

# ACME atmosphere Priority Metrics

Thanks to Salil Mahajan and Susannah Burrows as major developers for the effort I will present and use to start discussions today

# ACME atmosphere needs quick look diagnostics

- Python based
- Validation of metrics
- Extensible to include tier1B
- Quick and easy to run
- Reproducibility: produces midlevel data that is used to create plots
- Conda based to enable other packages (ncl, UVCDAT)
- Similar to what people do now with AMWG with some key improvements

[http://portal.nersc.gov/project/acme/milena/coupled\\_diagnostics\\_20160805v0atm.A\\_WCYCL1850\\_v0atm.ne30\\_oEC.edison.alpha7\\_00-obs/](http://portal.nersc.gov/project/acme/milena/coupled_diagnostics_20160805v0atm.A_WCYCL1850_v0atm.ne30_oEC.edison.alpha7_00-obs/)

portal.nersc.gov

## ACME Coupled Priority Metrics

Accelerated Climate Modeling for Energy

20160805v0atm.A\_WCYCL1850\_v0atm.ne30\_oEC.edison.alpha7\_00 (Years: 6-10)  
vs.  
obs (climo)

### Time Series Plots: Global and Zonal-band means (ATM)

20160805v0atm.A\_WCYCL1850\_v0atm.ne30\_oEC.edison.alpha7\_00 (Years: 1-10)  
obs (climo)

**Precipitation (GPCP)**  
[PRECT](#) Precipitation Rate

**Radiation (CERES-EBAF)**  
[RESTOM](#) TOM Net Radiative Flux  
[FLNT](#) TOM Net LW Flux  
[FSNT](#) TOM Net SW Flux

### Time Series Plots: Global/Hemispheric means (OCN/ICE)

[Global SST](#)  
[Global OHC](#)  
[NH Ice Area](#)  
[SH Ice Area](#)  
[NH Ice Volume](#)  
[SH Ice Volume](#)

### Climatology Plots (ATM)

20160805v0atm.A\_WCYCL1850\_v0atm.ne30\_oEC.edison.alpha7\_00 (Years: 6-10)  
obs (climo)

Precipitation (GPCP)		DJF JJA ANN
<a href="#">PRECT</a>	Precipitation Rate	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>

Radiation (CERES-EBAF)		DJF JJA ANN
<a href="#">FSNTOA</a>	TOA net SW flux	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>
<a href="#">FLUT</a>	TOA upward LW flux	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>
<a href="#">SWCF</a>	TOA shortwave cloud forcing	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>
<a href="#">LWCF</a>	TOA longwave cloud forcing	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>

Wind (ERS)		DJF JJA ANN
<a href="#">TAU</a>	Ocean Wind Stress	<a href="#">plot</a> <a href="#">plot</a> <a href="#">plot</a>

### Climatology Plots (OCN/ICE)

#### Northern Hemisphere

Ice Conc.	<a href="#">SSM/I Bootstrap</a>	<a href="#">JFM JAS</a>
	Ice concentration	<a href="#">plot</a> <a href="#">plot</a>
Ice Conc.	<a href="#">SSM/I NASA Team</a>	<a href="#">JFM JAS</a>
	Ice concentration	<a href="#">plot</a> <a href="#">plot</a>
Ice Thick.	<a href="#">ICE Sat</a>	<a href="#">FM ON</a>
	Ice Thickness	<a href="#">plot</a> <a href="#">plot</a>

#### Southern Hemisphere

Ice Conc.	<a href="#">SSM/I Bootstrap</a>	<a href="#">DJF JJA</a>
	Ice concentration	<a href="#">plot</a> <a href="#">plot</a>
Ice Conc.	<a href="#">SSM/I NASA Team</a>	<a href="#">JFM JAS</a>
	Ice concentration	<a href="#">plot</a> <a href="#">plot</a>
Ice Thick.	<a href="#">ICE Sat</a>	<a href="#">FM ON</a>
	Ice Thickness	<a href="#">plot</a> <a href="#">plot</a>

# ACME Coupled Priority Metrics

## ⊗ Steps to run the package:

### 1. Choose a machine:

1. Edison
2. Rhea
3. AIMS (Kate still todo)

**Note:** the script that works on Edison should work on Cori as well. Once this is tested, we can change its name to something more general (e.g., run\_NERSC instead of run\_EDISON).

### 2. System Set-up:

- ⊗ None (anaconda-2.7-climate environment is used)

### 3. Get the scripts from github

### 4. Edit a single run script:

- ⊗ Point to directories, casenames, options to compute climos, etc.

