

Introduction to E3SM Diagnostics Package (e3sm_diags v2)

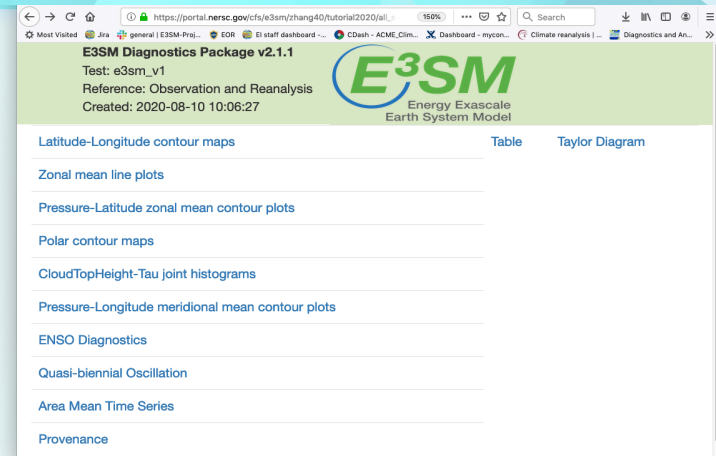
Core Development Team: Jill Chengzhu Zhang, Ryan Forsyth, Chris Golaz and Zeshawn Shaheen
Lawrence Livermore National Lab

Contributors: Xylar Asay-Davis, Charlie Zender, Sterling Baldwin

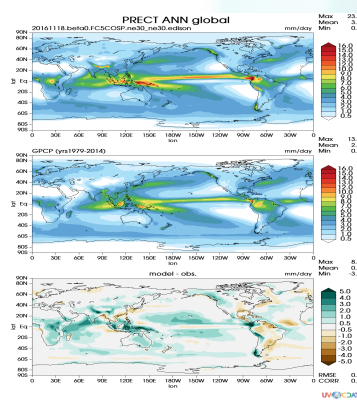
Chris Terai, Salil Mahajan, Tian Zhou, Wuyin Lin, Karthik Balaguru, Qi Tang and many others from E3SM

Introduction

- A **modern, Python-based** diagnostics package developed for supporting E3SM model development.
- Modeled after NCAR's atmosphere diagnostics package with key sets implemented.
- Focuses on atmospheric variables. Support for land/river variables is ongoing.
- Features:
 - ✓ Flexible to add new observational datasets/diagnostics, modify figures.
 - ✓ Easy installation, configuration, and execution.
 - ✓ Runs fast using multi-processing.
 - ✓ Provenance saved for reproducing diags figures.
- Maintain an **updated** observational data repository.
- A **community tool** that accommodates CMIP convention.



