Singletrack & CESM

Andrew Gettelman, On behalf of the *Singletrack Steering Group*

(Also a mountain biking Magazine: http://singletrackworld.com/magarchive/issue-87/)

Singletrack and CESM

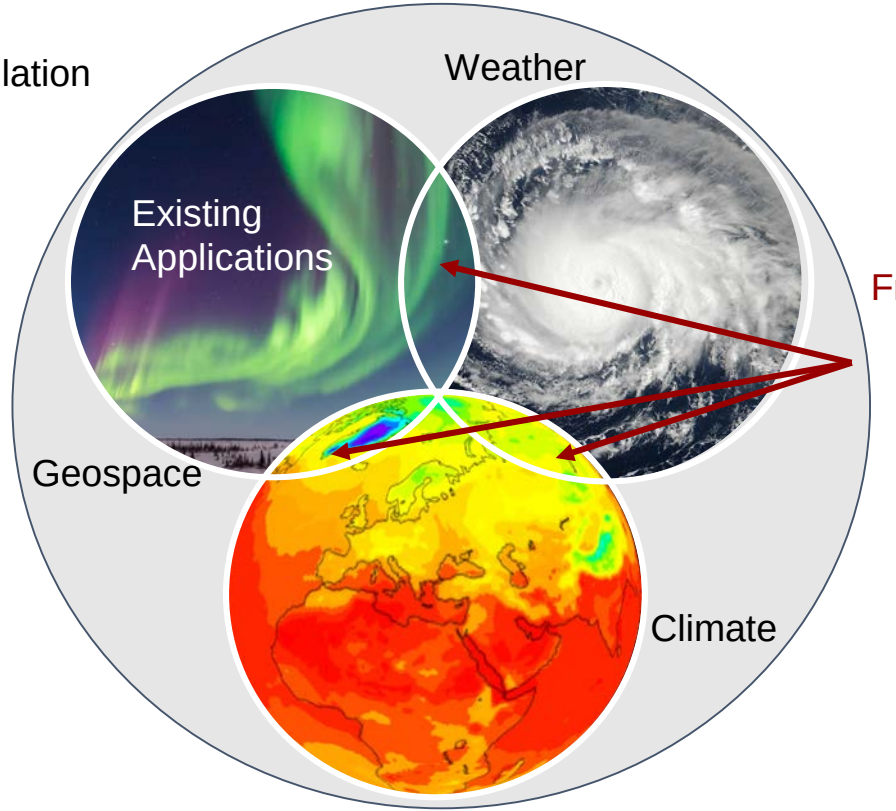
- No decisions have been made: engaging everyone in planning process
- A ‘singletrack’ model could be configured like CAM (global, uniform)
  - Designed to meet climate applications
  - Maintain existing capabilities: A ‘traditional’ CESM user would see minimal impacts/changes
- CESM would have expanded capabilities (Frontier Applications)
  - Better Diagnostics for weather, Data Assimilation, etc.
- CESM will have access to WRF physics (with Common Framework-CPF)
- WRF/MPAS will have access to CESM physics (via CPF)
- CESM will have access to the MPAS dynamical core for high-resolution (convection-permitting) simulations within a full ESM configuration
- MMM would continue to support stand-alone MPAS & WRF until all applications can be achieved within a ‘Singletrack’ framework

