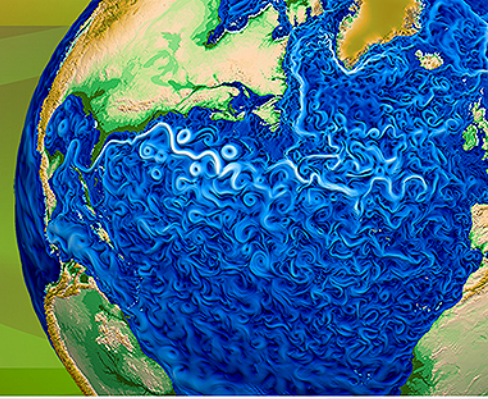




Accelerated Climate Modeling
for Energy



Status of ACME v1

Chris Golaz

on behalf of the entire Coupled Task

Deliverables: 1 July 2017 (from EC)

Low-res (DECK)

- PI control (500 years)
- 1%/year CO2 increase to doubling (150 years)
- Abrupt 4xCO2 (150 years)
- CMIP6 - Historical simulation using CMIP6 forcings (1850-2014; 165 years x 3 members)
- AMIP simulation (165 years)
- CORE-II IAF Ocean/Ice simulation (100 years)
- **Total: 1560 years**

Deliverables: 1 July 2017 (from EC)

NEW Low-res (water-cycle)

- **LR PI control-A:** simulation initialized from CORE-II MPAS low resolution ocean/ice run with 1850 climatological forcing for 100 years (this is different from LR PI control in the DECK experiments)
- **LR transient with all forcings-A:** initialize using LR PI control-A on year 1950 with all forcings for 100 years (1950 – 2050) (3 ensemble members) - first 20 years used as adjustment
- **LR transient with GHG-only forcing:** initialize using LR PI control-A on year 1950 with GHG-only forcing for 100 years (1950-2050) (3 ensemble members) - first 20 years used as adjustment
- **LR transient with GHG+aerosols only forcing:** initialize using LR control-A on year 1950 with GHG+aerosols only forcing for 100 years (1950-2050) (3 ensemble members) - first 20 years used as adjustment
- **LR transient with all forcings-B:** initialize using CORE-II MPAS low resolution ocean/ice run with historical atmospheric forcing for 100 years (1950-2050, first 20 years used as spinup)
- **LR transient with all forcings-C:** extend LR historical (from DECK) for 2015-2050
- **Total: 1135 years**

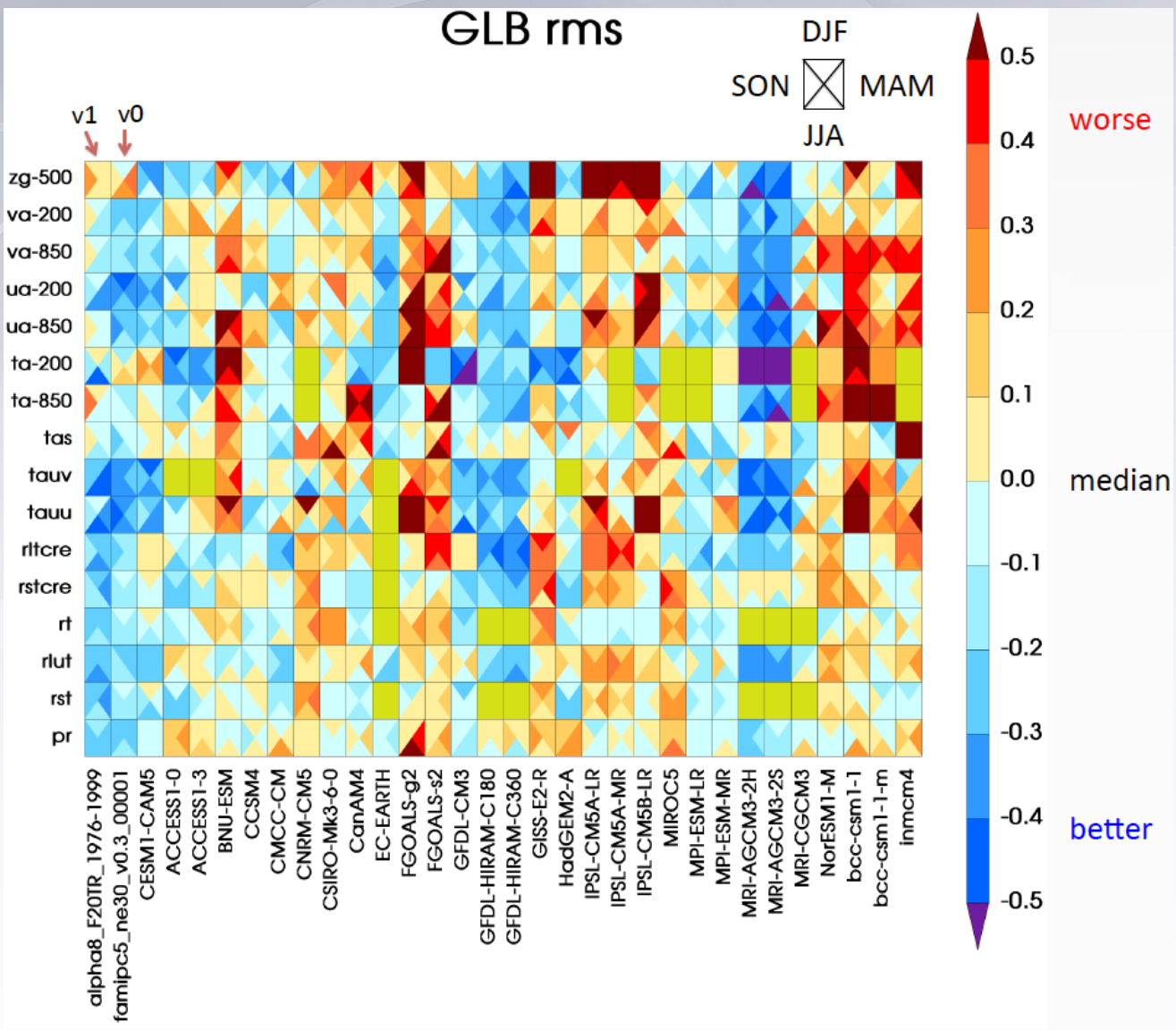
Deliverables: 1 July 2017 (from EC)

