

# Workflow in CESM2

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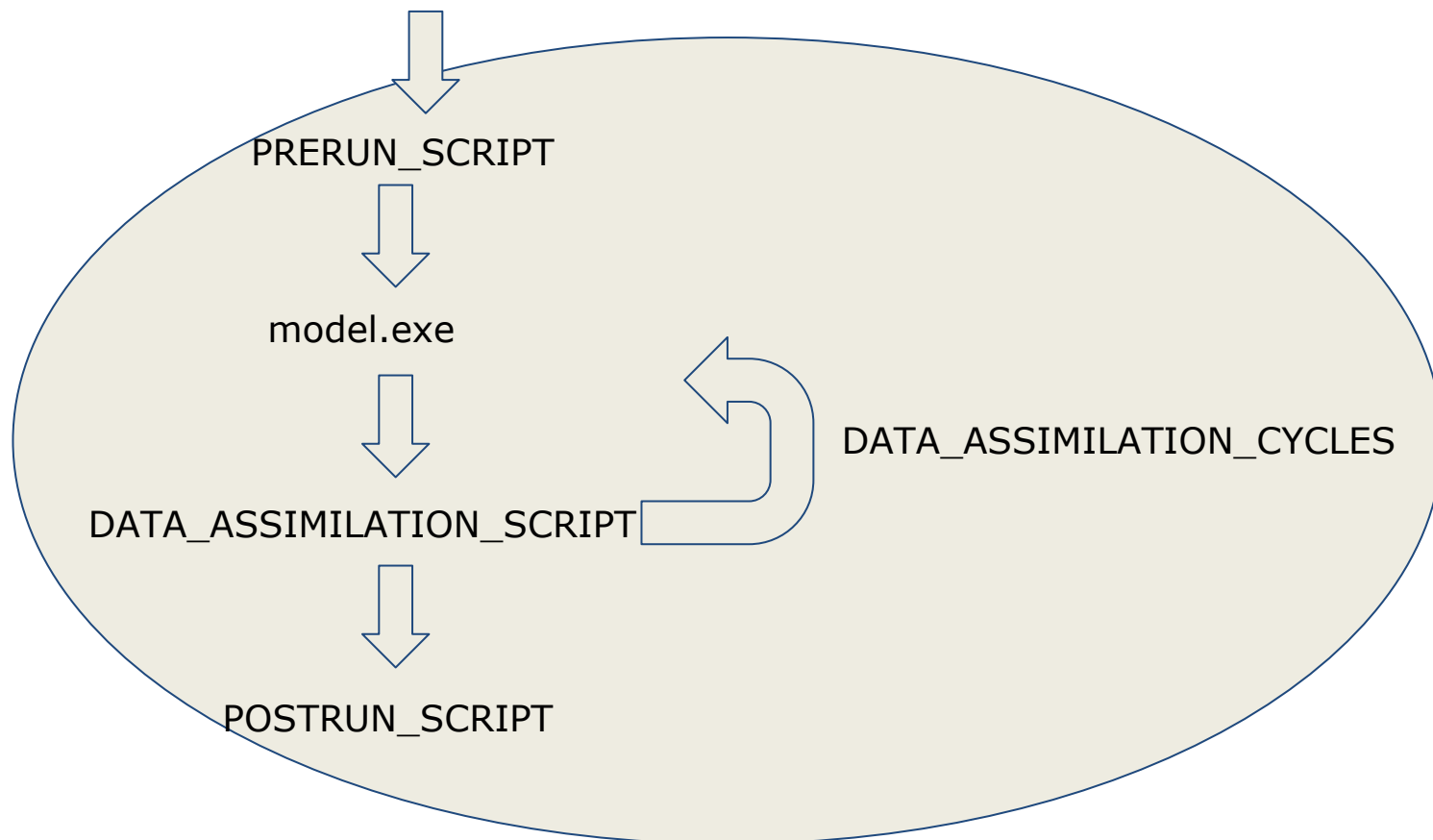
## **Workflow**

The sequence of steps involved in moving from the beginning to the end of a working process.

