Introduction to GFDL Earth System Models

Presented by

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Using GFDL ESMs for NOAA goals

NOAA Strategic Goals:
- Climate adaptation and mitigation
- Weather-ready nation
- Healthy oceans
- Resilient coastal communities and economies
GFDL ESM Genealogy

Increasing ocean res.: 1°->1/4°->1/10°

Ocean vert. coord.:
* ESM2M-z* (MOM)
* ESM2G-ρ (GOLD)
<table>
<thead>
<tr>
<th>Sea Ice</th>
<th>Land</th>
<th>Atmosphere</th>
<th>Ocean</th>
<th>Ocean BGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIS</td>
<td>LM2</td>
<td>AM2</td>
<td>MOM4.1</td>
<td>miniBLING</td>
</tr>
<tr>
<td></td>
<td>LM3</td>
<td>AM3 (chem.)</td>
<td>MOM5</td>
<td>BLING</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HiRAM</td>
<td>GOLD</td>
<td>TOPAZ</td>
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<td></td>
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<td>COBALT</td>
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<table>
<thead>
<tr>
<th></th>
<th></th>
<th>AM4</th>
<th>MOM6</th>
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<tr>
<td>SIS2</td>
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<tr>
<td>LM4</td>
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<td>AM4</td>
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<td>MOM6</td>
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GFDL 5-10 year strategic plan (2011):
- **CM4** to be the next generation climate model
- Trunk configuration: 0.5° atmosphere; 0.25° ocean
Using GFDL OBGCS to optimize science

Animation: Whit Anderson

<table>
<thead>
<tr>
<th>Model</th>
<th>Cost</th>
<th>Throughput</th>
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</thead>
<tbody>
<tr>
<td>Workhorse spec</td>
<td>1/8 Gaea</td>
<td>5 yrs/day</td>
</tr>
<tr>
<td>CM2.6</td>
<td>1/6 Gaea</td>
<td>2 yrs/day</td>
</tr>
<tr>
<td>ESM2.6 (COBALT)</td>
<td>1/6 Gaea</td>
<td>0.4 yrs/day</td>
</tr>
<tr>
<td>CM2.6miniBLING</td>
<td>1/5 Gaea</td>
<td>2 yrs/day</td>
</tr>
</tbody>
</table>
Earth System Model Components

- **Atmospheric circulation, radiation, clouds and aerosols**
  - S-J Lin
  - Yi Ming

- **Atmospheric chemistry & interactive CO₂**
  - Olga Sergienko

- **Ocean physics**
  - Bob Hallberg

- **Ocean ecology and Biogeochemistry**
  - Larry Horowitz

- **Terrestrial ecosystems and land use**
  - Chris Milly

- **Land physics and hydrology**

**Components:**
- Land physics and hydrology
- Sea Ice
- Land Ice
- Ocean physics
- Ocean ecology and Biogeochemistry
- Atmospheric circulation, radiation, clouds and aerosols
- Atmospheric chemistry & interactive CO₂

**Authors:**
- S-J Lin
- Yi Ming
- Olga Sergienko
- Larry Horowitz
- Bob Hallberg
- Chris Milly