

# DART and CESM: Current Status



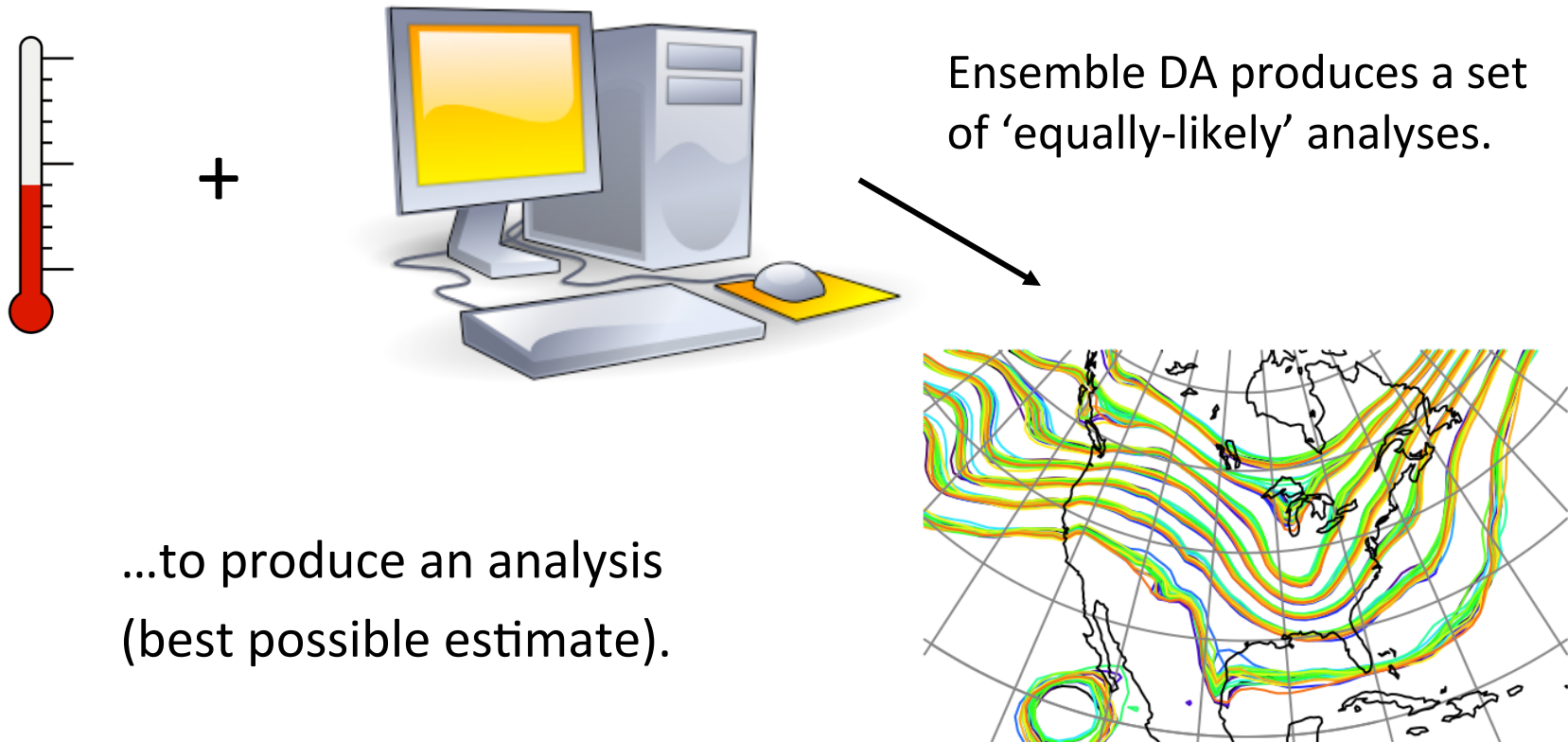
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NCAR Data Assimilation Research Section

With thanks to the DART Group (Jeff Anderson, Tim Hoar, Kevin Raeder) and the CESM Software Development Group (Mariana Vertenstein, Tony Craig, Jim Edwards)

# What is Data Assimilation?

Observations combined with a Model forecast...