Many CESM workflows are mostly manual processes which require human intervention at multiple points.

The CIME workflow tools are designed to reduce human intervention to the extent possible.

## Workflow control within case.run



## **Workflow control in the case control system**

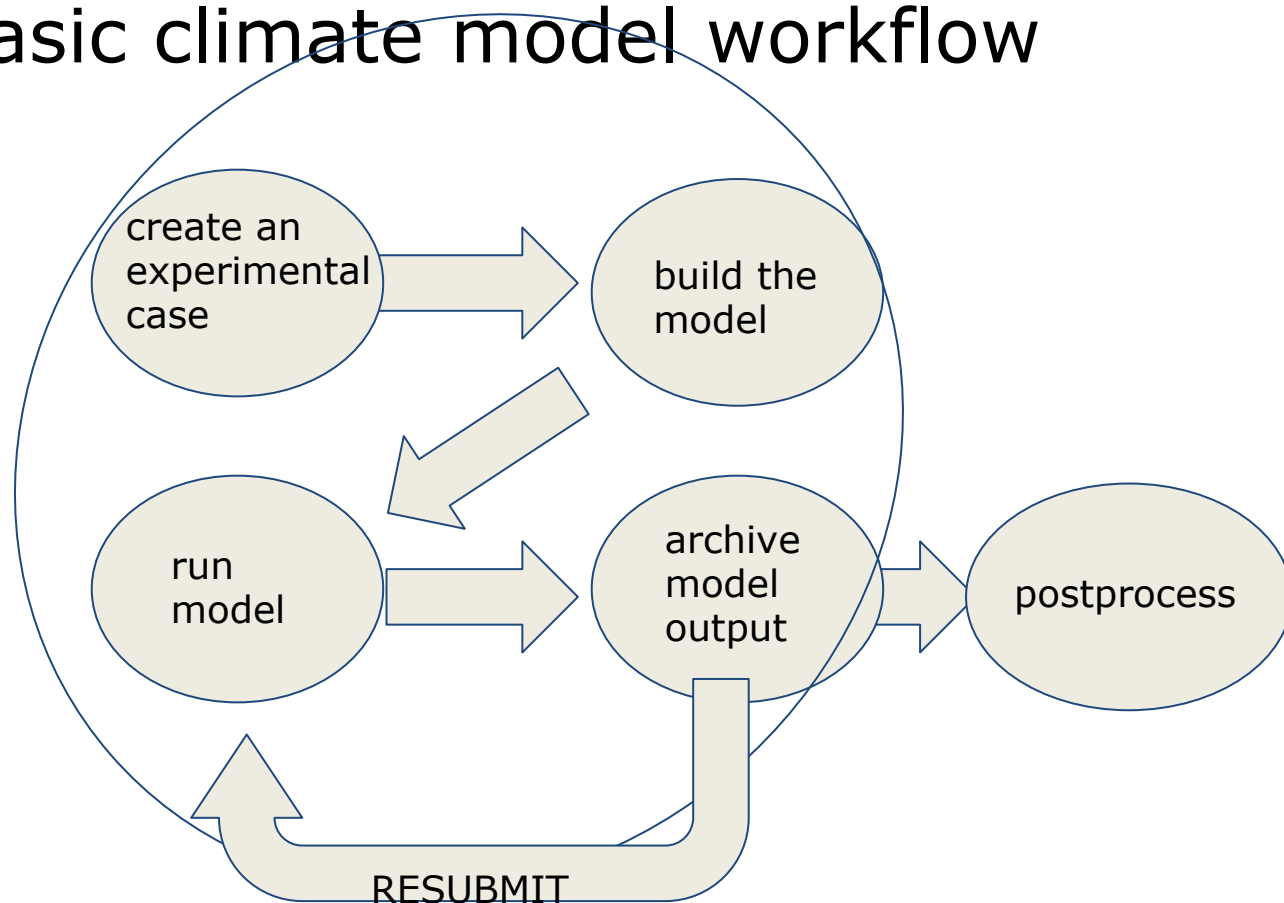
RESUBMIT: While RESUBMIT>0 upon completion of a case.run->archive cycle, the job is resubmitted to the queue and the RESUBMIT value is decremented.