High-res (water-cycle)

- **HR PI control-A:** simulation initialized from CORE-II MPAS high resolution ocean/ice run with 1850 climatological forcing for 100 years
- **HR transient with all forcings-A:** initialize using HR PI control-A on year 1950 with all forcings for 100 years (1950-2050) (1 member) - first 20 years used as adjustment
- **HR transient with all forcings-B:** initialize using CORE-II MPAS high resolution ocean/ice run with historical atmospheric forcing for 100 years (1950-2050, first 20 years used as spinup)
- **Total: 300 years**
- Note: INCITE 2017 award only permits PI Control

Most recent configuration

ACME atmospheres (v0, prototype v1) compared to CMIP



Note: some bugs were discovered in prototype v1 atmosphere (AV1C-04P).

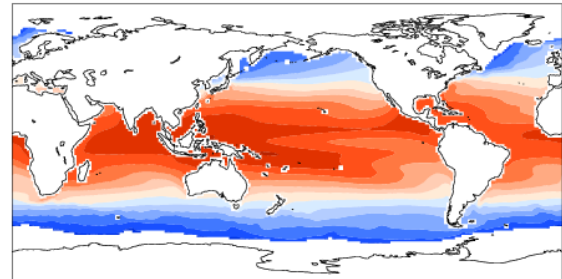
Checkout Qi Tang's poster

SST pre-industrial

alpha6

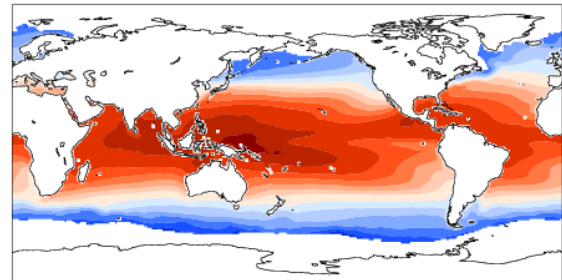
alpha8

1850_alpha6_01_(0011-0020) (yrs 0011-0020)
Sea surface temperature mean= 19.50 C

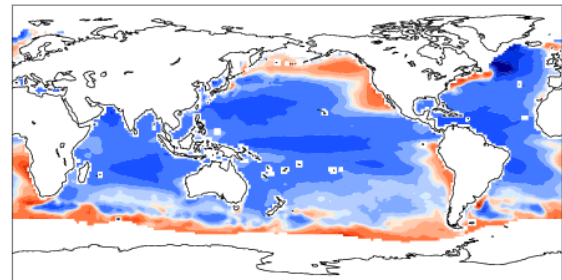


HadISST (pre-industrial)

Sea surface temperature mean= 20.41 C

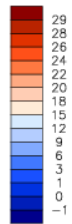


1850_alpha6_01_(0011-0020) - HadISST (pre-industrial)
mean = -0.91 rmse = 1.45 C

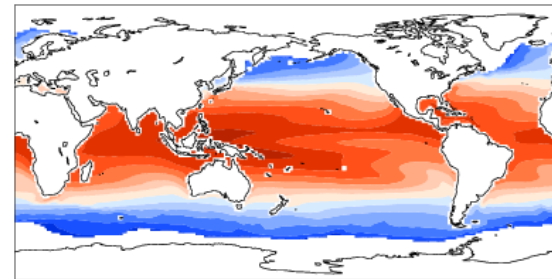


ANN

Min = 0.17 Max = 28.34

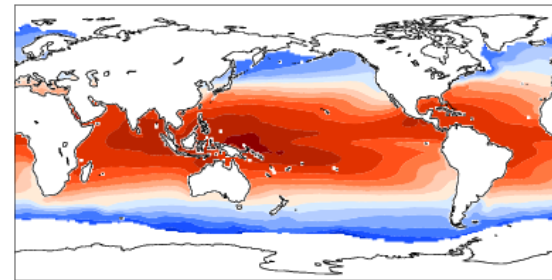


20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (yrs 0011-0020)
Sea surface temperature mean= 19.57 C

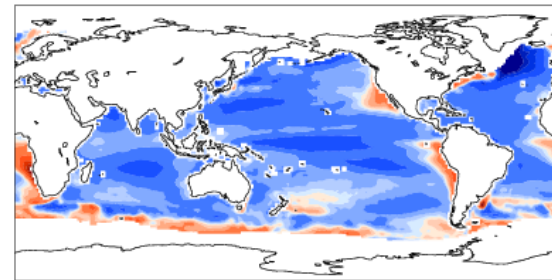


HadISST (pre-industrial)

Sea surface temperature mean= 20.48 C

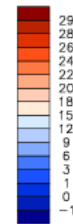


20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison - HadISST (pre-industrial)
mean = -0.92 rmse = 1.37 C