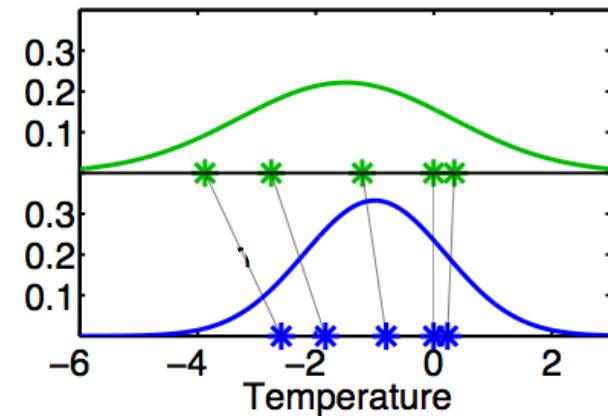
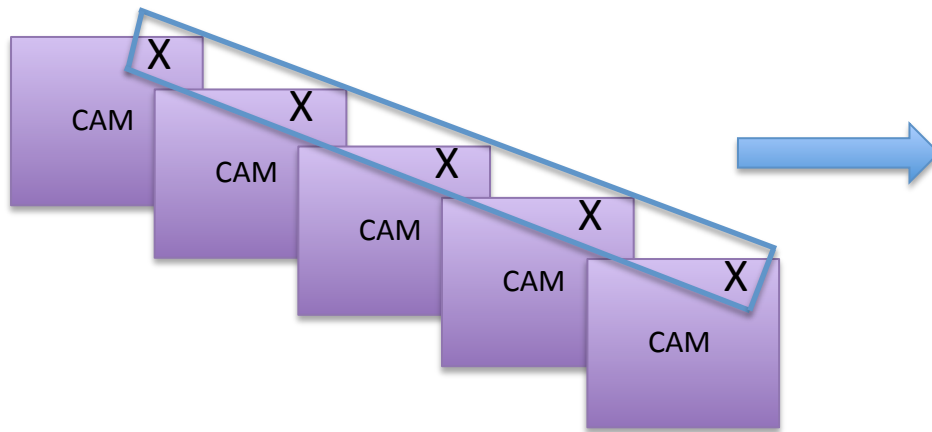


Ensemble DA produces a set of 'equally-likely' analyses.

...to produce an analysis  
(best possible estimate).