CONTINUE\_RUN is set to True

(unless RESUBMIT\_SETS\_CONTINUE\_RUN=False)

The --resubmit-immediate option to the case.submit script will cause all RESUBMIT jobs to be submitted at once with queueing system dependancies.

## Basic climate model workflow



## Extending the workflow

Workflows are defined in:

`cime/config/cesm/machines/config_workflow.xml`

```
./create_newcase --case mycase01 --compset FHIST --res  
f19_f19_mg17 --workflow timeseries
```

This will add a timeseries generation step.

## **CCS workflow generator**

The CCS provides a basic workflow generator which uses queueing system native dependency tools to schedule jobs in a workflow.

Limitations:

- all jobs are submitted to queues
- no submission clock or calendar support
- limited to a single case

Use `preview_run` to view the current workflow.

## XML Elements of a workflow definition.

- workflow\_jobs {case, [prepend], [append]}
  - job {name}
    - template (script template to submit)
    - dependency (other job that must complete first)
    - prereq (logical to include in workflow)
    - runtime\_parameters
      - task\_count
      - tasks\_per\_node
      - walltime



## Controlling the Workflow

- **case.submit** (submits end-to-end workflow)
- **case.submit** --resubmit-immediate
- **case.submit** --job *case.st\_archive*
- **case.submit** --only-job *case.run*

# Ensemble Workflow

```
create_clone --clone mycase --case mycase01 --ensemble 8 --keepexe
```

Will create 8 new cases

mycase01 - mycase08 all using the cesm.exe from mycase.

## Adding CYLC

CCS provides a script **generate\_cylc\_workflow.py** to translate a CCS workflow to a CYLC suite.rc

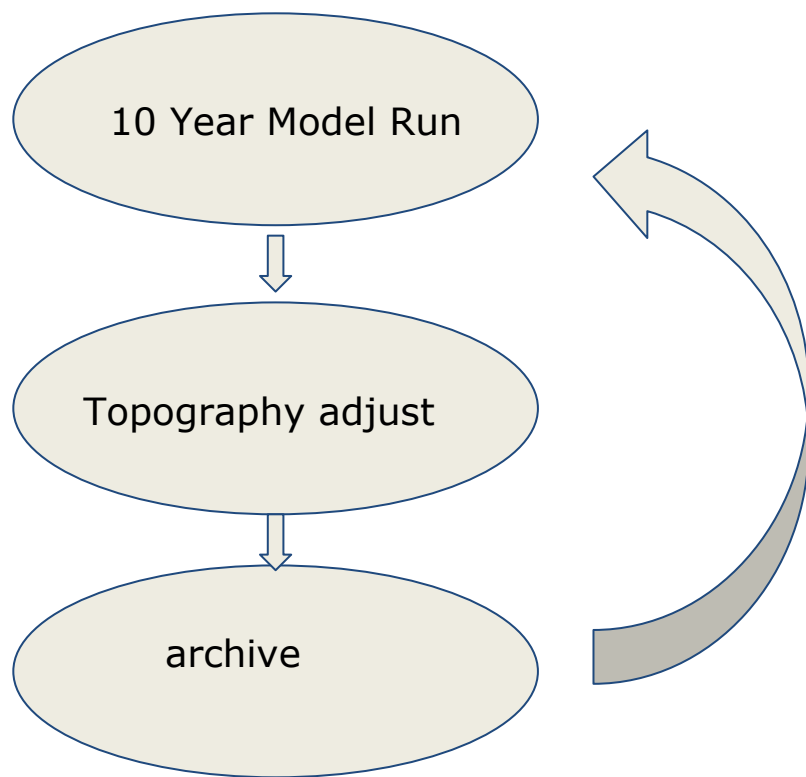
- Provides support for ensembles
- Allows the user to customize workflows with all of the extensive feature set of CYLC

