CESM Diagnostics Packages Integration into the Workflow using Python

CESM Workshop – June 21, 2016
Alice Bertini – CSEG
aliceb@ucar.edu

Contributors:
CISL ASAP Group – Sheri Mickelson, Kevin Paul, John Dennis
CMIP6 CESM Workflow Group – Mariana Vertenstein, Gary Strand, Jim Edwards
Early Users – John Truesdale, Dave Bailey, Keith Oleson, Keith Lindsay, Cecile Hannay
Python Advice – Ben Andre
NCL Advice – Adam Phillips, Mary Haley
History and Motivation

1990’s through early 2000’s
The serial versions of the diagnostics were cumbersome to setup and took a loooooong time to run.
late 2000’s
Limited parallelism was introduced to create averages and climatology files using Swift
...BUT... the diagnostics were still cumbersome to setup and even harder to debug.
Starting in 2015...
A framework is built to support light weight parallel python tools that are used to create the averages and climatology files and to run plotting routines in parallel.
User Requirements

1. Use the existing CESM working group diagnostics packages
2. Provide an extensible framework to easily add new diagnostics plots and tables in NCL, Python or any other language
3. Provide an easily configurable interface to control options for each diagnostics package
4. Integrate the running of the diagnostics into the CESM workflow tools
1. Use the existing CESM working group diagnostics packages
2. Provide an extensible framework to easily add new diagnostics plots and tables in NCL, Python or any other language.
2. Provide an extensible framework to easily add new diagnostics plots and tables in NCL, Python or any other language (continued)

Each diagnostic type is a python “class” with the following methods:
- Initialize
- Check prerequisites pertaining to all plot “classes”
- Run plot “classes” in parallel
- Create HTML

Examples of Diagnostic Types: Model vs. Observations, Model vs. Model, Model Time Series, Model Variability

Each plot module is a python “class” with the following methods:
- Initialize
- Check prerequisites
- Generate plots
- Create Plot HTML

Examples of Plot “classes”: Ocean 2D Surface Fluxes, Atmospheric Seasonal Global and Regional Means and RMSE, NH and SH Sea Ice Contour Plots, RTM River flow and discharge to oceans
3. Provide an easily configurable interface to control options for each diagnostics packages

 env_diags_[component]. xml with id / value pairs
  * component is atm, ice, lnd, or ocn

Examples:

<!-- Compute climatologies for CASE1. -->
<entry id="LNDDIAG COMPUTE CLIMO CASE1" value="False" />

<!-- Output file names for CASE1 climos -->
<entry id="LNDDIAG_prefix_1" value="$CASE.$LNDDIAG_lnd_modelstream_1." />

Tool to modify and query the XML in the post processing caseroot directory:
pp_config –set id=value
pp_config –get id [-value]
xmllint –schema [POSTPROCESS_PATH]/Tools/env_file.xsd env_diags_[component].xml
4. Integrate the running of the diagnostics into the CESM workflow tools

Notes:
- Diagnostics can be run using history slice or variable time series input files
- Diagnostics can be submitted in parallel
Use Cases

• Stand alone post processing
  – CESM output history slice data OR variable time series data without a CESM caseroot

• Non stand alone post processing
  – CESM caseroot exists regardless of CESM version

Command Examples on Yellowstone:

```bash
create_python_env -machine [machine] -cimeroot [path_to_cimeroot]
* Once per post processing tag download
create_postprocess -caseroot [path_to_caseroot]
  • for each case to be post processed
Edit XML env_diags_[component].xml files using pp_config -set
bsub < timeseries * optional
bsub < [component]_averages
bsub < [atm,lnd]_regrid * optional
bsub < [component]_diagnostics

* component is atm, ice, lnd, or ocn
```
Code Repositories

SVN – code https://svn-ccsm-models.cgd.ucar.edu/postprocessing/
Github – Project Issues and Documentation https://github.com/NCAR/CESM_postprocessing

CESM Python Post Processing Users Guide
Alice Bertini edited this page 2 days ago · 5 revisions

 CESM Python Post Processing Users Guide

Authors: NCAR - CESM Software Engineering Group
Version: 0.1.0

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System requirements and dependencies
Downloading the code
Setting up the python virtualenv using create_python_env
Setting up a post processing case files using create_postprocess
Customizing post processing settings using pp_config
Running post processing script to convert history time-slice data to variable time-series files
Questions?
What we do in the Shadows (Clement, Waititi, 2014)

Borat: Cultural Learnings of America for Make Benefit Glorious Nation of Kazakhstan (Charles, 2006)

This is Spinal Tap (Reiner, 1984)

Best in Show (Guest, 2000)

Despicable Me (Coffin, Renaud, 2010)

Silicon Valley (Altshuler, Judge, Krinsky, 2014-2016)