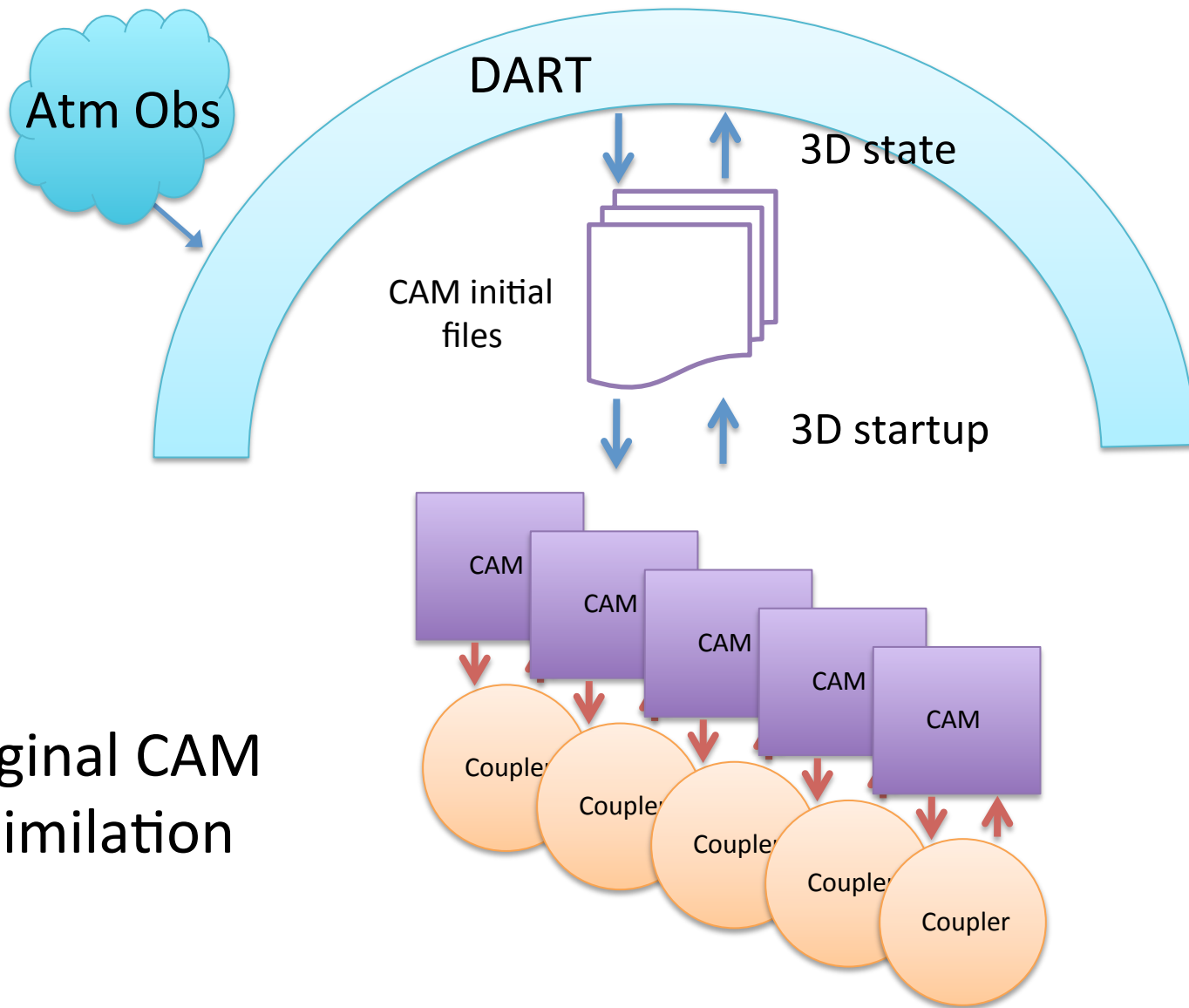
# Ensemble Data Assimilation

- Estimate observation values from N model states, compare to actual observation
- Difference of ensemble of estimated observations and actual observation is used to update ensemble of states
- Ensemble sizes of 20-100 members to accurately sample distributions

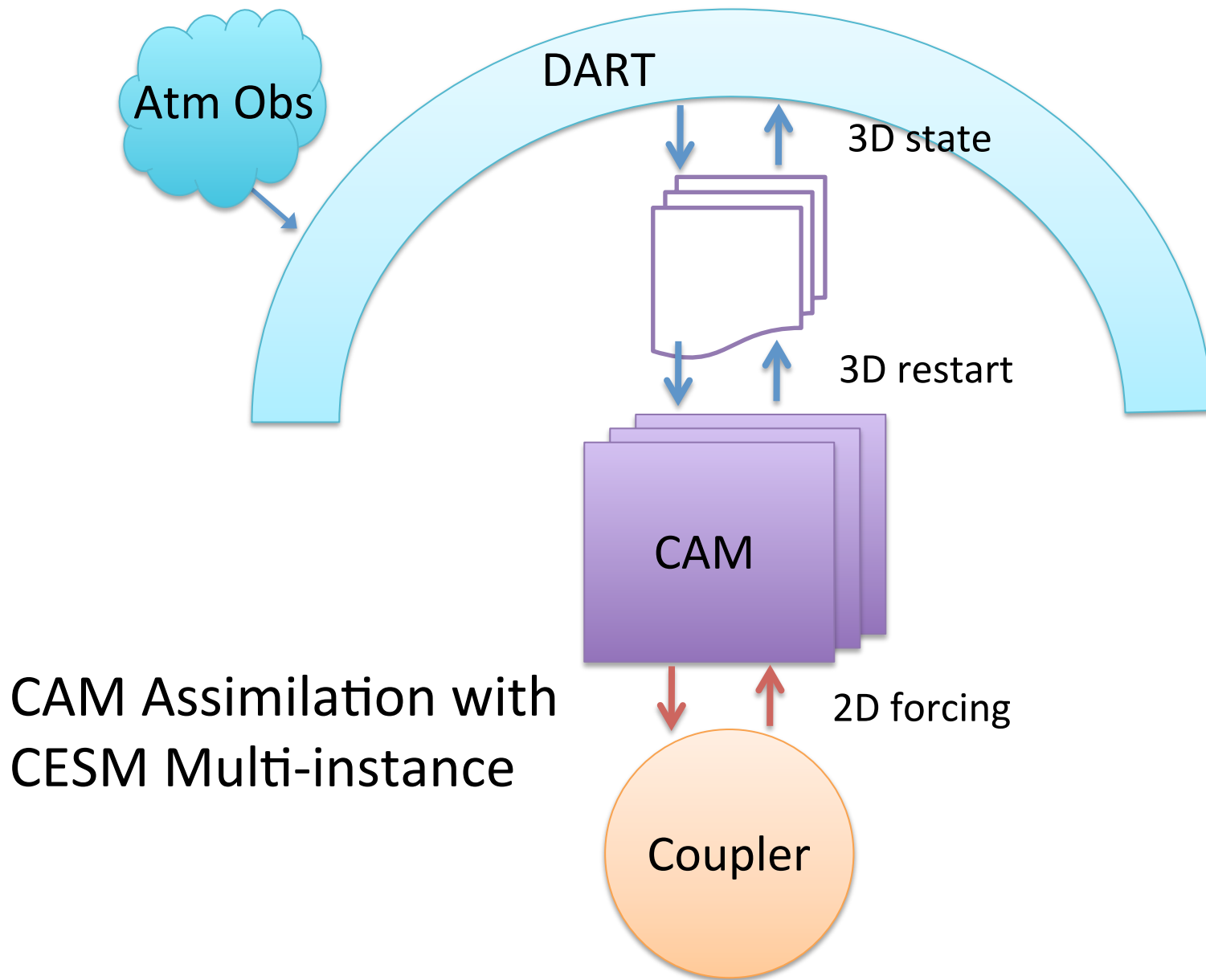


# New Since Last Year

- CESM supports multiple **active** Multi-instance components
- With CESM 1.1 Beta15 release **all** components have consistent namelist/configuration support
- CESM short-term archiver updated to handle N instances of output files
- POP
  - First CESM component to support Multi-instance capability; running various ongoing assimilation projects
- CAM
  - Routinely running CAM assimilations with CESM Multi-instance
- CLM
  - Doing initial assimilations with CESM Multi-instance

