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 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
**Singletrack Climate Applications (3 years)**

Application Examples and Configurations

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<thead>
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<td>Chemistry</td>
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<td>Urban: &lt;1km regional forecast. Regional: 3km refined global mesh, climate and forecast</td>
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# Singletrack Climate Applications (3 years)

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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

WRF/MPAS

Singletrack

CESM (CAM)

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

Physics

CPF

Common Dy Core (e.g. MPAS)

CPF

Physics

CPF

WRF High Res/Regional

CESM (Singletrack)
Singletrack Topical Areas

Core Topics
• Dynamical Core
• Physical Parameterizations
• Data Assimilation
• Infrastructure

Additional Topics
• Diagnostics/Observations
• Governance
• Education/Training/Tutorials
Singletrack: Relation to Existing Models

- CESM Advisory Board
- Scientific Steering Committee
- Working Group
  - Atmos WG
    - Int Chair
    - Ext Chair
    - WG Liaison
  - WACCM WG
    - Int Chair
    - Ext Chair
    - WG Liaison
  - Chem WG
    - Int Chair
    - Ext Chair
    - WG Liaison
- Software Eng. Working Group
- Singletrack Efforts ‘MAP’ to CESM and WRF working groups
- Infrastructure (Software Eng) for atmosphere ‘evolving’ together