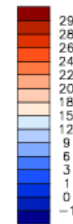


ANN

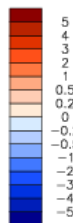
Min = -0.05 Max = 28.80



Min = -0.12 Max = 29.34



Min = -8.85 Max = 6.17



Precipitation ANN

alpha6

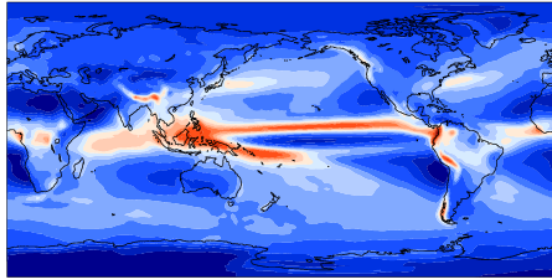
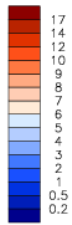
alpha8

1850_alpha6_01_(0011-0020) (yrs 0011-0020)

Precipitation rate mean= 3.07 mm/day

ANN

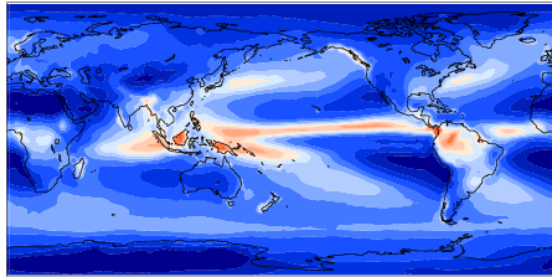
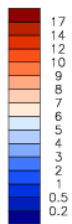
Min = 0.03 Max = 19.36



GPCP

Precipitation rate mean= 2.67 mm/day

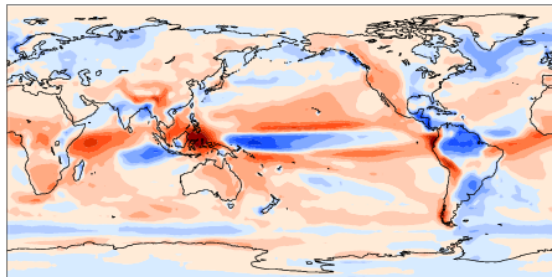
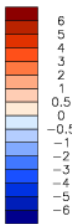
Min = 0.02 Max = 12.22



1850_alpha6_01_(0011-0020) - GPCP

mean = 0.40 rmse = 1.21 mm/day

Min = -5.80 Max = 11.06

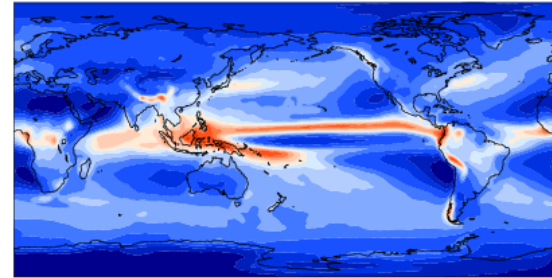
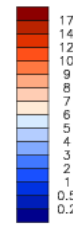


20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (yrs 0011-0020)

Precipitation rate mean= 2.99 mm/day

ANN

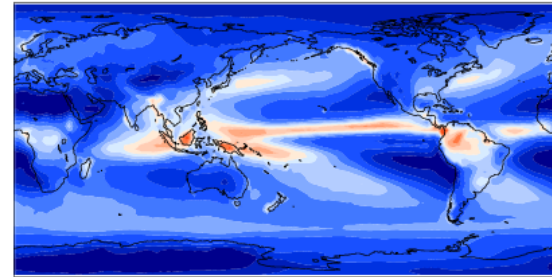
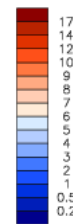
Min = 0.02 Max = 18.84



GPCP

Precipitation rate mean= 2.67 mm/day

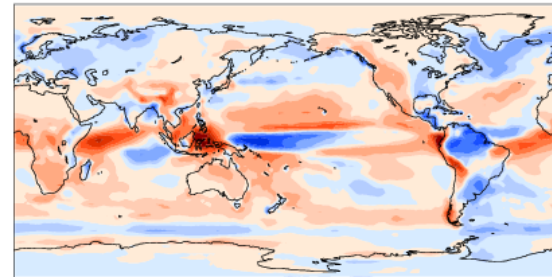
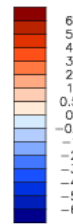
Min = 0.02 Max = 12.22



20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison - GPCP

mean = 0.32 rmse = 1.17 mm/day

Min = -4.85 Max = 11.26



TOA SW CRE ANN

alpha6

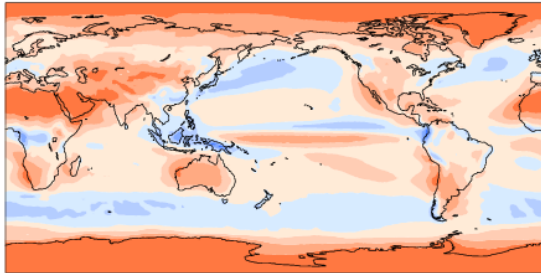
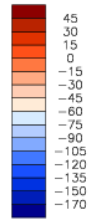
alpha8

1850_alpha6_01_(0011-0020) (yrs 0011-0020)

TOA SW cloud forcing mean = -47.33 W/m²

ANN

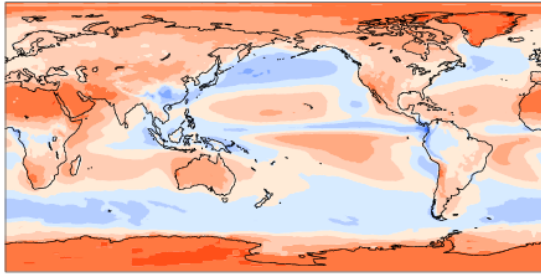
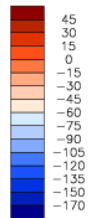
Min = -114.11 Max = -0.25



