High resolution runs with RASM
Andrew Roberts
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Bart Nijssen, Alice DuVivier, Robert Osinski, Tony Craig, Joe Hamman

Mimi Hughes, Brandon Fisel, Saffia Hossainzadeh, Jeremy Fyke, Michael Brunke, Jackie Clement-Kinney, Anna Carolina Barbosa, Thomas Mills, and more.

PIs: Wieslaw Maslowski, Andrew Roberts, Bill Gutowski, Xubin Zeng, Bill Lipscomb, Bill Robertson, Slawek Tulaczyk, John Cassano, Dennis Lettenmaier
The Regional Arctic Climate Model (RASM)
RASM configuration vs CESM configuration

- Atmospheric and oceanic forcing
- Coupling channels between component models
- Component models
RASM configuration vs CESM configuration

<table>
<thead>
<tr>
<th>Component</th>
<th>Model/Code</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere</td>
<td>WRF</td>
<td>50km, 35 levels, dt=2.5mins</td>
</tr>
<tr>
<td>Land Hydrology</td>
<td>VIC</td>
<td>50km, dt=20mins</td>
</tr>
<tr>
<td>Ocean</td>
<td>POP</td>
<td>9km, 45 levels, dt=8/8/4mins</td>
</tr>
<tr>
<td>Sea Ice</td>
<td>CICE</td>
<td>9km, 5cats, dt=20mins/xndt_dyn=4</td>
</tr>
<tr>
<td>Coupler</td>
<td>CPL7</td>
<td>20min coupling</td>
</tr>
</tbody>
</table>

- RASM uses the same software and scripting framework as CESM
- Using different ocean/atmosphere grid configurations in a regional setting
- There are no poles in the component model grids
- Passing log(z₀) through the coupler to WRF from VIC, POP and CICE
- Using CCSM framework, but transitioning to CESM version
- WRF and VIC are now compliant with CESM standards (almost)
- Updates are being committed to the CESM repository from RASM
Characteristics of recent simulations in RASM - Coupled

Courtesy Thomas Mills
Characteristics of recent simulations in RASM - Coupled

Difficulties handling strong wind speeds off the Greenland coast
Characteristics of recent simulations in RASM - Ice-Ocean

Parameter space tests with CORE 2 by Robert Osinski and Wieslaw Maslowski
WRF stability calculations: Passing $\log(z_0)$ through the coupler

Shaded: Roughness length passed to WRF 06-Sep-1989 00Z
Contour: Wind speed (contour)
WRF stability calculations: Passing $\log(z_0)$ through the coupler

Compare lowest 1000m for wrf-1990-01-06Z
WRF stability calculations: Passing log(z₀) through the coupler
Adding the streamflow model to RASM

Mean Monthly Discharge

Yukon
Mackenzie
Kolyma

Lena
Yenisey
Ob

Pechora
Severnaya Dvina

Streamflow (1,000 m³/s)

Month

Observations *
RASM

*Observations obtained from R-ArcticNET, www.r-arcticnet.sr.unh.edu

Courtesy Bart Nijssen and Joe Hamman
Adding the streamflow model to RASM

Courtesy Bart Nijssen and Joe Hamman
How constrained is the climate in RASM?

Three ensemble members started with identical ice-ocean initial conditions, with 2-month staggered initialization, results in almost identical sea ice volume after 6 years using typical WRF spectral nudging.