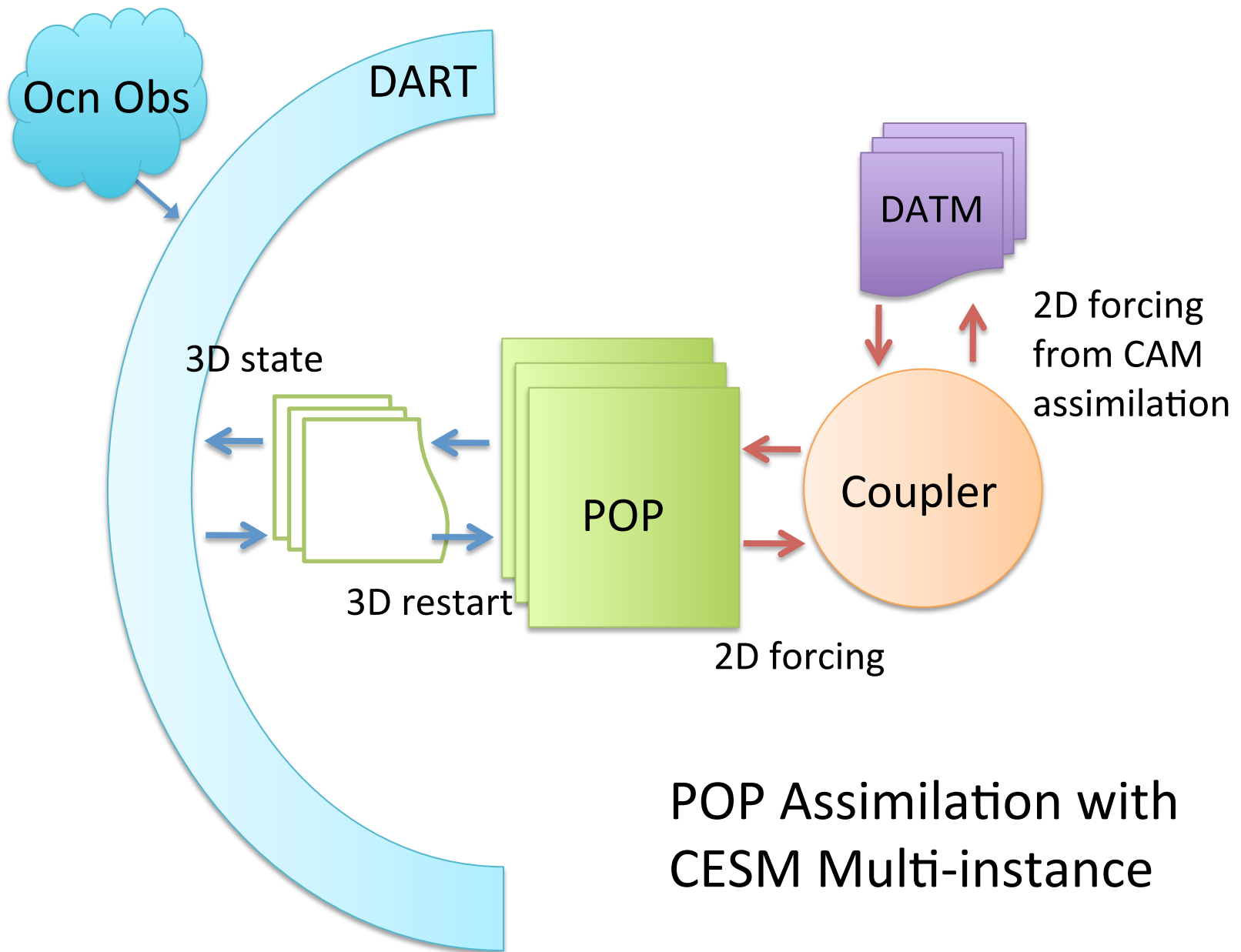


## Original CAM Assimilation



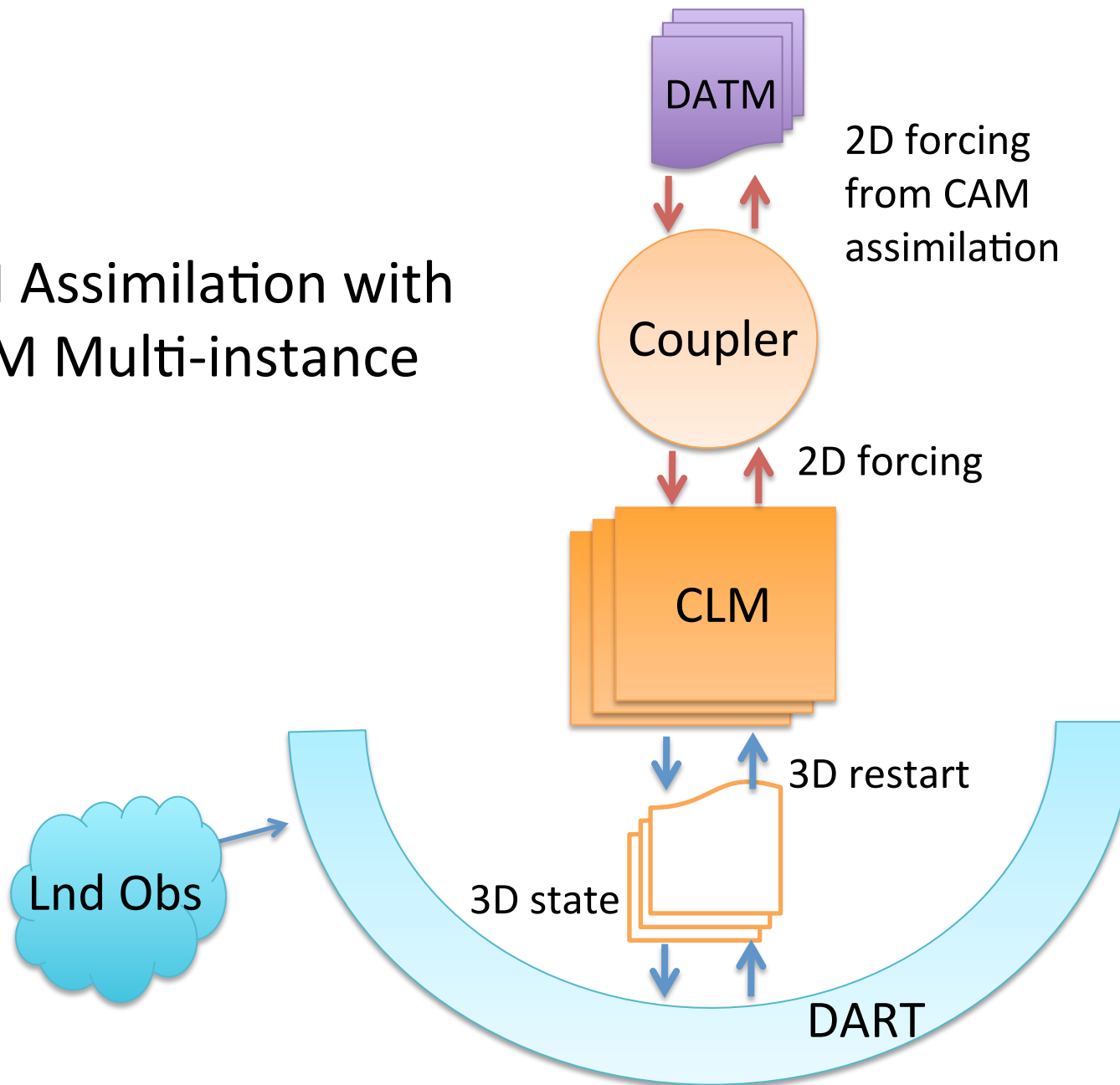
CAM Assimilation with CESM Multi-instance