Singletrack Vision

Support Existing and Frontier Applications

Unified Infrastructure

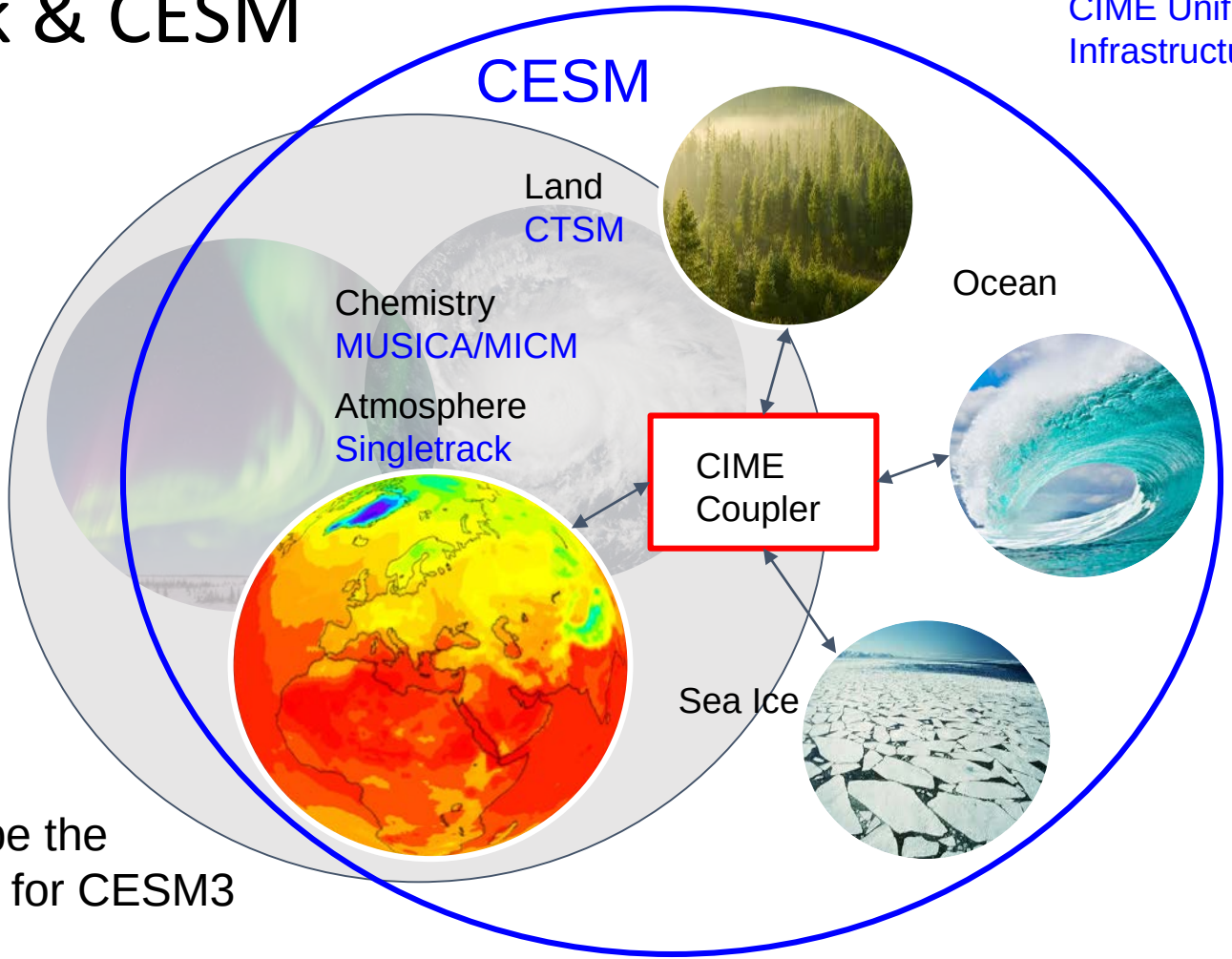
- Initialization/Assimilation
- Diagnostics
- Coupling in ESMs
- Small to Exascale
- Usability



Frontier Applications

- Coupled Weather
- Climate Extremes
- Space Weather
- Air Pollution

Singletrack & CESM



Singletrack : CAM
CTSM : CLM

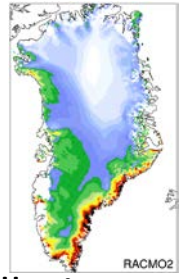
Singletrack could be the atmosphere model for CESM3

Frontier Science Goals

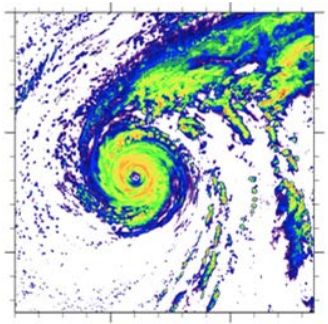
Map to specific applications

- Coupled Simulations at the Weather Scale
  - Tropical cyclones, Extreme convection, Urban pollution
- Extreme weather under climate conditions
  - Extreme heat and precipitation, extreme weather under climate change, air quality
  - Polar Prediction
- Integrated Geospace modeling
- Subseasonal to Seasonal (S2S) to Decadal Prediction
  - Intra-seasonal (MJO), And interannual (ENSO)
- An Atmospheric Model in the coupled system
  - Land - Atmosphere Interactions
  - Unified chemistry