CERES-EBAF

TOA SW cloud forcing mean = -47.15 W/m²

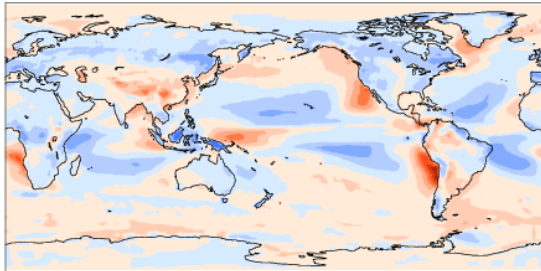
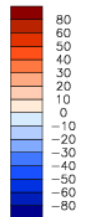
Min = -122.82 Max = 27.03



1850_alpha6_01_(0011-0020) - CERES-EBAF

mean = -0.18 rmse = 10.62 W/m²

Min = -42.93 Max = 80.32

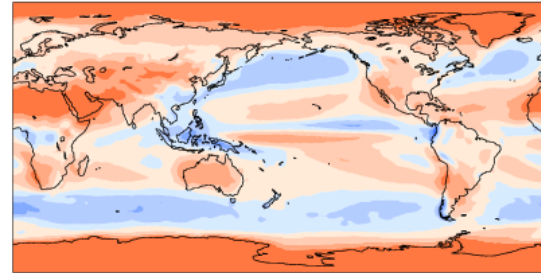
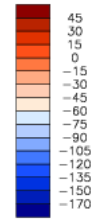


20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (yrs 0011-0020)

TOA SW cloud forcing mean = -48.16 W/m²

ANN

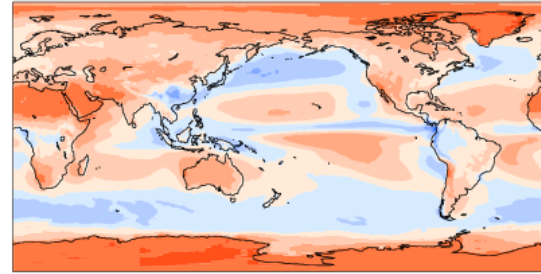
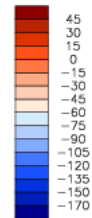
Min = -120.08 Max = -0.22



CERES-EBAF

TOA SW cloud forcing mean = -47.15 W/m²

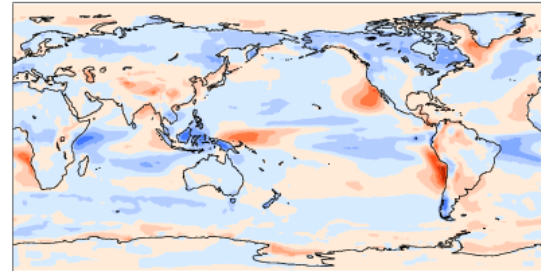
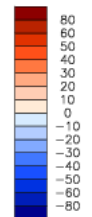
Min = -122.82 Max = 27.03



20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison - CERES-EBAF

mean = -1.00 rmse = 9.90 W/m²

Min = -47.07 Max = 80.59



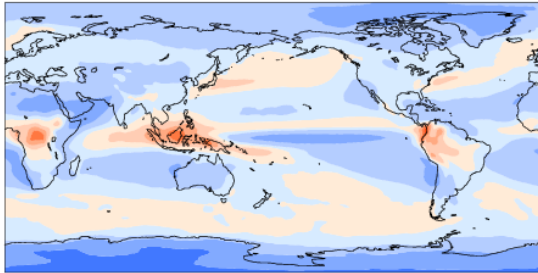
TOA LW CRE ANN

alpha6

alpha8

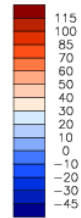
1850_alpha6_01_(0011-0020) (yrs 0011-0020)

TOA LW cloud forcing mean= 24.01 W/m²



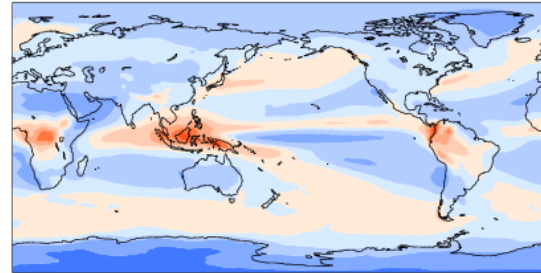
ANN

Min = -1.24 Max = 77.89



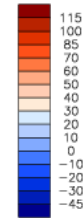
20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (yrs 0011-0020)

