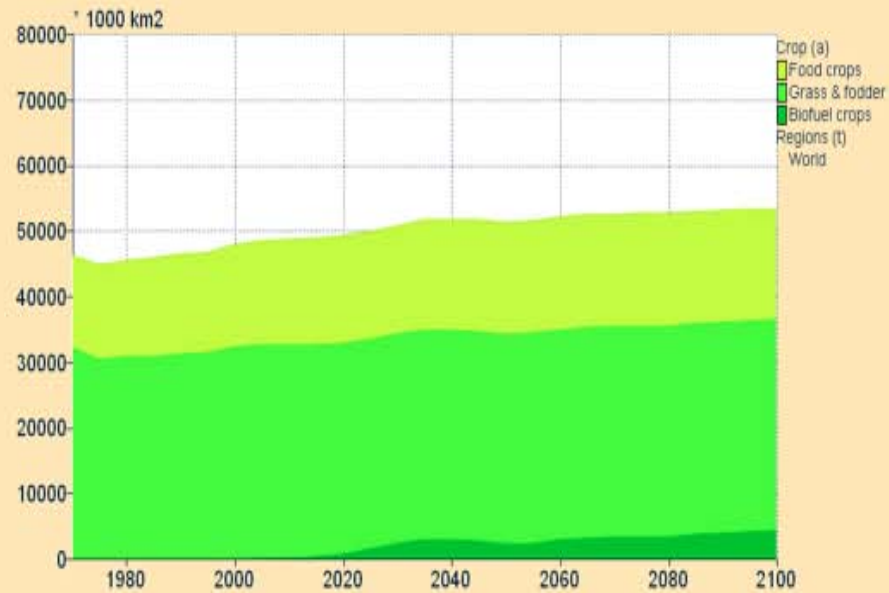
Land-cover Area - RCP_2_6_ccsm_co2



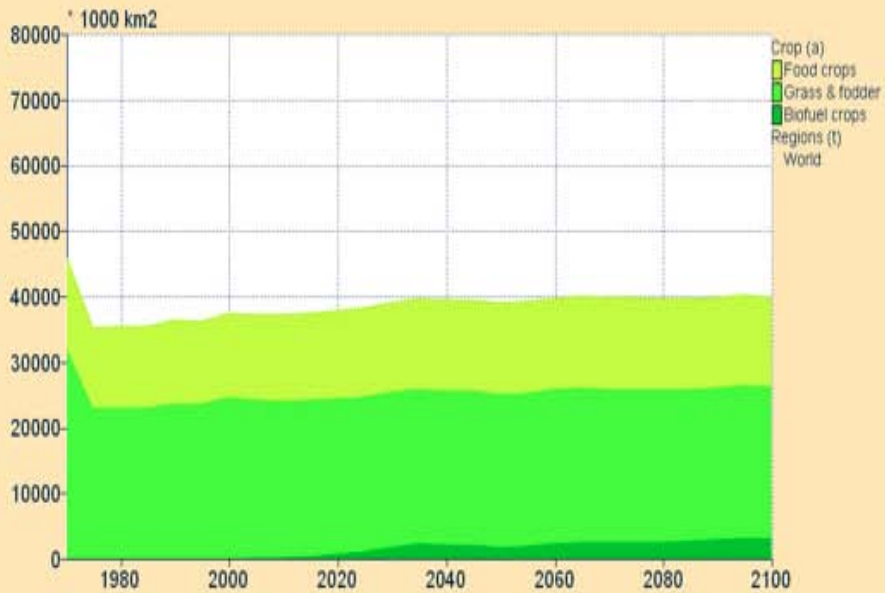
Crop Area - RCP_2_6



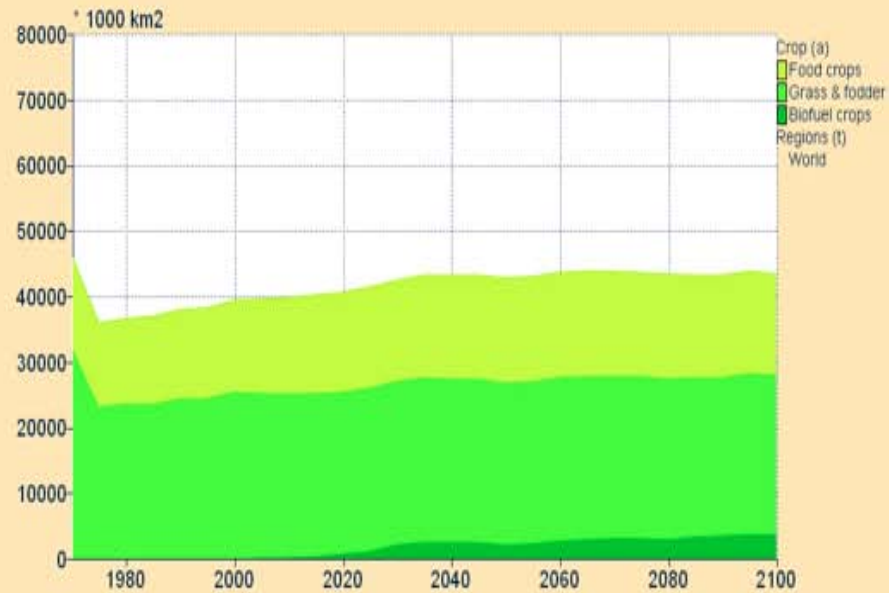
Crop Area - RCP_2_6_climea_ncep



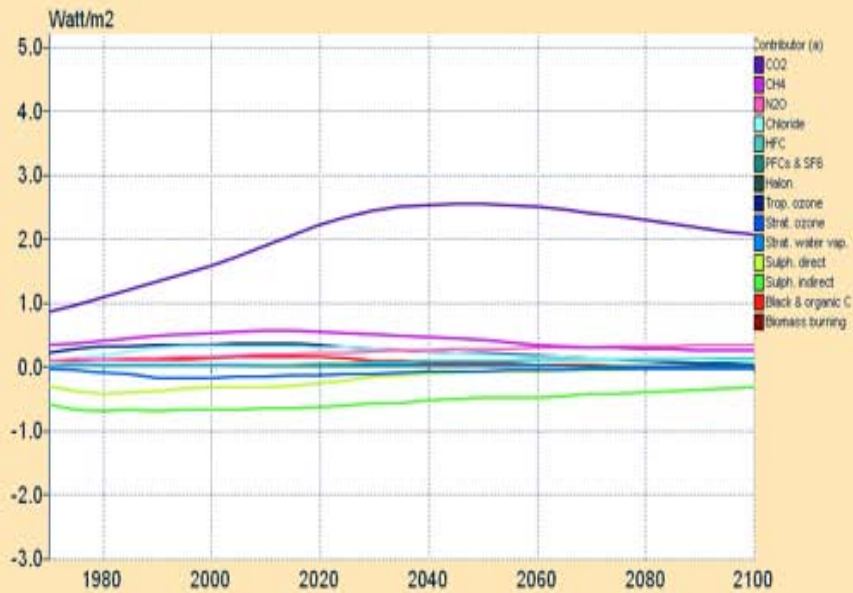
