A Synoptic-Dynamic Model (SDM) of Subseasonal Variability: A role for monitoring and global synoptics

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• Background
• The Synoptic Dynamic Model
• Recent Synoptic Variability
• Activities Related to THORPEX
Three Different Time Scales:

- Madden-Julian Osc: 30-70d (quasi-oscillatory)
- Teleconnections: 5-10 day decay (red noise)
- Synoptics: 1-2 day decay (white noise)

Predictive Focus

<table>
<thead>
<tr>
<th>i.c.</th>
<th>Week 1</th>
<th>week 2</th>
<th>&gt;2?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 4</td>
<td>Day 8</td>
<td>Day 11</td>
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</tbody>
</table>

Extreme weather events

Prediction of tropical convection

Responding to initial conditions of convection
200 hPa vector wind and SLP

Day 0 regressed on global frictional torque

Day 0 regressed on global mountain torque

Day 0 regressed on 20-100 day OLR EOF1

Nov-Mar 1979-95

Global Frictional Torque

Global Mountain Torque

20-100 day filtered OLR EOF1

~8 dy

1-2 dy

30-70 dy
**Synoptic Model of Subseasonal Variability: Stage 1**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
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<tbody>
<tr>
<td>MJO convection at 110E</td>
<td>NH “index cycle”: $\tau_M --, \tau_F +$</td>
</tr>
<tr>
<td>MJO global AAM minimum</td>
<td>“La Nina-like”: Split flow oceans</td>
</tr>
<tr>
<td>MJO Torques: $\tau_F +$, $\tau_M --, +$</td>
<td>Polar block 150W (west prop. mode)</td>
</tr>
<tr>
<td>Wave energy dispersion favors high impact weather event in USA Plains</td>
<td>Pacific Ocean anticyclonic wave breaking</td>
</tr>
</tbody>
</table>
Vertical and Zonal Integral of Relative Atmospheric Angular Momentum

Linear perturbations on the climatological stationary wave

Baroclinic wave packet in anomalous split flow

Anticyclonic wave breaking events
Baroclinic wave packet

Wave Breaking Event: 250 mb wind anomalies

Role of tropical convection?
Orographic component?
Activities Related to THORPEX

- Monitoring real time subseasonal variability
- Developing Synoptic Dynamic Model that integrates three time scales
- Focusing on prediction of extreme events and circulation transitions
Synoptic Model of Subseasonal Variability: Stage 2

**Stage 2**

<table>
<thead>
<tr>
<th>MJ O$^{150\text{E}}$ + wPw$^+$ +????</th>
<th>MJ O west Pacific wavetrain (wPw)</th>
<th>west Pacific wavetrain: psbl cold temps with core in central USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJ O global AAM tendency &gt;0</td>
<td>wPac low slp rapidly moves to 80W</td>
<td></td>
</tr>
<tr>
<td>MJ O Torques: $\tau_F$, --; $\tau_M$, +</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Synoptic Model of Subseasonal Variability: Stage 3

#### Table:

<table>
<thead>
<tr>
<th>MJO180 + PNA+ + ?? ??</th>
<th>NH “index cycle”: τ_M +, τ_F --</th>
<th>High impact weather event along US west coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJO global AAM maximum</td>
<td>“El Nino-like”: Split flow continents</td>
<td>Pacific Ocean cyclonic wave breaking favored</td>
</tr>
<tr>
<td>MJO Torques: τ_F --, -- ; τ_M +, --</td>
<td>Strong, southerly displaced jet stream</td>
<td></td>
</tr>
</tbody>
</table>
Synoptic Model of Subseasonal Variability: Stage 4

Stage 4

MJO\textsuperscript{WH} + \text{wPw}-- + sAw+ + ???

NH “index cycle”: \( \tau_M +, \tau_F -- \)

sAw+ precedes a hemisphere wide weakening of westerly flow

Convection at 160°W, 60°W, 60°E
Global AAM tendency < 0

Subtropical westerlies weakening

South Asian wavetrain (sAw)

MJO Torques: \( \tau_F --, +; \tau_M --, -- \)

A moist subtropical jet into the southwest USA more likely