### 5. Run on an interactive node or submit a job

### 6. View the webpage

# Grab from ACME github repo

- ⊗ `>git clone git@github.com:ACME-Climate/PreAndPostProcessingScripts.git`
- ⊗ `>cd PreandPostProcessingScripts`
- ⊗ `>git checkout origin/master` for the coupled model version
- ⊗ `>git checkout origin/kevans32_newdiags` for atm version
- ⊗ `>cd coupled_diags` (showing coupled for now)

# run\_EDISON.csh or run\_RHEA.csh

## 🎲 Example:

```
~ — corkscrew ssh -Y -o ProxyCommand=corkscrew snowman.ornl.gov 3128 %h %p salil@edison.nersc.gov — ttys005 — 266
#!/bin/csh

#Driver script to generate coupled diagnostics on rhea
#Basic usage:
#   1. set user defined case specific variables below
#   2. execute: csh run_edison.csh

#Meaning of acronyms/words used in variable names below:
#   test:      Test case
#   ref:       Reference case
#   ts:        Time series; e.g. test_begin_yr_ts, here ts refers to time series
#   climo:     Climatology
#   begin_yr:  Model year to start analysis
#   end_yr:    Model year to end analysis
#   condense:  Create a new file for each variable with time series data for that variable.
#             This is used to create climatology (if not pre-computed) and in generating time series plots
#   archive_dir: Location of model generated output directory
#   scratch_dir: Location of directory where the user wants to store files generated by the diagnostics.
#             This includes climos, remapped climos, condensed files and data files used for plotting.

set projdir = /global/project/projectdirs/acme

#USER DEFINED CASE SPECIFIC VARIABLES TO SPECIFY (REQUIRED)

#Test case variables
setenv test_casename 20160520.A_WCYCL2000.ne30_oEC.edison.alpha6_01
setenv test_native_res ne30
setenv test_archive_dir /scratch1/scratchdirs/golaz/ACME_simulations
setenv test_short_term_archive 0
setenv test_begin_yr_climo 70
setenv test_end_yr_climo 100
setenv test_begin_yr_ts 1
setenv test_end_yr_ts 100
```

# run\_EDISON.csh or run\_RHEA.csh

⊗ Similarly for reference case:

```
~ — corkscrew ◀ ssh -Y -o ProxyCommand=corkscrew snowman.ornl.gov 3128 %h %p salil@edison.nersc.gov — ttys005 — #6
#Reference case variables (similar to test_case variables)
setenv ref_case 20160520.A_WCYCL1850.ne30_oEC.edison.alpha6_01
setenv ref_archive_dir /scratch1/scratchdirs/golaz/ACME_simulations
#setenv ref_case obs
#setenv ref_archive_dir $projdir/obs_for_diagnostics

#The following are ignored if ref_case is obs
setenv ref_native_res ne30
setenv ref_short_term_archive 0
setenv ref_begin_yr_climo 70
setenv ref_end_yr_climo 100
setenv ref_begin_yr_ts 70
setenv ref_end_yr_ts 100
□
```

61,0-1 27%

**Note #1:** Since ACME v1 ocn/ice are so different from v0, comparison with v0 has to be handled separately (v0 data needs to be pre-processed)

**Note #2:** The script currently handles comparison to ocn/ice v0 time-series only, but changes will be made soon to compare with v1 results as well

# Flags/Options

~ — corkscrew ◀ ssh -Y -o ProxyCommand=corkscrew snowman.ornl.gov 3128 %h %p salil@edison.nersc.gov — ttys005 — ⌘6

```
#Switches (True(1)/False(0)) to condense variables, compute climos, remap climos and condensed time series file
#If no pre-processing is done (climatology, remapping), all the switches below should be 1
setenv test_compute_climo          1
setenv test_remap_climo            1
setenv test_condense_field_climo   1      #ignored if test_compute_climo = 0
                                       #if test_condense_field_climo = 1 and test_compute_climo = 0
                                       #the script will look for a condensed file

setenv test_condense_field_ts      1
setenv test_remap_ts               1
```

37,1

20%

~ — corkscrew ◀ ssh -Y -o ProxyCommand=corkscrew snowman.ornl.gov 3128 %h %p salil@edison.nersc.gov — ttys005 — ⌘6

```
setenv ref_condense_field_climo    1
setenv ref_condense_field_ts       1
setenv ref_compute_climo           1
setenv ref_remap_climo             1
setenv ref_remap_ts                1
```

61,0-1

33%

# Run

## ⊗ Edison:

```
>./run_EDISON.csh
```

Or

```
>SBATCH run_EDISON.sl
```

Check status:

```
>sqsh -u $USERNAME
```

## • Rhea:

```
>./run_RHEA.csh
```

Or

```
>qsub run_RHEA.pbs
```

Check status:

```
>qstat -u $USERNAME
```

# Next steps for discussion

- Avoid use of shell scripts
- Use common packages to read netcdf, HDF etc
  - NCO
  - CDMS2
  - UVCDAT
- Matplotlib to plot , but folks can use other things if they are willing to maintain this on an “opt-in basis” (default is off and not required that software be built)
  - Ncl
  - Matlab
- Create functionality to have templates for different kinds of analysis and plots to scientists can grab an example and modify
- Need validation through a test for all analysis added to the package (see Mike Heroux talk)
- Develop convections for processing and display of data
- Further out: high quality PDF, interactive analysis..
- What else?