<https://cylc.github.io/>

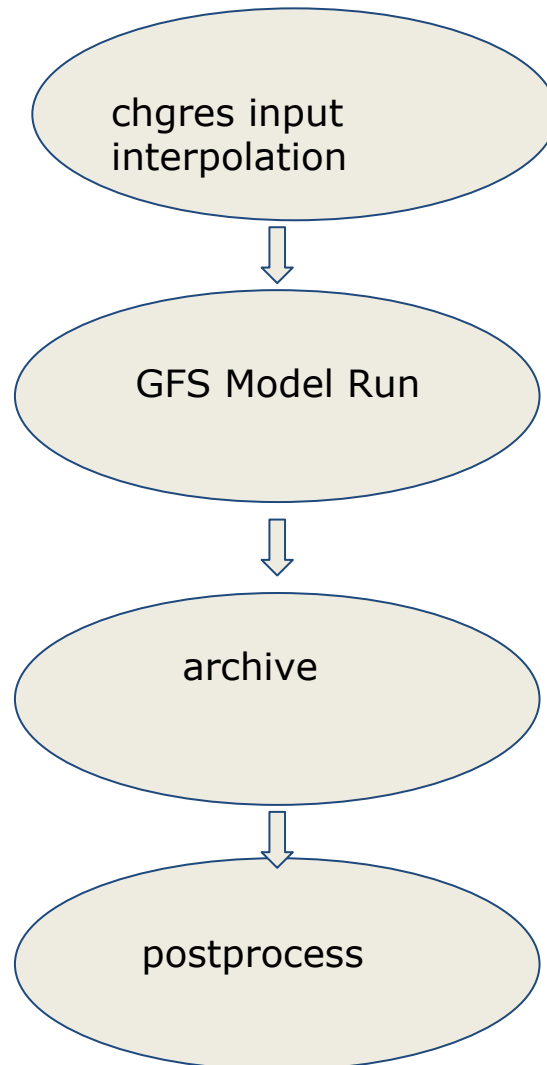
```
cime/scripts/Tools/create_cylc_workflow.py  
/glade/scratch/jedwards/mycase01 --ensemble 8 --cycles 14
```

Will create a CYLC suite.rc file to set RESUBMIT=8 and run the ensemble.