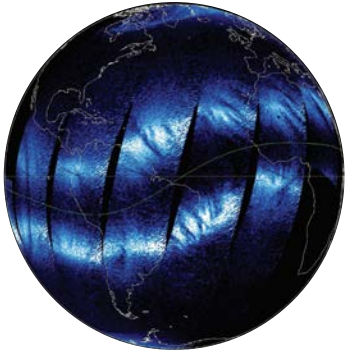
Polar



Hydrology Extremes



Tropical Cyclones



Space Weather

Singletrack Climate Applications (3 years)

Application Examples and Configurations

Topic	Example Application	Configuration
Weather	Tropical Cyclones	3km refined mesh, coupled ocean, forecasts
Climate	Hydrologic Extremes	3km refined mesh, forecast and climate simulations
Polar	Arctic Prediction	10km refined mesh, coupled ocean, land, sea ice, land ice. Forecast and climate simulations
Geospace	Space Weather Prediction	25km global atmosphere to the ionosphere, forecast.
Chemistry	Urban/Regional Air Quality Prediction	Urban: <1km regional forecast. Regional: 3km refined global mesh, climate and forecast

Singletrack Climate Applications (3 years)

Application Examples and Configurations

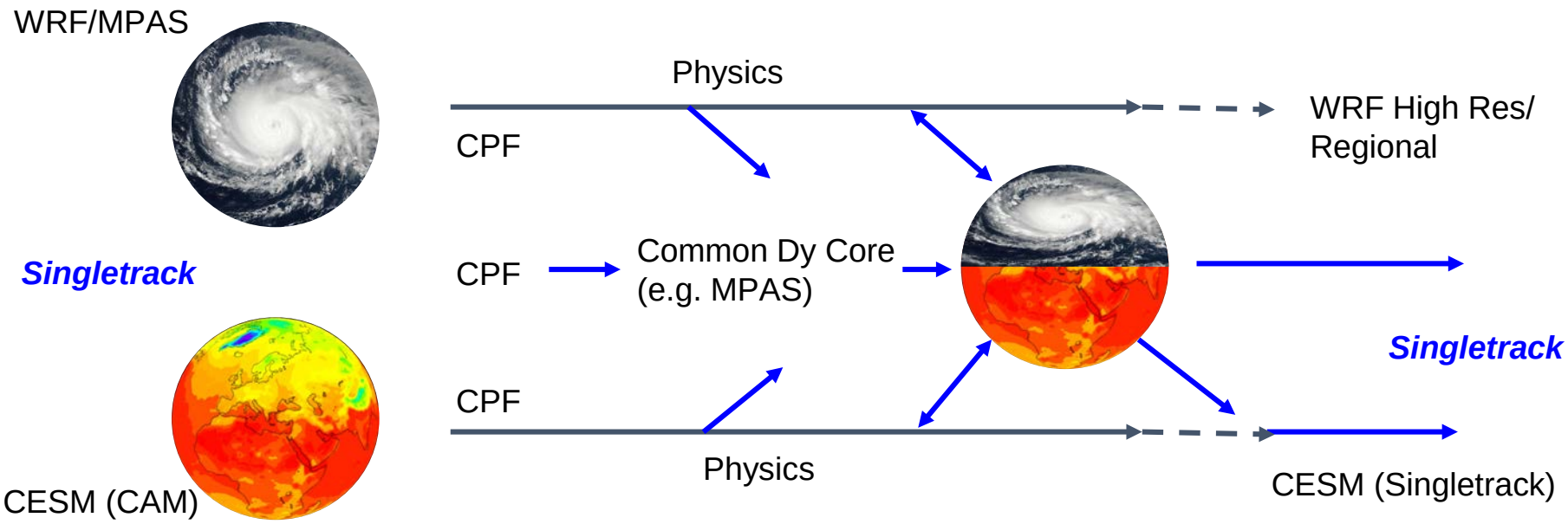
Topic	Example Application	Configuration
Weather	Tropical Cyclones	3km refined mesh, coupled ocean, forecasts
Climate	Hydrologic Extremes	Coupled Refined Mesh Climate Simulations. 3 &10km
Polar	Arctic Prediction	Climate (10km) simulations refined mesh, coupled ocean, land, sea ice, land ice.
Geospace	Space Weather Prediction	25km global atmosphere to the ionosphere. Initialized.
Chemistry	Urban/Regional Air Quality Prediction	3km refined mesh global