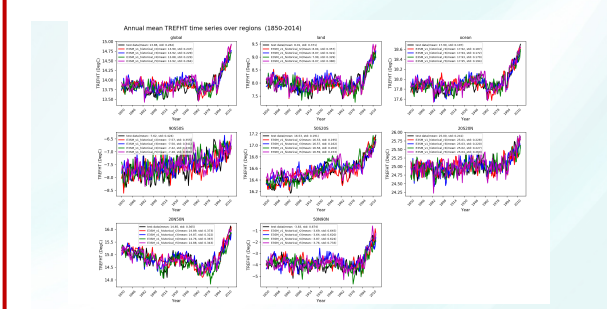
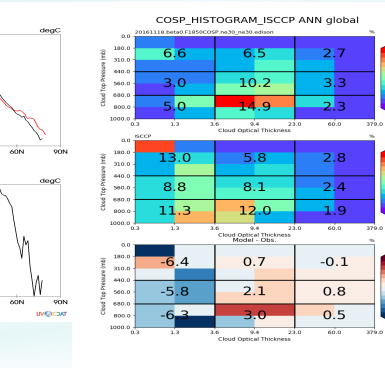
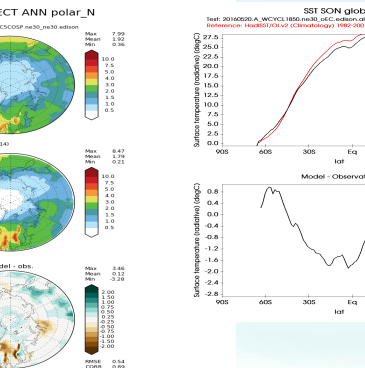
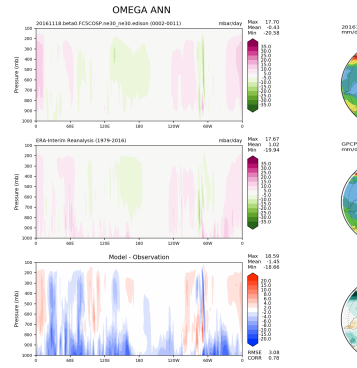
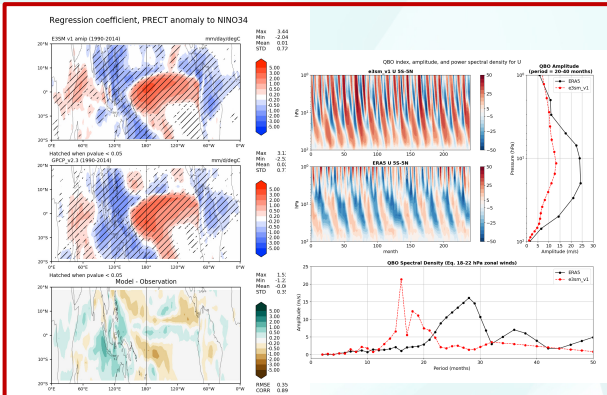
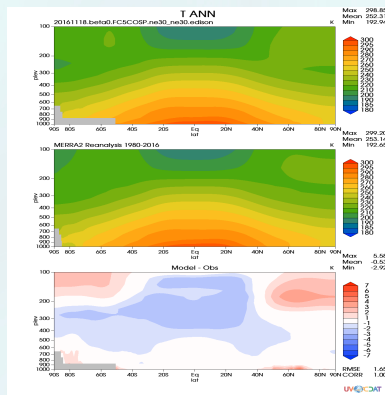
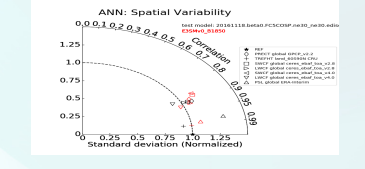
Current Available Sets



Model Name: 20161118_beta01_FCISOSP_m30_m30_ensemble

ANN Mean

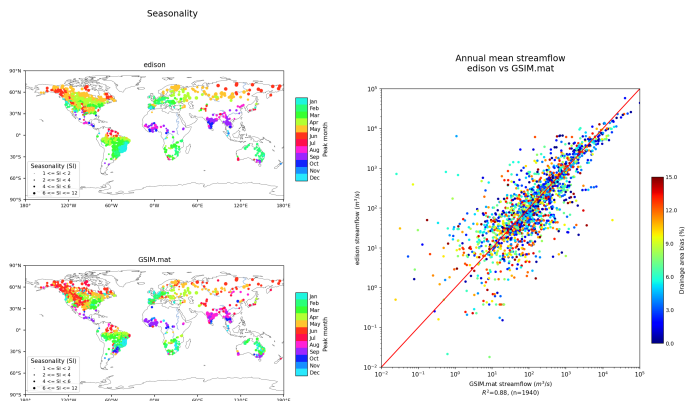
Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023



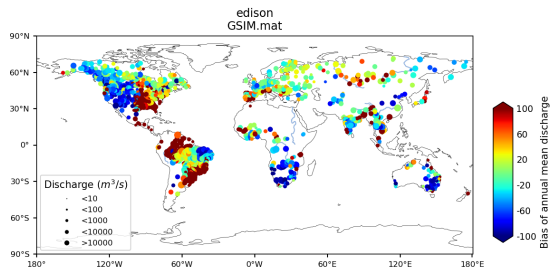
Core Sets

ENSO diags and QBO diags
Annual mean time series

Coming Soon in Next Release (v2.3.0)