TOA LW cloud forcing mean= 24.72 W/m²



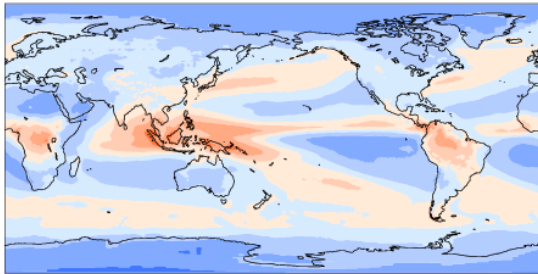
ANN

Min = -1.25 Max = 82.77

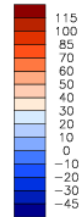


CERES-EBAF

TOA LW cloud forcing mean= 26.07 W/m²

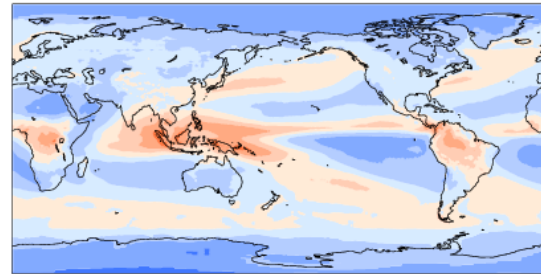


Min = -0.88 Max = 71.64

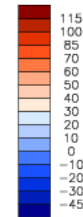


CERES-EBAF

TOA LW cloud forcing mean= 26.07 W/m²

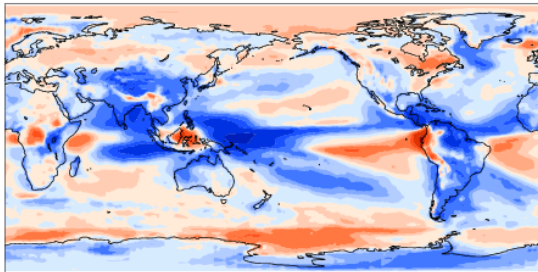


Min = -0.88 Max = 71.64

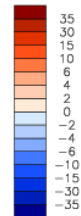


1850_alpha6_01_(0011-0020) - CERES-EBAF

mean = -2.06 rmse = 6.17 W/m²

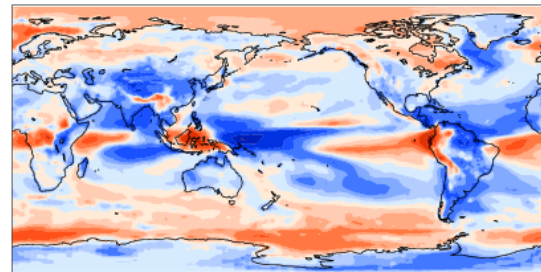


Min = -34.61 Max = 46.39

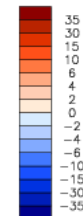


20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison - CERES-EBAF

mean = -1.34 rmse = 5.92 W/m²



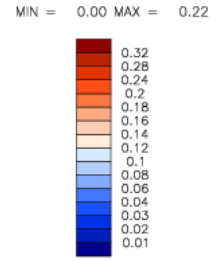
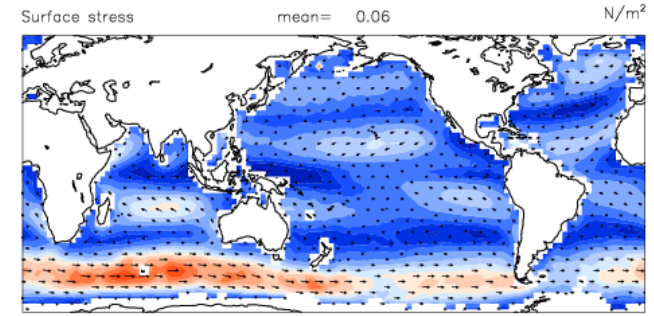
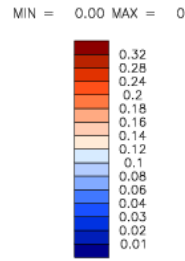
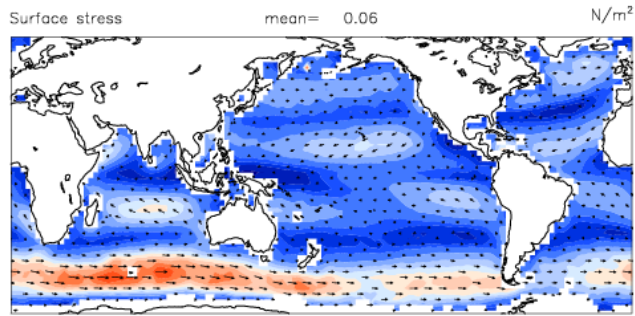
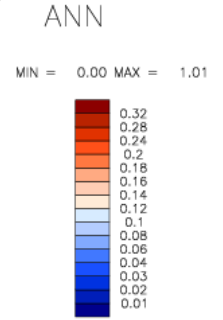
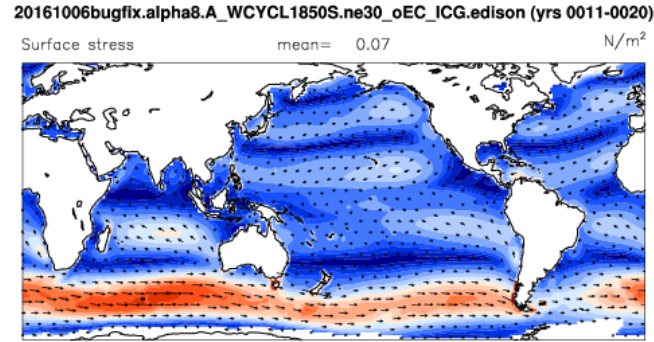
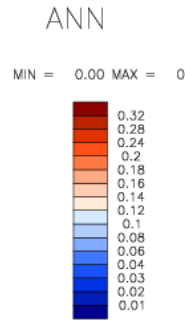
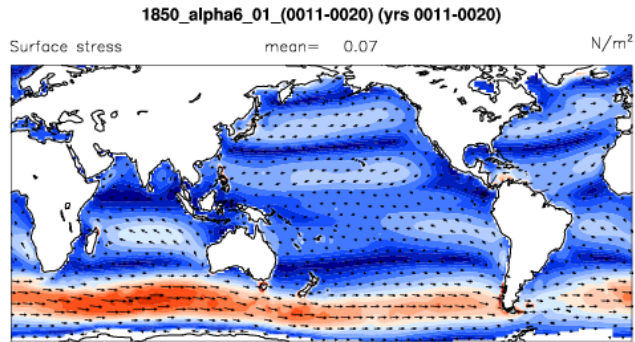
Min = -35.54 Max = 48.76



