Impact of horizontal resolution on the tropical intraseasonal variability: Results from the Project Athena


1Center for Ocean-Land-Atmosphere Studies, USA. 2George Mason University, USA. 3European Centre for Medium-range Weather Forecasts, United Kingdom. 4University of Tokyo, Japan. 5RIKEN Advanced Institute for Computational Sciences, Japan. 6Japan Agency for Marine-Earth Science and Technology, Japan. 7International Pacific Research Center, USA.

Objective
Examine the impact of spatial resolution on the South Asian monsoon mean climate and the northward propagating summer intraseasonal oscillation

Null hypothesis
Finer resolution

Model runs

<table>
<thead>
<tr>
<th>Model</th>
<th>Resolution</th>
<th>Grid size (km)</th>
<th>Length of each integration</th>
<th>Total period</th>
<th>Prescribed SST, sea ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFS</td>
<td>T511</td>
<td>10</td>
<td>20-100 day filtered</td>
<td>1960-2007 (19 integrations)</td>
<td></td>
</tr>
<tr>
<td>IFS</td>
<td>T1279</td>
<td>15</td>
<td>20-100 day filtered</td>
<td>1979-2009</td>
<td></td>
</tr>
<tr>
<td>IFS</td>
<td>T2047</td>
<td>10</td>
<td>20-100 day filtered</td>
<td>1989-2007</td>
<td></td>
</tr>
</tbody>
</table>

Mean climate (Summer: June – September)
- Rainfall
- OLR
- OISST

Daily variance (Summer: June – September)
- Rainfall
- U850
- V850

Summer intraseasonal mode
- Analysis used: Multi-channel Singular Spectrum Analysis (MSSA) on 20-100 day filtered U850 anomalies
- Higher resolution model outputs interpolated to T159/125 km grid.
- Period analyzed: 1999-2008, MJJASO season
- MSSA lag window length: 85 days

MSSA
- Trajectory matrix for one grid point, \( M \times N' \)
- Make \( L \) such trajectory matrices and stack them together
- Eigen analysis of covariance matrix of \( B \), \( C_L = \sum_{m=1}^{L} B_m L_m \)

Power Spectra of the northward propagating mode

Time – latitude diagrams of phase composites

Summary and discussion
- Mean climatology over the monsoon region is similar across all the resolutions; especially in the winds.
- Marginal improvement in daily variance in precipitation
- Northward propagating ISO:
  - Spatial structure and amplitude similar across all runs
  - IFS model, even at T159 resolution, simulates the northward propagation of U850 reasonably well
- Propagation in precipitation is weak for all resolutions
- Mean easterly wind shear is supposed to favor emission of Rossby waves; thereby critical for the northward propagation. This is similar in all resolutions.
- Increase in stratiform precipitation →7 better ISO. Stratiform fraction is slightly increased from T119 to T151, but a not reflected in the ISO.

For correspondence: deepthi@cola.iges.org