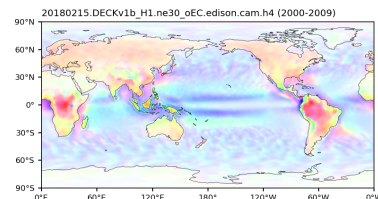


Bias of Annual Mean Discharge

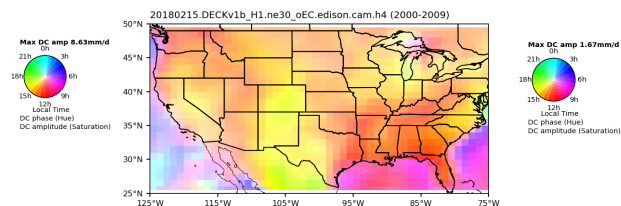


Streamflow diagnostics based on GSIM gauge data
Diurnal cycle of precipitation using TRMM [0.25 deg]

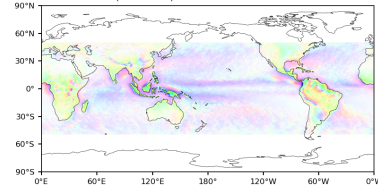
PRECT Diurnal Cycle ANN global



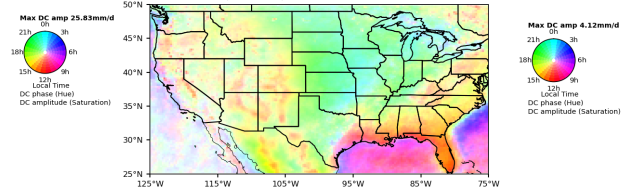
PRECT Diurnal Cycle ANN CONUS



TRMM-3B43v-7 (1998-2013)



TRMM-3B43v-7 (1998-2013)



Input Data Requirement

- Support data on regular latitude-longitude grids (not support raw EAM output)
 - [Preprocessing through NCO](#) to generate regrided climo and time series files
- Use seasonal climatology data as input for core set
 - `ncclimo -s start_yr -e end_yr -c run_id -i drc_in -o drc_out -r map_fl -O drc_rgr \`
`-a sdd --no_amwg_links`
 - Filename: 20180215.DECKv1b_H1.ne30_oEC.edison_ANN_200001_200112_climo.nc
- Use monthly time series data as input for both core and new sets
 - # Pipe list to stdin
 - `cd $drc_in;ls *cam*200[1-9]*.nc | ncclimo -v TREFHT -s 1 -e 9 -o drc_out -r map_fl -O drc_rgr`
 - Filename: TREFHT_185001_201312.nc or tas_185001_201312.nc or tas_185001_201312.xml
- [Example data](#)

Installation

- Run on Linux or MacOS machines/ or use the latest version
 - Install [Miniconda](#) and initialize conda.
 - Create conda env from an [e3sm_diags_env.yml file](#)
 - Activate conda env
 - Download obs and sample model data for testing available from E3SM data server
Obs: [climatology](#) and [time-series](#)[Example testing data](#)
- On E3SM supported machines (Cori, Compy, Acme1, Anvil, Cooley, Rhea)
 - **source <activation_path>/load_latest_e3sm_unified.sh**
 - [Paths to activation scripts of different machines](#)
 - Observation data and example data for testing are available on these machines