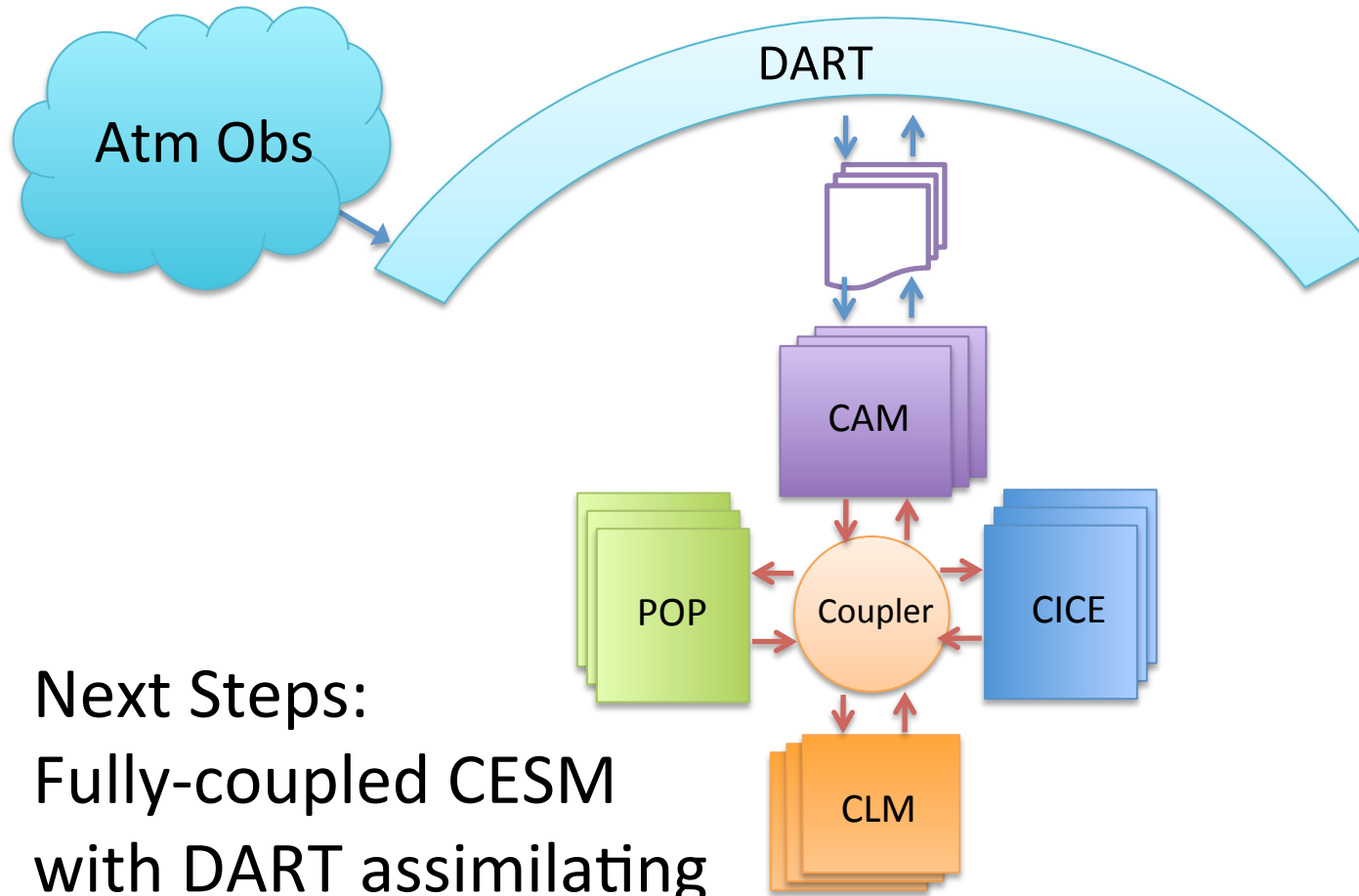


## POP Assimilation with CESM Multi-instance

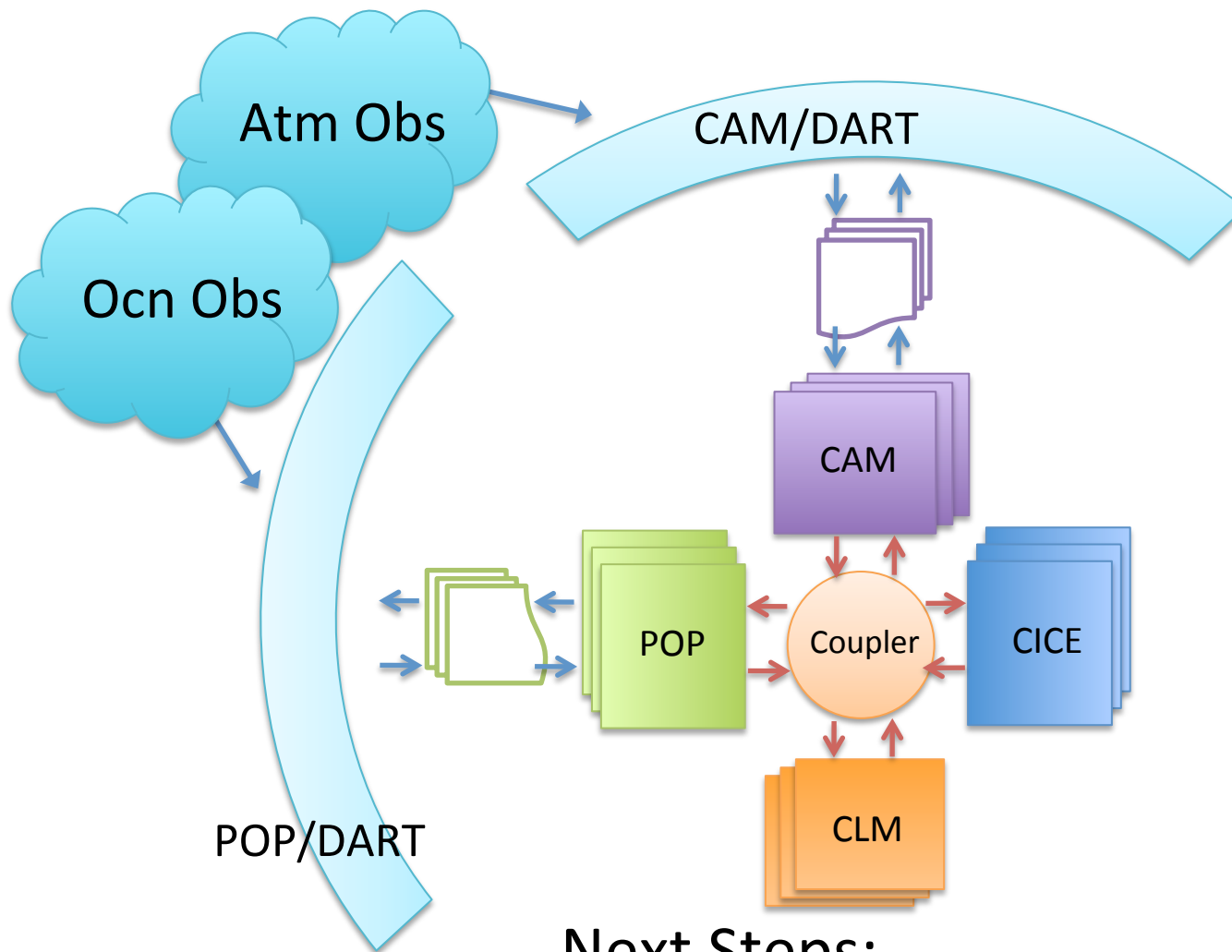
# CLM Assimilation with CESM Multi-instance