# Interglacial LandIce experiment

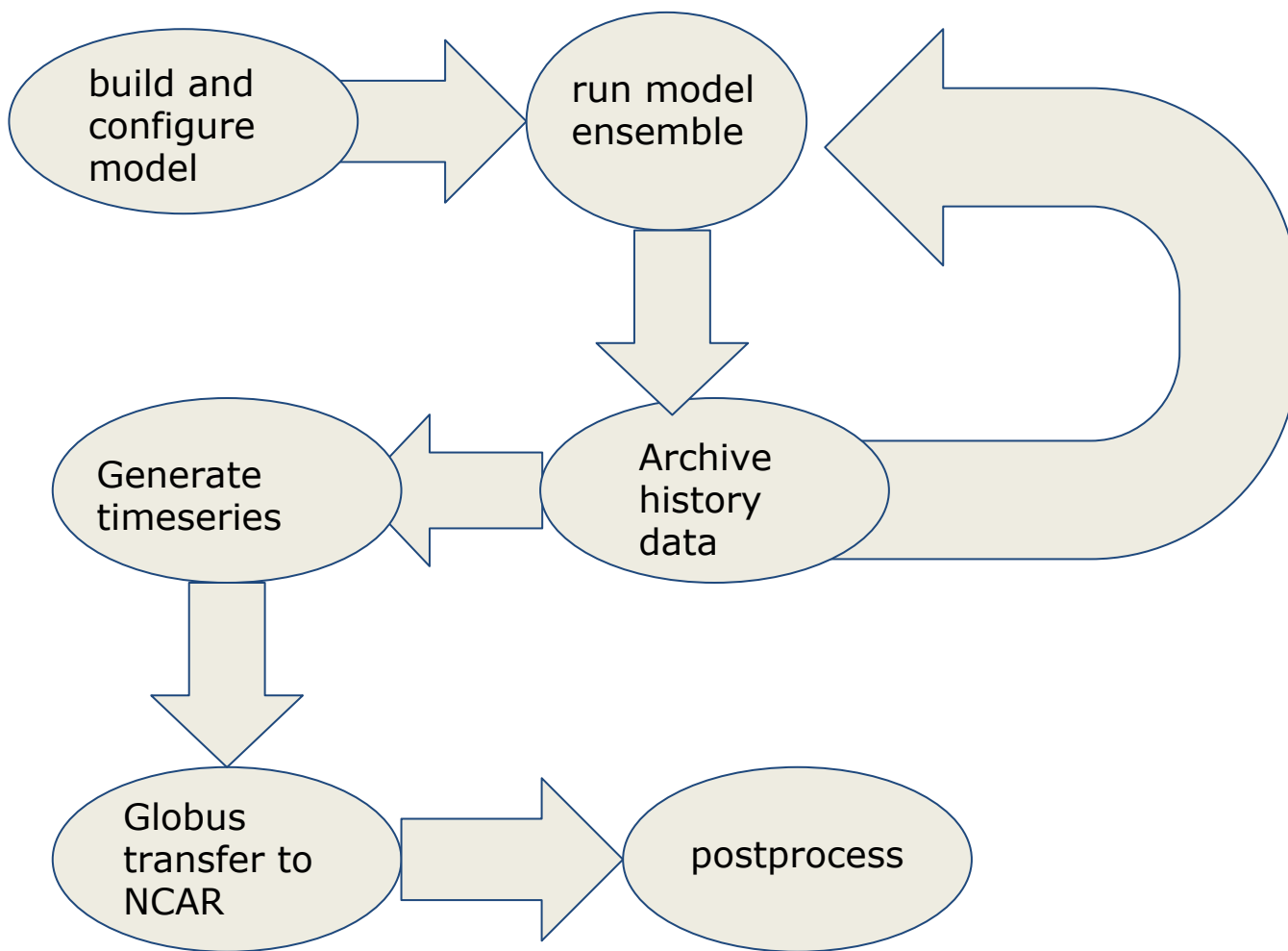


# MR Weather App



## **CESM2 Large Ensemble Experiment**

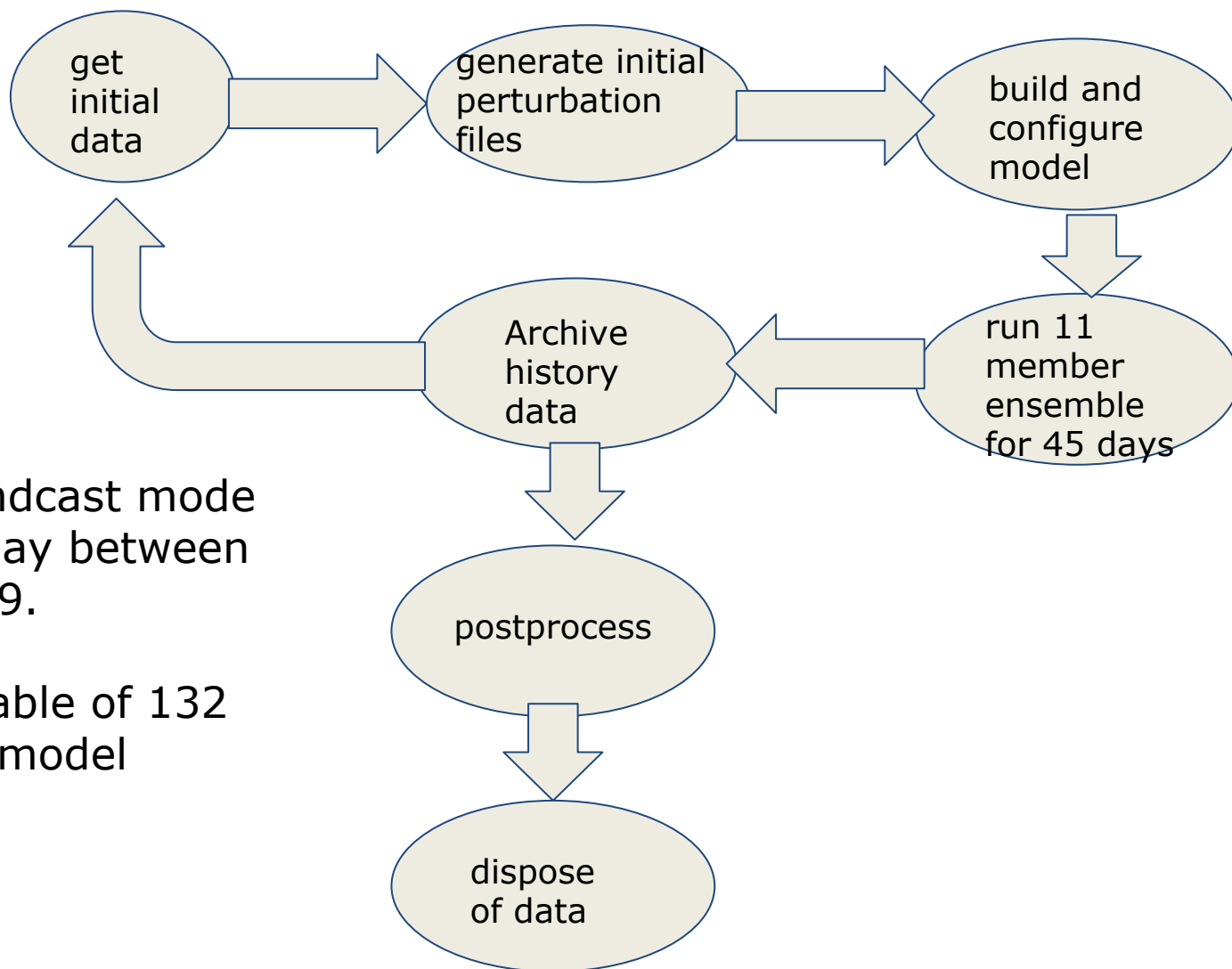
- Cooperative project with ICCP South Korea
- 100 member ensemble climate study running from 1850-2100
- Running on the ICCP system Aleph with postprocessing and data storage at NCAR



NCAR/ICCP CESM2 CMIP6 Large Ensemble  
Experiment Workflow



## Subseasonal to Seasonal prediction using CESM and CYLC



Running in hindcast mode for each Monday between 1999 and 2019.

Currently capable of 132 simultaneous model simulations.

# CIME

github repository:

<https://github.com/ESMCI/cime>

documentation:

[esmci.github.io/cime](https://esmci.github.io/cime)

developers guide:

<https://github.com/ESMCI/cime/wiki/CIME-Developers-Guide>

## Questions?

## Thank You

## **Foundational CESM2 workflow experience:**

We would like to acknowledge and credit the work done by NCAR's ASAP group, especially Sheri Mickelson, in instrumenting CESM2 with CYLC for the CMIP6 experiments.

- CMIP6 Experimental Status (since August 2018)
  - Have run **979 different CESM cases**.
  - Published **690 cases**.
  - Generated **~1.3 PB of compressed (lossless)** time series files.
  - Published **~310 TB** of compressed CMIP6 files to ESGF.