Surface wind stress (ocean) ANN

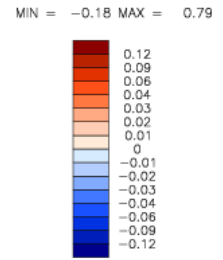
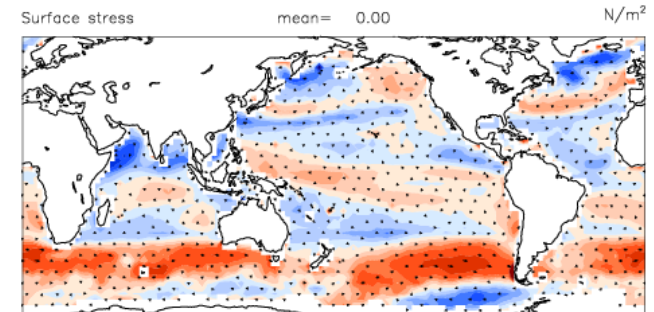
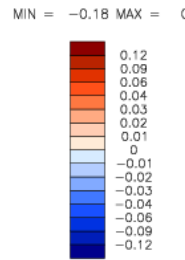
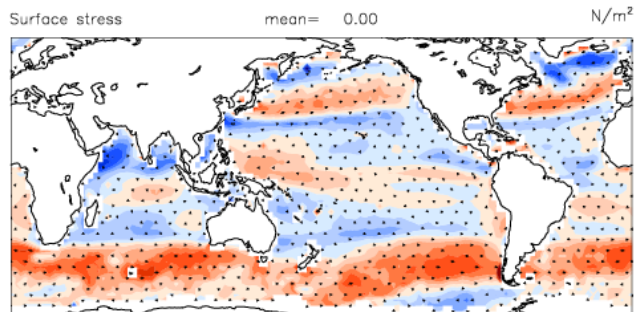
alpha6

alpha8

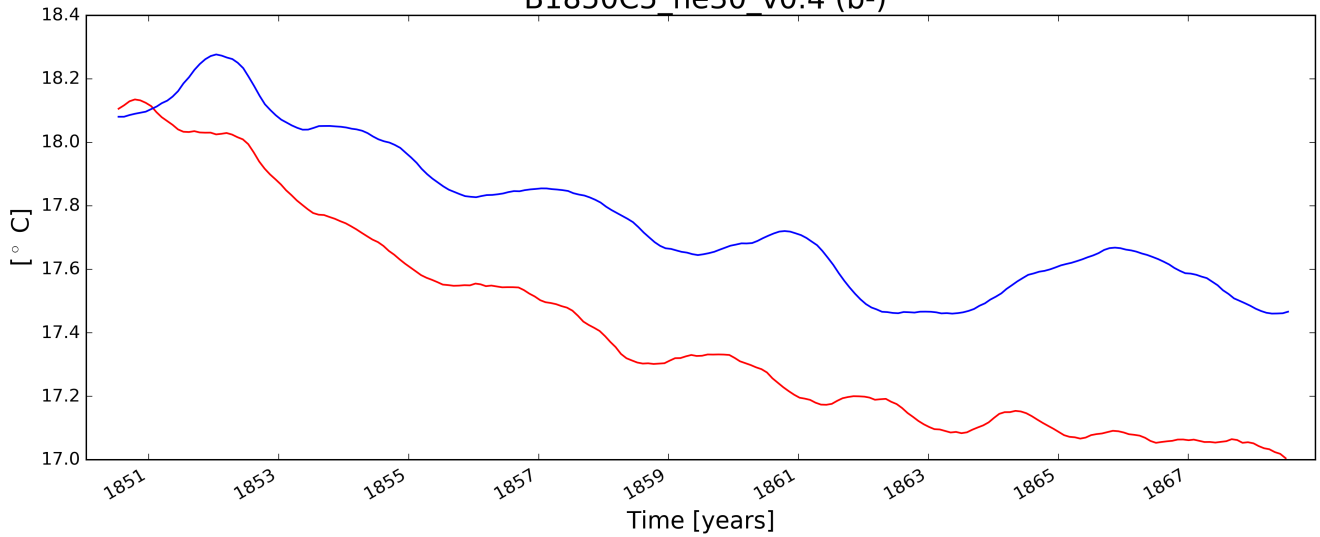


1850_alpha6_01_(0011-0020) - ERS

20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison - ERS



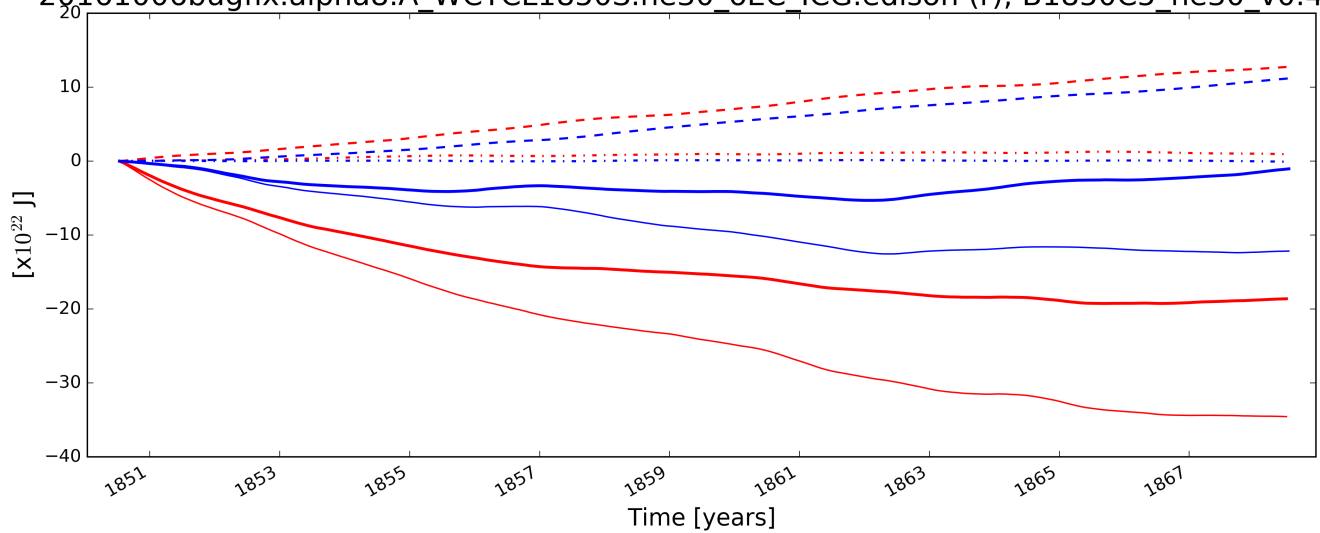
SST, Global Ocean, 20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (r-)
B1850C5_ne30_v0.4 (b-)



