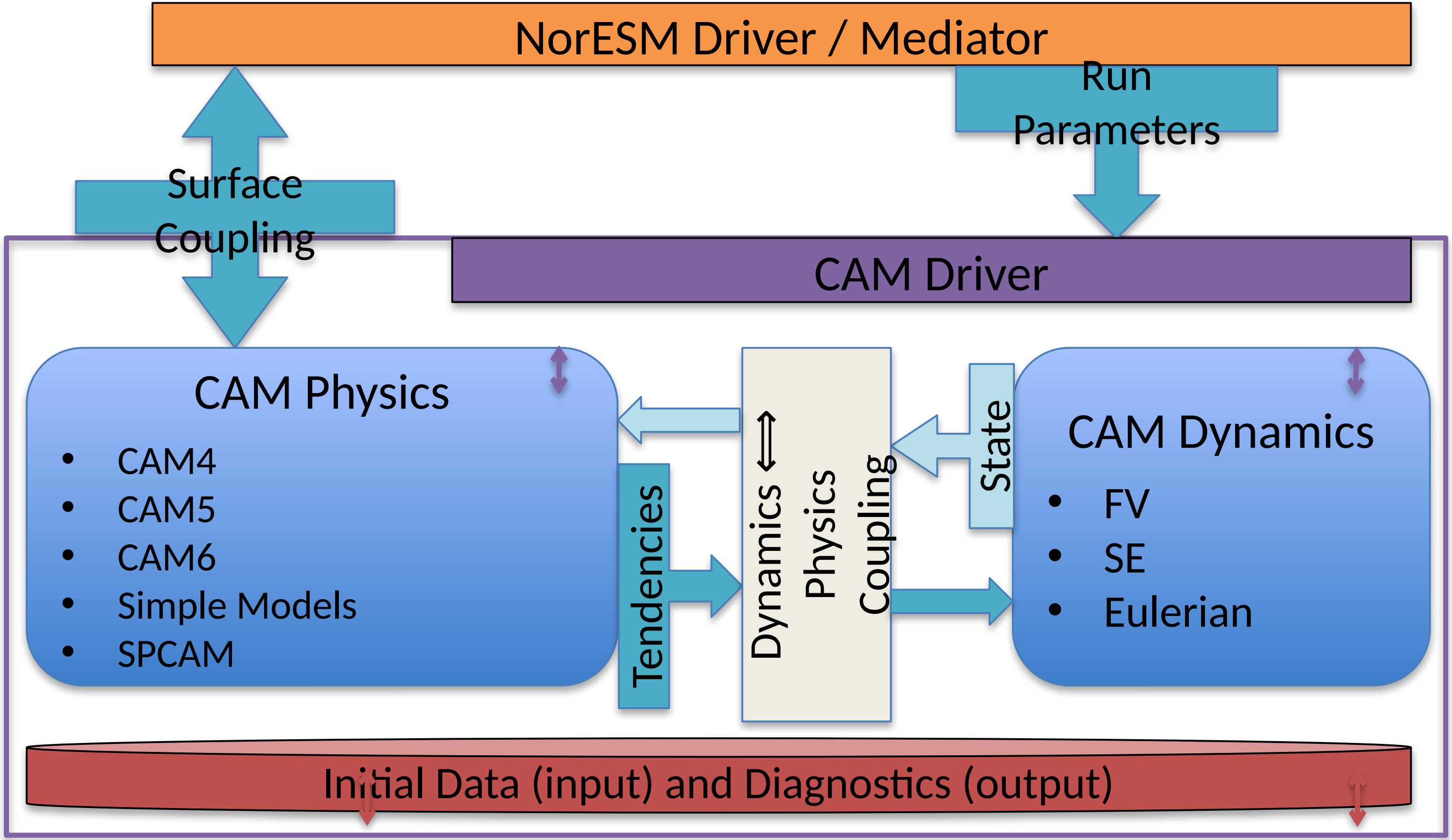
Introduction to CAM

Introduction to the Community Atmosphere Model (CAM)

