Seasonal climate prediction using a high resolution coupled GCM

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The SINTEX-F Coupled GCM

1. **Model components:**  No flux correction

   AGCM *(MPI, Germany)*: ECHAM4 (T106L19)
   OGCM *(LODYC, France)*: OPA8 (2° x 0.5° ~ 2°, L31)
   Coupler *(CERFACS, France)*: OASIS2

2. **International collaborators:**

   LODYC: OPA model group
   INGV (Italy): Antonio Navarra’s group
   MPI: ECHAM model group
   CERFACS: OASIS coupler group
   PRISM project group
Seasonal hindcast experiments

1. Five experiments with different coupling physics:
   - **sfe1**: Ocean surface is solid to atmosphere.  
     \(|Ua| \ (Ua \text{ for } Tau)\)
   - **sfe2**: Ocean surface current gives momentum to atmosphere.  
     \(|Ua-Uo| \ (Ua-Uo) \text{ for both heat flux and } Tau\)
   - **sfe3**: Ocean surface is solid to atmosphere, but  
     \(|Ua-Uo| \ (Ua-Uo) \text{ for } Tau\)
   - **sfe4**: Ocean surface current gives momentum to atmosphere.  
     \(|Ua| \ (Ua-Uo) \text{ for } Tau\)
   - **sfe5**: Ocean surface is solid to atmosphere, but  
     \(|Ua| \ (Ua-Uo) \text{ for } Tau\)

2. Initial condition:
   - **1971-1981**: Model spin-up
   - **1982-2001**: A simple coupled SST-nudging scheme
Initial condition:

*Ensemble mean*

20C depth anomaly

a) SODA

b) SINTEX-F
ACC scores of SST

(5-month running mean)

Shaded: >0.6

3-month lead
6-month lead
9-month lead
12-month lead
a) Nino3.4 SSTA prediction

b) ACC

c) RMSE

Lead time (months)
El Nino:
1986/87
1991/92
1997/98

La Nina:
1984/85
1988/89
1999/2000
Initial condition of model:
ENSO:
\[ r = -0.13 \, (0.37) \]
at 0(7)-month lag

---persistence
___model
ACC scores of SST (5-month running mean)

Shaded: >0.6

3-month lead
6-month lead
9-month lead
12-month lead
ENSO:

$r = 0.63$

at 3-month lag

--- persistence

___ model
ENSO:
$r = -0.24$
at 0-month lag, no delayed impact.

--- persistence
___ model
Summary
Seasonal forecast performance of the SINTEX-F CGCM
• Different coupling physics for ensemble prediction
• A simple SST-nudging scheme for initial condition
• Skillful ENSO prediction over 1 year lead time
• Realistic prediction of ENSO-related SSTA and rainfall
• Considerable predictability in the tropical Indian Ocean

Future work
• Assimilating subsurface data
• Probabilistic forecast