Assessment of CFS_v2 over the Pacific Islands

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Talk Outline

1 CFS_v1 – Sooraj, Annamalai, Kumar and Wang (2012) – Weather and Forecasting

   L0-2 months – useful prediction of precipitation over Pacific Islands
   Skill of ENSO prediction – tied to skillful prediction of USAPI precipitation

2 CFS_v2 - During El Nino – dryness over USAPI begins in SON (Y0) and continues into MAM (Y+1) or even into JJA (Y+1)

   2000 – 2010 – Skill assessment with TRMM precipitation observations

   Feb-Mar 2006 – continuous rainfall for about 45 days over Hawaii

3 Way forward – MSE diagnostics – moist and radiative processes – rainfall anomalies
Too much precipitation along SPCZ
Too early monsoon onset – W. Pacific
Annual march of SPCZ is realistic
W. Pacific – Too far poleward
Deep tropics SST realistic – too much rainfall
too high variance
Nino3.4 SST anomalies (December – February)

Equatorial Pacific (170 E – 110 W) rainfall anomalies (December – February)

Kumar et al. 2012

ACC

L0 – 0.96
L1 – 0.92
L2 – 0.89
L3 – 0.85
L4 – 0.82
L5 – 0.79
L6 – 0.76

L0 – 0.98
L1 – 0.95
L2 – 0.91
L3 – 0.85
L4 – 0.82
L5 – 0.79
L6 – 0.73
December – February rainfall anomalies hindcast

Hawaii

South Pacific

West Pacific

“sign realistic magnitude not”
Based on ACC – Version 2 shows improvement over Version 1

"poor"

DJF – ACC drops off quickly

"Based on ACC – Version 2 shows improvement over Version 1"
CFS_v2 validation against TRMM

<table>
<thead>
<tr>
<th>Lead</th>
<th>Hawaii</th>
<th>W. Pacific</th>
<th>S. Pacific</th>
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<tr>
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<td>0.83</td>
<td>0.82</td>
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</table>

DJF – rainfall anomalies
Persistence of dryness over the USAPI (L0 hindcast)

SON (0)

DJF (0/1)

MAM (+1)

How the dryness is maintained –
Large-scale and local feedbacks

W Pacific (Wang et al. 2000 – local air/sea;
(Annamalai et al. 2005a,b – TIO effect)

Hawaii (Chu et a. 1996 – large-scale descent)

S. Pacific (Su and Neelin 2002;2005 –
reduction in evaporation) – but over
the S. Pacific Islands
(i) High pressure anomalies over West Pacific forms in SON (0) – RW descent

(ii) TIO SST/SSH – well represented in CFS

(iii) W. Pacific SST anomalies – realistic in CFS
CFS_v2 (L0) – Hindcast 850 hPa wind anomalies

SON (0)

DJF (0/1)

MAM (+1)

Circulation anomalies – realistic
advection low MSE air – reduce rainfall over Hawaii
March 2006 event

Observed Rainfall anomalies

Jeyawardene et al. (2012)
- Three events during 1958-2010

ERA-Interim Z500 / Wind 850hPa
Summary

1. Based on ACC – CFS_v2 shows improvement in rainfall prediction over USAPI

2. Large-scale processes are well represented during ENSO

3. Extreme events during Feb-March 2006 – L0-1 months skillful prediction

4. Apply MSE diagnostics – details physical processes identification
Mean Annual Rainfall
State of Hawai‘i
2011 Rainfall Atlas of Hawai‘i
Department of Geography, University of Hawai‘i at Mānoa
CFS_v2 (L0)

DJF

MAM

JJA

SON

“low variance over the Pacific Islands”

“Obs – constraints over open oceans”
CFS_v2 Rainfall Climatology (L0)

DJF

MAM

JJA

SON
850 hPa wind anomalies El Nino (DJF) composite
CFS_v2 (L0) – Hindcast 850 hPa wind anomalies

A/C – Rossby wave – realistic
advect low MSE air -
DJF rainfall over S. Pacific
L0

Obs
SST - DJF (L0)

SST - MAM (L0)

SSH – DJF (L0)

“thermocline”

SSH – MAM (L0)
JJA rainfall anomalies
W. Pacific (L0)