2026 NorESM user workshop
15. January 2026

CAM6 Architecture Overview



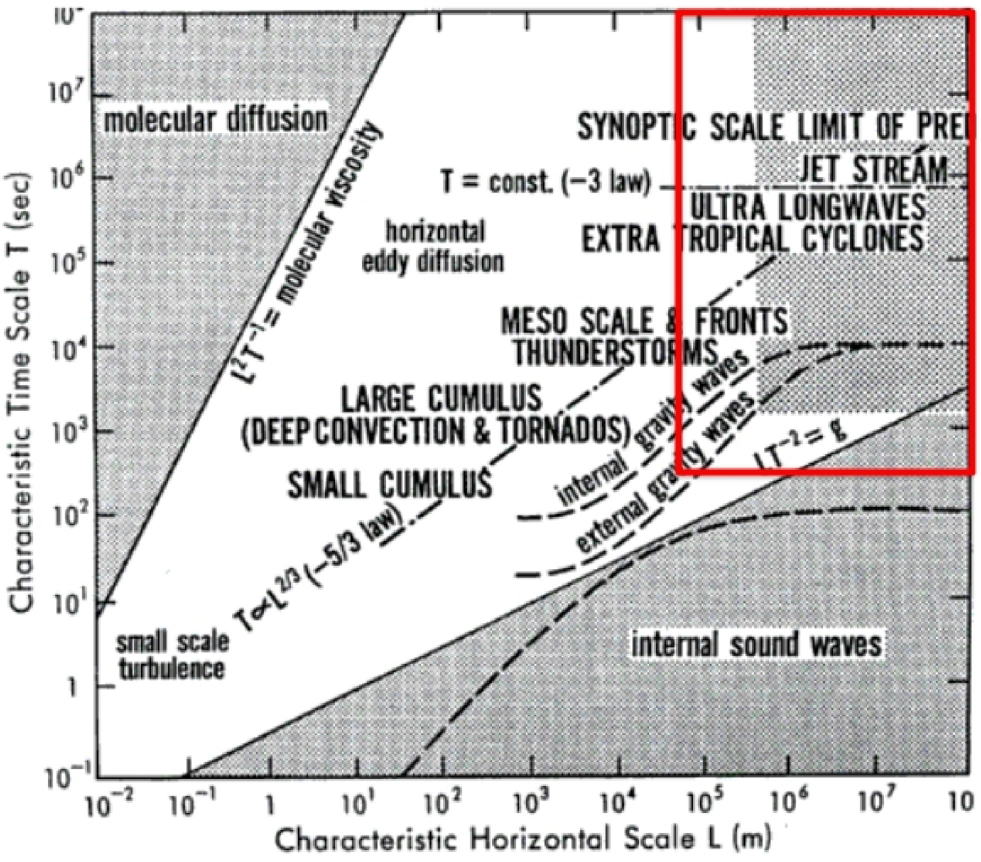
Overview of sample CAM run step

- Import surface fluxes from coupler
- Run physics parameterizations which deal with surface fluxes (physics package #1, tphysac)
- Physics → dynamics coupling
- Dynamics run
- Write history, restart
- Dynamics → physics coupling
- Run post-dynamics physics processes (physics package #2, tphysbc)
- Export surface fluxes to coupler

CAM Dynamics (dycore)

- The dycore computes the large-scale motion of the atmosphere.
- It is responsible for updating the state of the model including surface pressure
- NorESM2 (including NorESM2.3) uses the Lin-Rood finite volume dynamical core (1994)
- Logically rectangular grid (longitude / latitude)
- Very efficient but does not scale to very large numbers of cores due to convergence of grid lines at the poles