Summary

- Will Singletrack Work in CESM?
  - Yes. A ‘Singletrack’ model intended as the atmospheric component of CESM
  - Coupled under CIME
- What is the future of CAM?
  - CAM will evolve with (or into) ‘Singletrack’ (e.g. CAM7 = Singletrack1.0)
  - Singletrack is starting with CAM Physics, Dy-Cores, etc
  - Singletrack initial goals match CAM development (CPF, Dy Core evaluation)
- What about WACCM? CAM-CHEM?
  - Unified chemistry coming under MUSICA/MICM (CPF compliant)
  - Geospace (high top, WACCM-X) is a part of Singletrack
- How do I get involved?
  - Let the AMWG, ChemWG, WAWG co-chairs know your interest
  - Comment on target applications. What is missing? What is your interest?
- Who governs a unified atmosphere? Good question

Extra

NCAR Community model evolution



Proposed Development Steps	Put CPF in CAM & WRF	Physics from CAM & WRF	Test applications in CAM & WRF

Singletrack Topical Areas

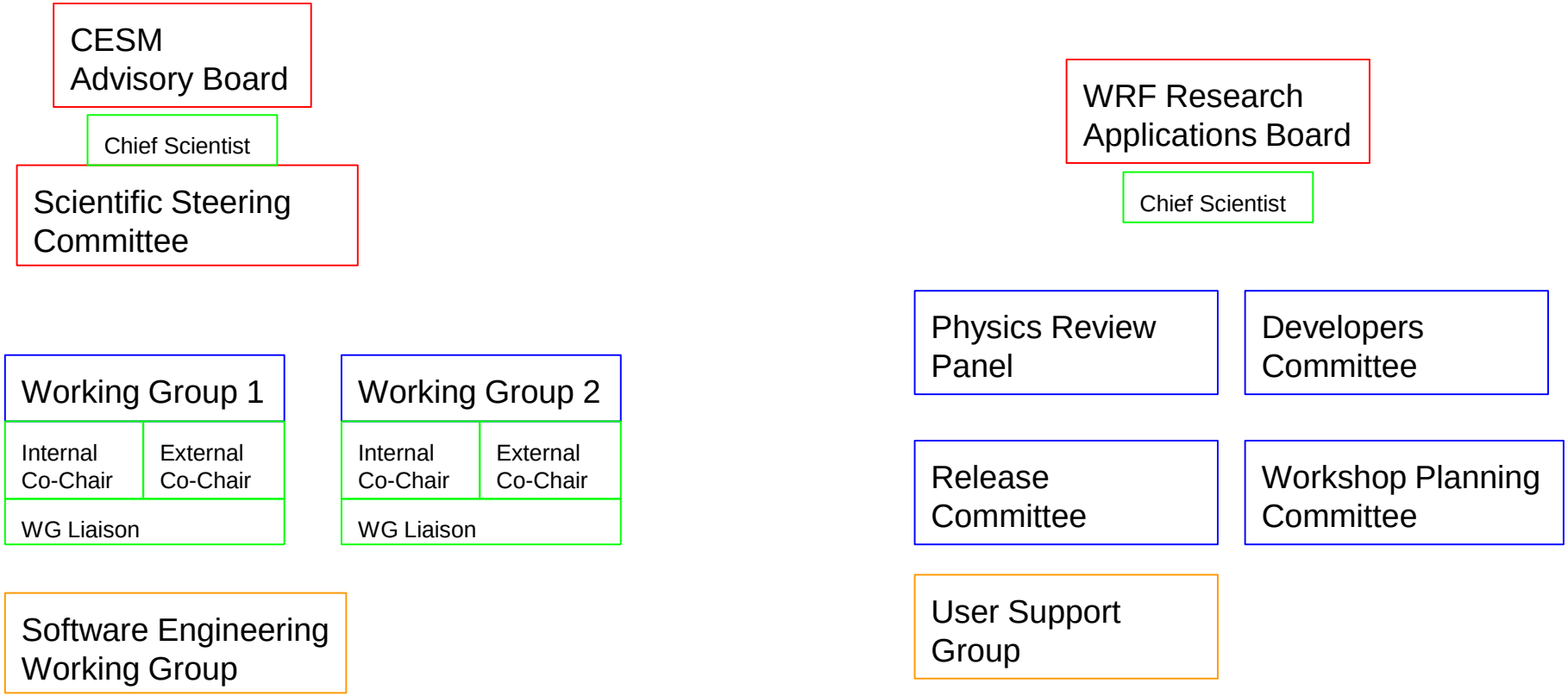
Core Topics

- Dynamical Core
- Physical Parameterizations
- Data Assimilation
- Infrastructure

Additional Topics

- Diagnostics/Observations
- Governance
- Education/Training/Tutorials

CESM v. WRF Organization(2018)



Singletrack: Relation to Existing Models