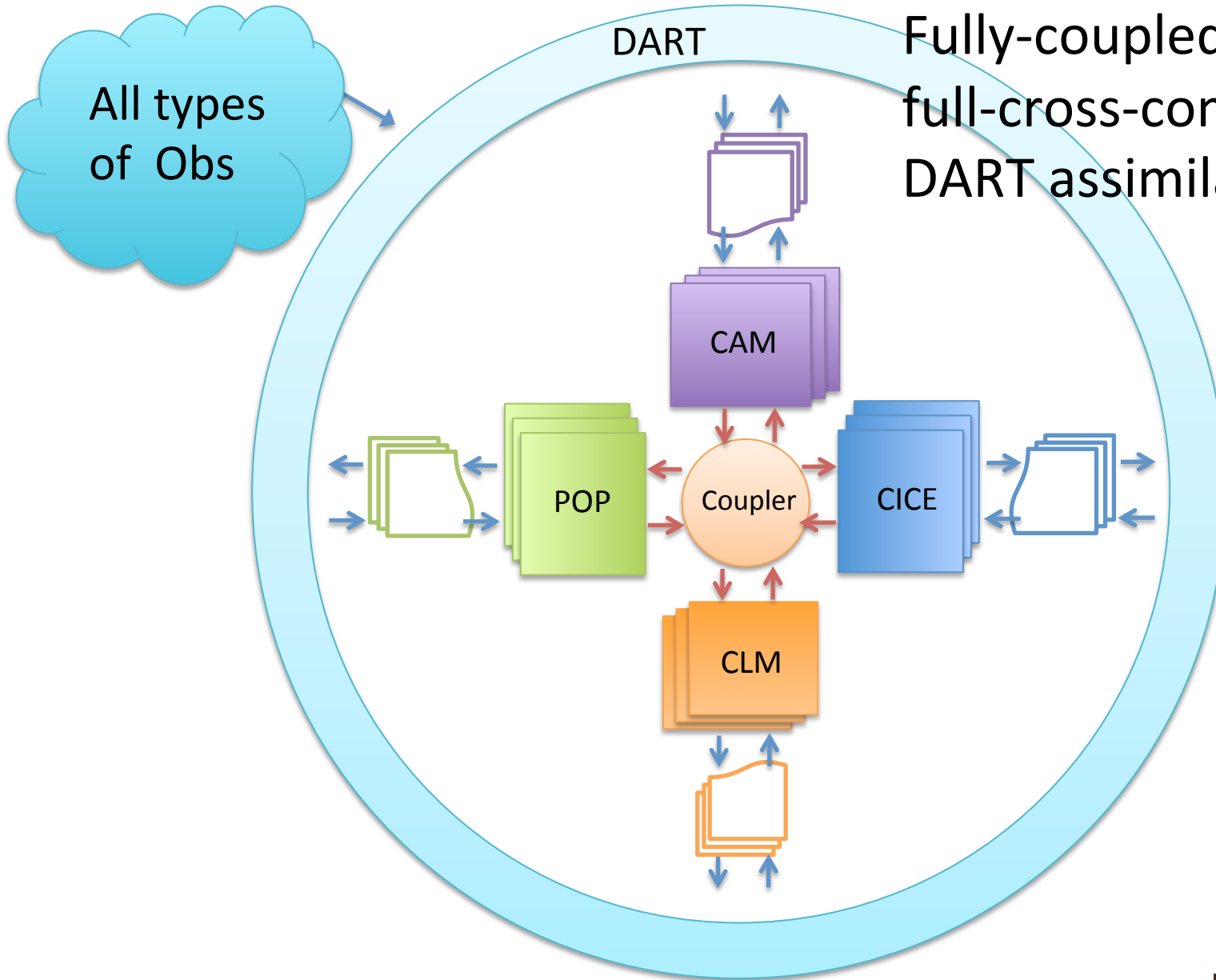


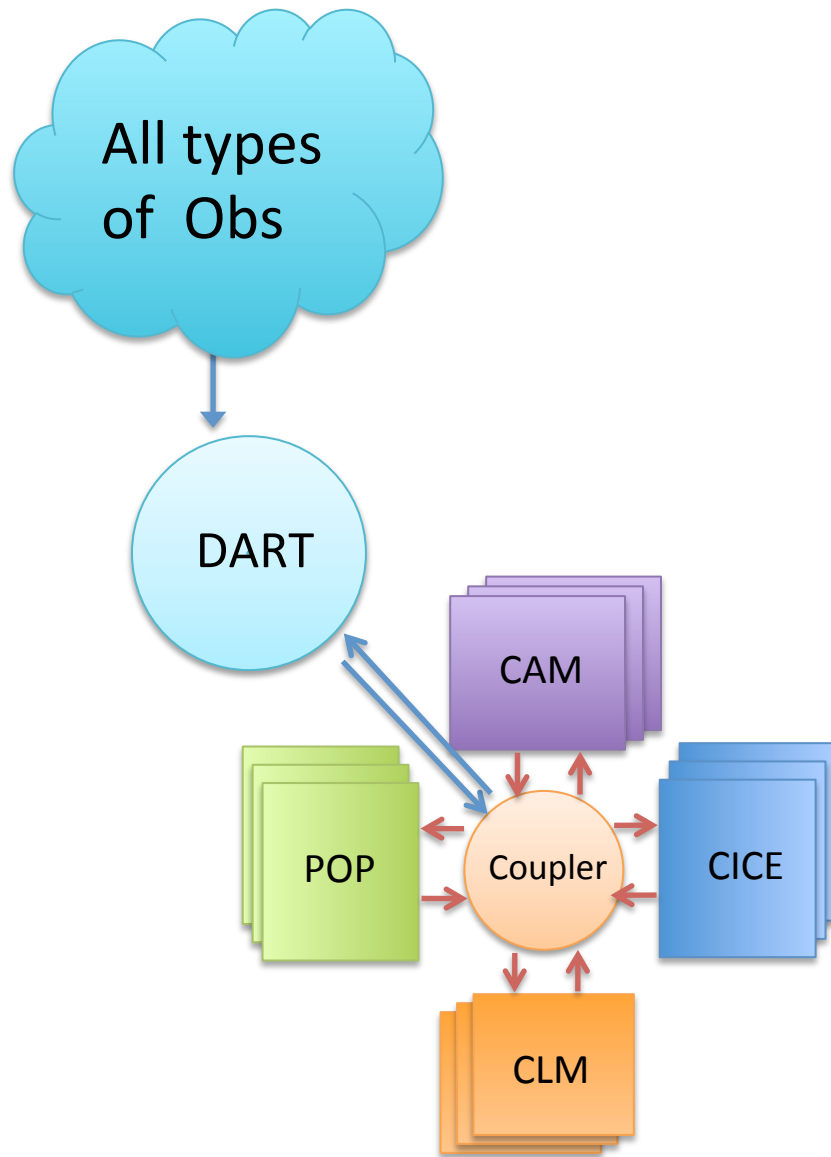
Next Steps:  
Fully-coupled CESM  
with DART assimilating  
observations into a  
single component



Next Steps:  
 Multiple components assimilating with  
 different DART(s) in fully-coupled CESM

# Next Steps: Fully-coupled CESM with full-cross-component DART assimilation





Longer term goal is to avoid file I/O when passing data between CESM and DART.

This will require the coupler to pass subdomains of 3d fields (N instances of them!) instead of the 2d fields it passes now.

The decomposition won't just be inside a single grid, but will be across the N instances of a 3d subdomain.

# Challenges and Opportunity

- Yellowstone (and other large clusters) has less memory per node but more nodes
  - Communication costs are high if all tasks involved
  - Using intermediate files will kill performance
  - Forward operator computation on partial states
- DART group has 1-year term position open now for either SE II/III or PS I/II to work on the next generation of many aspects of the DART software package

# Web and Contact Info

- <http://www.image.ucar.edu/DAReS/DART>
- General questions: [dart@ucar.edu](mailto:dart@ucar.edu)
- Or contact the DART team members directly:
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