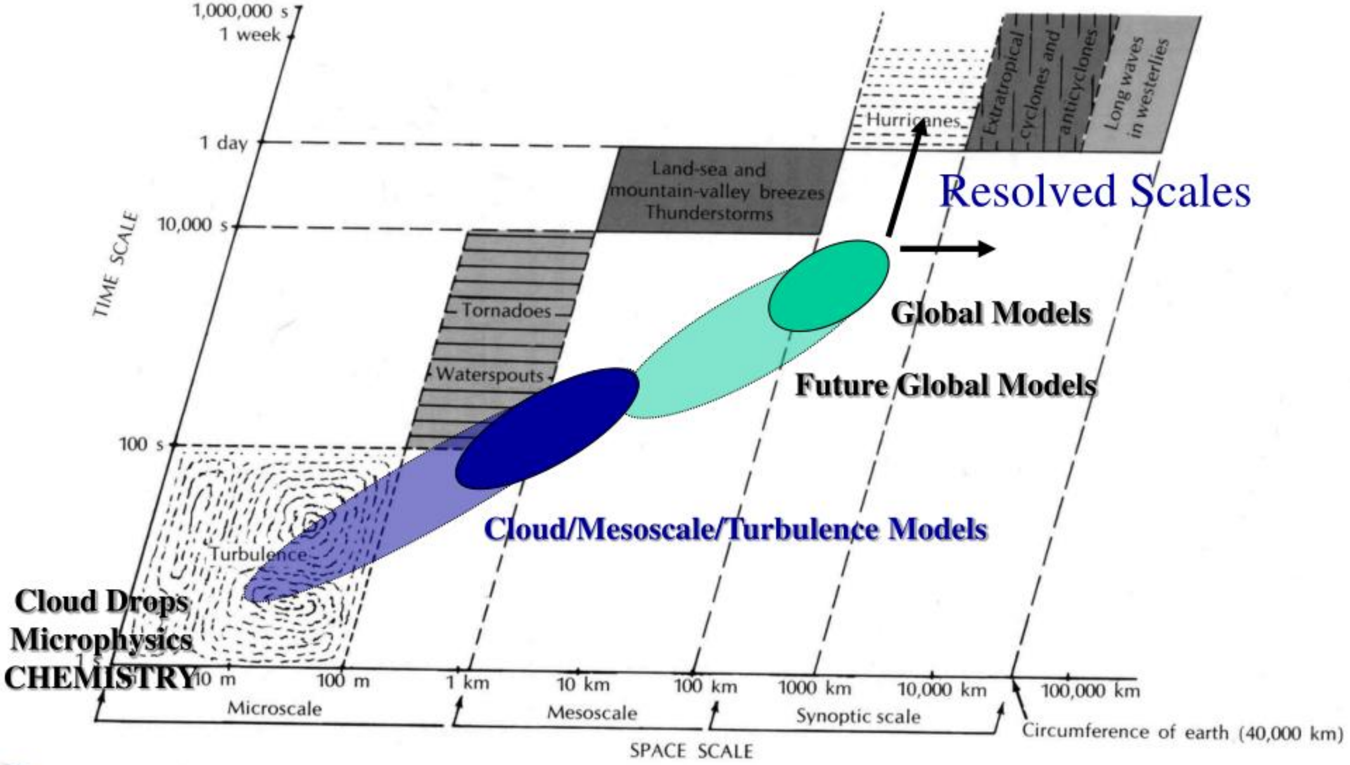
Spatial and temporal scales of the atmosphere



Courtesy: Smagorinsky (1974).

- The dycore resolves the large scale movement of the atmosphere by solving the Navier-Stokes equations discretized onto a grid.
- Smaller scale (both time and space) phenomena are simulated by parameterizations.

Scales of Atmospheric Motions/Processes



Anthes et al. (1975)

NCAR

CAM Physics (parameterizations)

- The CAM physics suite (set of parameterizations) is how NorESM works to represent the atmospheric processes not resolved by the dycore.
- CAM physics must
  - Process fluxes from the surface components (which come through the coupler) and incorporate 3-D emissions
  - Create tendencies (d**S** / dt) of the CAM state which are sent to the dycore for it’s state update
  - Communicate updated state and flux information back to the coupler for communication with the surface components.

CAM Physics (parameterizations)

- Radiation (RRTMG)
  - Clear sky (typically no subgrid variability used)
  - Cloudy
- Surface exchanges (Monin-Obukhov similarity theory)
- Boundary Layer Turbulence (CLUBB)
- Shallow convection (CLUBB)
- Cloud “macrophysics” (CLUBB)
- Deep Convection (Zhang & McFarlane mass flux scheme)
- Cloud microphysics (Morrison Gettelman 2-moment)
- PBL form drag (Beljaars et. al. neutral shear flow over obstacles)
- Gravity wave drag (Lindzen-type schemes for various sources)
- Oslo Aero prognostic aerosols and chemistry