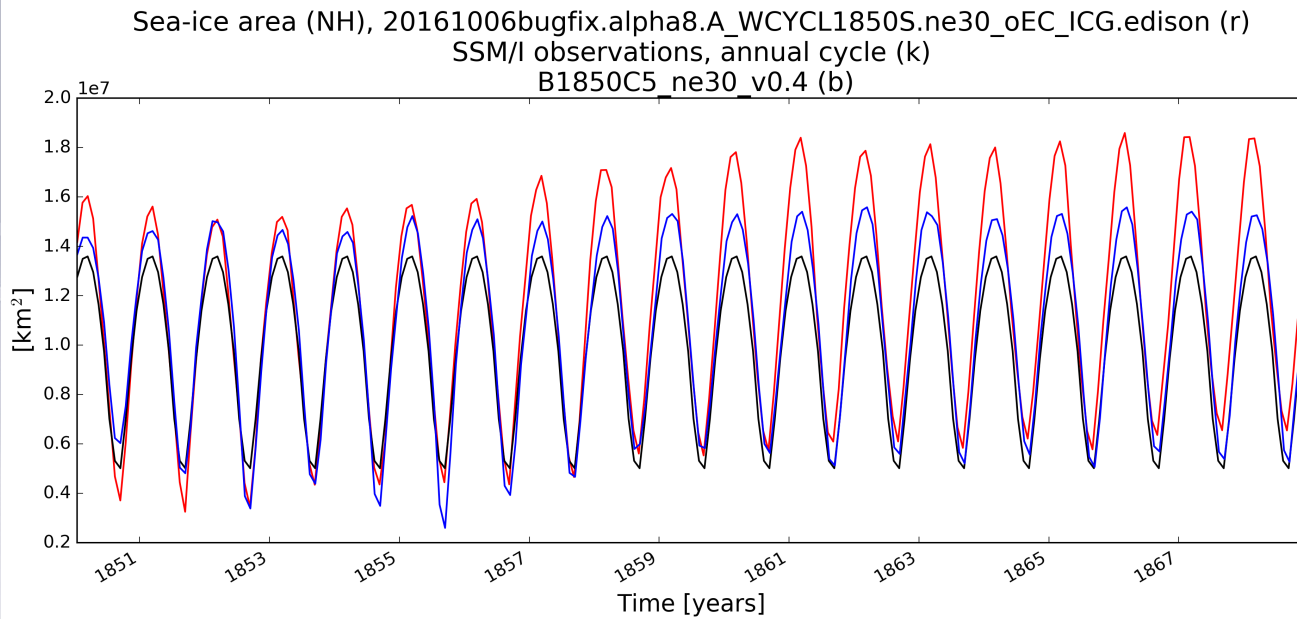
ACME v0

ACME v1 alpha8

OHC, Global Ocean, 0-bottom (thick-), 0-700m (thin-), 700-2000m (--), 2000m-bottom (-.)
20161006bugfix.alpha8.A_WCYCL1850S.ne30_oEC_ICG.edison (r), B1850C5_ne30_v0.4 (b)