The screenshot shows the ACME Coupled Priority Metrics website. The header includes the ACME logo and the text "Accelerated Climate Modeling for Energy". The main content area is titled "20160805v0atm.A\_WCYCL1850\_v0atm.ne30\_oEC.edison.alpha7\_00 (Years: 6-10) vs. obs (climo)". Below this, there are sections for "Time Series Plots: Global and Zonal-band means (ATM)", "Time Series Plots: Global/Hemispheric means (OCN/ICE)", and "Climatology Plots (ATM)". The "Climatology Plots (ATM)" section is further divided into "Precipitation (GPCP)", "Radiation (CERES-EBAF)", and "Wind (ERS)". The "Climatology Plots (OCN/ICE)" section is divided into "Northern Hemisphere" and "Southern Hemisphere". Each section lists various variables and provides links to plots for different time periods (e.g., DJF, JJA, ANN).

# Goals for ACME

- ⊗ Software release with v1
- ⊗ Full documentation and validation
- ⊗ Papers can point to diags of runs they used to show validation?

Extra slides

# Edit run script: run\_Edison.csh or run\_Rhea.csh

## ⊗ TEST CASE SPECIFIC VARIABLES

<code>test_casename</code>	Name of model run case
<code>test_native_res</code>	Atmosphere resolution of the case (e.g. ne30, ne120)
<code>test_archive_dir</code>	Location of case output history files
<code>test_short_term_archive</code>	Short term archiving directory structure (Yes/No)  <b>Note:</b> short-term archiving does <b>not</b> currently work for MPAS
<code>test_begin_yr_climo</code>	Start year for computing climatology diagnostics
<code>test_end_yr_climo</code>	End year for computing climatology diagnostics
<code>test_begin_yr_ts</code>	Start year for computing time series diagnostics
<code>test_end_yr_ts</code>	End year for computing time series diagnostics

**Note:** last two variables are relevant for atm diags only (ocn/ice scripts load in all output files)

# Software Design

## ⊗ Steps

1. Extract variables into individual files (nco). Atmosphere only (ocn/ice use python 'xarray' to load in specific fields from many output files).
2. Compute climatologies (python scripts, ncclimo)
3. Remap files (ncremap)
4. Create plots (matplotlib)
5. Generate HTML page (csh script to create index.html)

## ⊗ Structure:

- ⊗ Each script creates separate log files
- ⊗ Intermediate files are saved
- ⊗ Final plot data files saved
- ⊗ Filenames structured.

# Software Design

## ❁ Flexible and Extensible

- ❁ All case information written to a file for other scripts to access.
- ❁ Variable list for analysis is read from a file.
  - ❁ Different lists for model vs model and model vs. obs
  - ❁ Different lists for climatology and time series analysis
- ❁ Variables belong to groups (Radiation – FLNT, FSNT etc.)
- ❁ List also contains information about interpolation grid
- ❁ Easy to add new variables
- ❁ Derived variables allowed
  - ❁ Required to add the formula to a python script as well (e.g. PRECT = PRECC + PRECL)
- ❁ Will soon mirror MPAS Analysis framework public repo (so that adapting the script to include more ocn/ice diags will be easier)

```
#!/bin/csh -f
set var_set = ()
set interp_grid_set = ()
set interp_method_set = ()
set var_group_set = ()
set var_name_set = ()

set source_var_set = ()
set source_interp_grid_set = ()
set source_interp_method_set = ()

#PRECT
set var_interp_grid = GPCP
set var_interp_method = conservative_mapping
set var_group = Precipitation

set var_set = ($var_set PRECT)
set interp_grid_set = ($interp_grid_set $var_interp_grid)
set interp_method_set = ($interp_method_set $var_interp_method)
set var_group_set = ($var_group_set $var_group)
set var_name_set = ($var_name_set:q "Precipitation Rate")

set source_var_set = ($source_var_set PRECC PRECL)
set source_interp_grid_set = ($source_interp_grid_set $var_interp_grid $var_interp_grid)
1,1 Top
```