Configuration and Run: All Sets

- **Run: Python tutorial_2020_all_sets.py**

```
import os
from acme_diags.run import runner
from acme_diags.parameter.core_parameter import CoreParameter
from acme_diags.parameter.area_mean_time_series_parameter import AreaMeanTimeSeriesParameter
from acme_diags.parameter.enso_diags_parameter import EnsoDiagsParameter
from acme_diags.parameter.qbo_parameter import QboParameter

param = CoreParameter()

param.reference_data_path = '/global/cfs/cdirs/e3sm/acme_diags/obs_for_e3sm_diags/climatology'
param.test_data_path = '/global/cfs/cdirs/e3sm/acme_diags/test_model_data_for_acme_diags/climatology/'
param.test_name = '20161118.beta0.FC5COSP.ne30_ne30.edison'
param.seasons = ["ANN", "JJA"]

prefix = '/global/cfs/cdirs/e3sm/www/zhang40/tutorial2020'
param.results_dir = os.path.join(prefix, 'all_sets_10yr')
param.multiprocessing = True
param.num_workers = 30
```

Continue

Configuration and Run: all sets

- **Run: Python tutorial_2020_all_sets.py**

```
#Set specific parameters for new sets
enso_param = EnsoDiagsParameter()
enso_param.reference_data_path = '/global/cfs/cdirs/e3sm/acme_diags/obs_for_e3sm_diags/time-series/'
enso_param.test_data_path = '/global/cfs/cdirs/e3sm/acme_diags/test_model_data_for_acme_diags/time-series/E3SM_v1/'
enso_param.test_name = 'e3sm_v1'
enso_param.start_yr = '1990'
enso_param.end_yr = '1999'

qbo_param = QboParameter()
qbo_param.reference_data_path = '/global/cfs/cdirs/e3sm/acme_diags/obs_for_e3sm_diags/time-series/'
qbo_param.test_data_path = '/global/cfs/cdirs/e3sm/acme_diags/test_model_data_for_acme_diags/time-series/E3SM_v1/'
qbo_param.test_name = 'e3sm_v1'
qbo_param.start_yr = '1990'
qbo_param.end_yr = '1999'

ts_param = AreaMeanTimeSeriesParameter()
ts_param.reference_data_path = '/global/cfs/cdirs/e3sm/acme_diags/obs_for_e3sm_diags/time-series/'
ts_param.test_data_path = '/global/cfs/cdirs/e3sm/acme_diags/test_model_data_for_acme_diags/time-series/E3SM_v1/'
ts_param.test_name = 'e3sm_v1'
ts_param.start_yr = '1990'
ts_param.end_yr = '1999'

runner.sets_to_run = ['lat_lon', 'zonal_mean_xy', 'zonal_mean_2d', 'polar', 'cosp_histogram', 'meridional_mean_2d', 'enso_diags', 'qbo', 'area_mean_time_series']
runner.run_diags([param, enso_param, qbo_param, ts_param])
```

[See output results](#)

Quick Guide on Cori NERSC

- SSH to cori
- Download tutorial examples: `wget https://raw.githubusercontent.com/E3SM-Project/e3sm_diags/master/examples/tutorials/tutorial_2020_all_sets.py`
- Edit script: `tutorial_2020_climo_sets.py`
 - Change `results_dir`
- `salloc --nodes=1 --partition=debug --time=00:30:00 -C haswell`
- `conda activate e3sm_diags_env`

(Alternatively, source

`/global/cfs/cdirs/e3sm/software/anaconda_envs/load_latest_e3sm_unified.sh`)

- `python tutorial_2020_climo_sets.py`
- Go through output at https://portal.nersc.gov/cfs/e3sm/zhang40/tutorial2020/all_sets/viewer/

How to Contribute

- Feature requests
- Share the data sets and Python-based script (including instructions on data pre-processing)
- [Developer's guide](#) on how to add new diagnostics set.
- We will help with providing skeleton codes and provide infrastructure help.
- Final touch-up: linking viewers, code structure re-org, testing etc.

Thank you!

Please try it out and give us your feedback 😊

GitHub: https://github.com/E3SM-Project/e3sm_diags

Documentation on quick guide and more examples:

https://e3sm-project.github.io/e3sm_diags/docs/html/index.html