NH

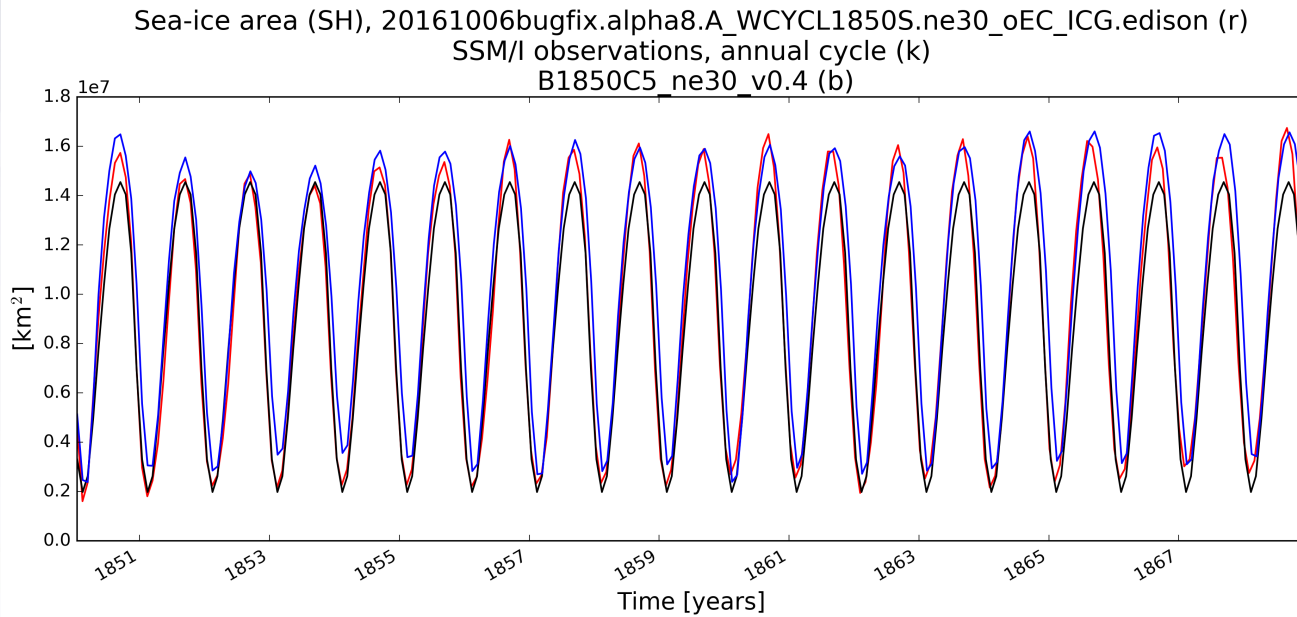


ACME v1 alpha8

ACME v0

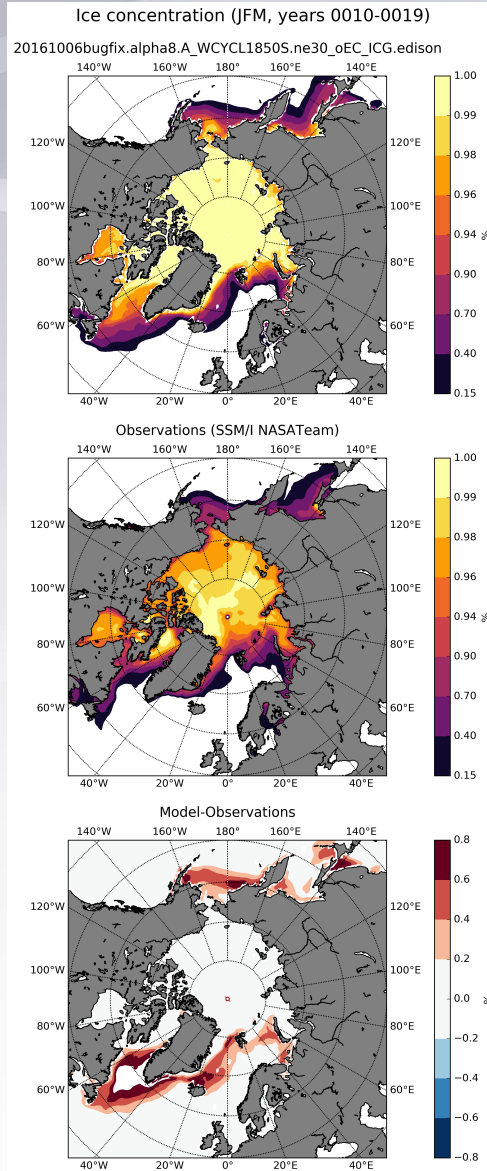
PD climatology

SH

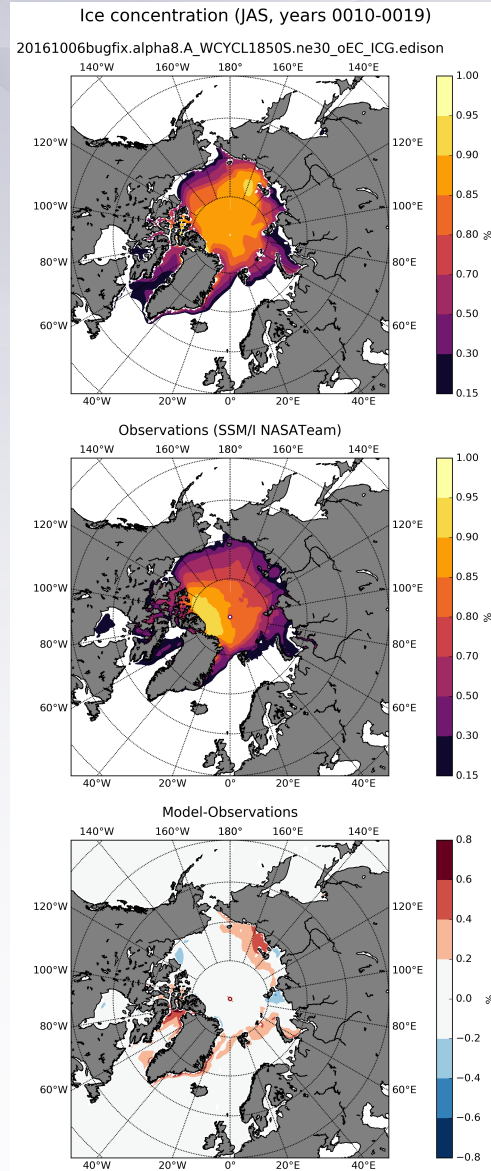


NH ice concentration

JFM



JAS



Looking ahead: what we need

- **A well performing model...**
- **Computational resources**
 - compute hours, post-processing machines, disk, HPSS, ...
- **Compsets**
- **Output** variables and frequency
 - what to save, what to publish
 - satisfy CMIP requirements for output
 - reconcile against available resources
- **Tools** to help run and monitor simulations
- **Post-processing**
 - time series and climatology files, regridding
 - CMORization
 - publishing
 - data archiving
- **Diagnostic suites**