Crop Area - RCP_2_6_ccsm



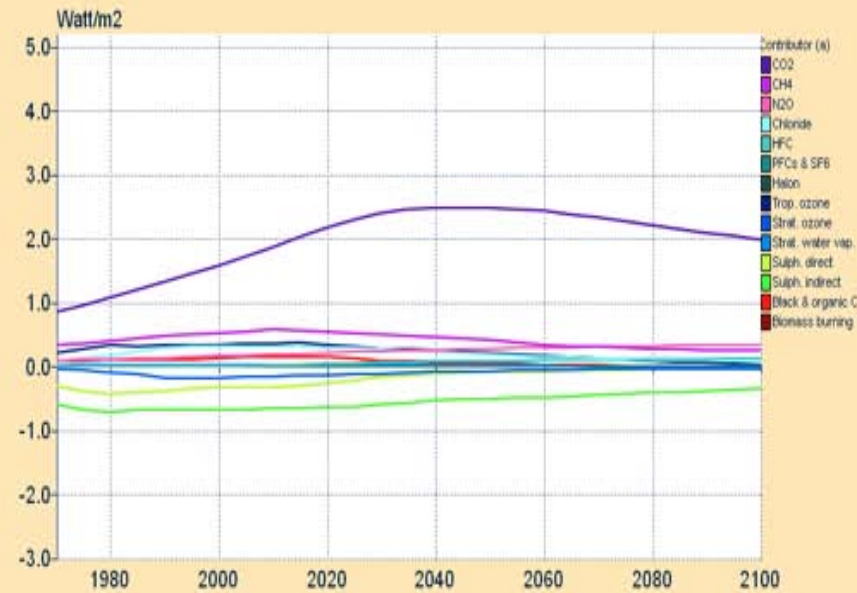
Crop Area - RCP_2_6_ccsm_co2



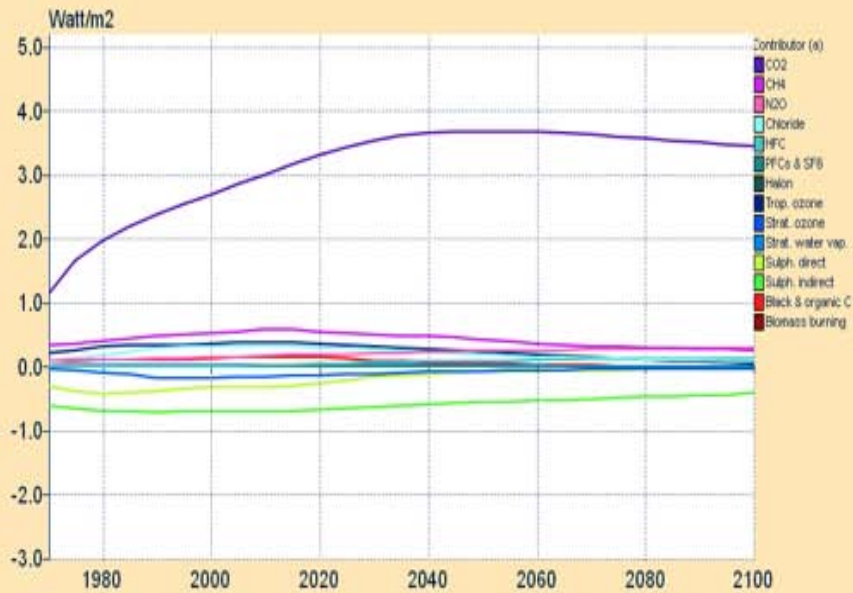
Radiative Forcing - RCP_2_6



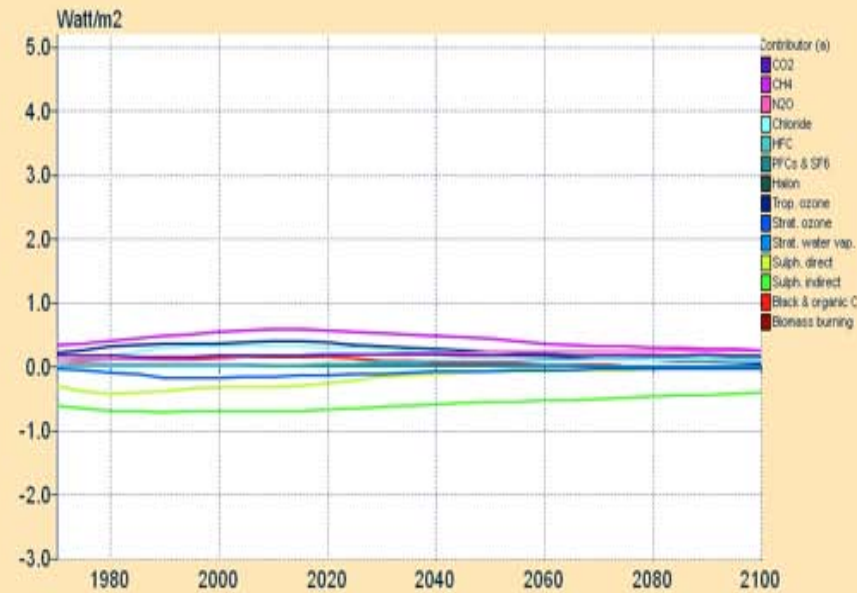
Radiative Forcing - RCP_2_6_climea_ncep



Radiative Forcing - RCP_2_6_ccsm



Radiative Forcing - RCP_2_6_ccsm_co2





Next steps

- I. Keep the couplings between IMAGE and CESM transient run
- I. Integrate GLM/Peter Lawrence codes within CLM
- II. Call IMAGE as CLM subroutine?



Thanks