SMOS reveals the SSS signature of Indian Ocean Dipole events

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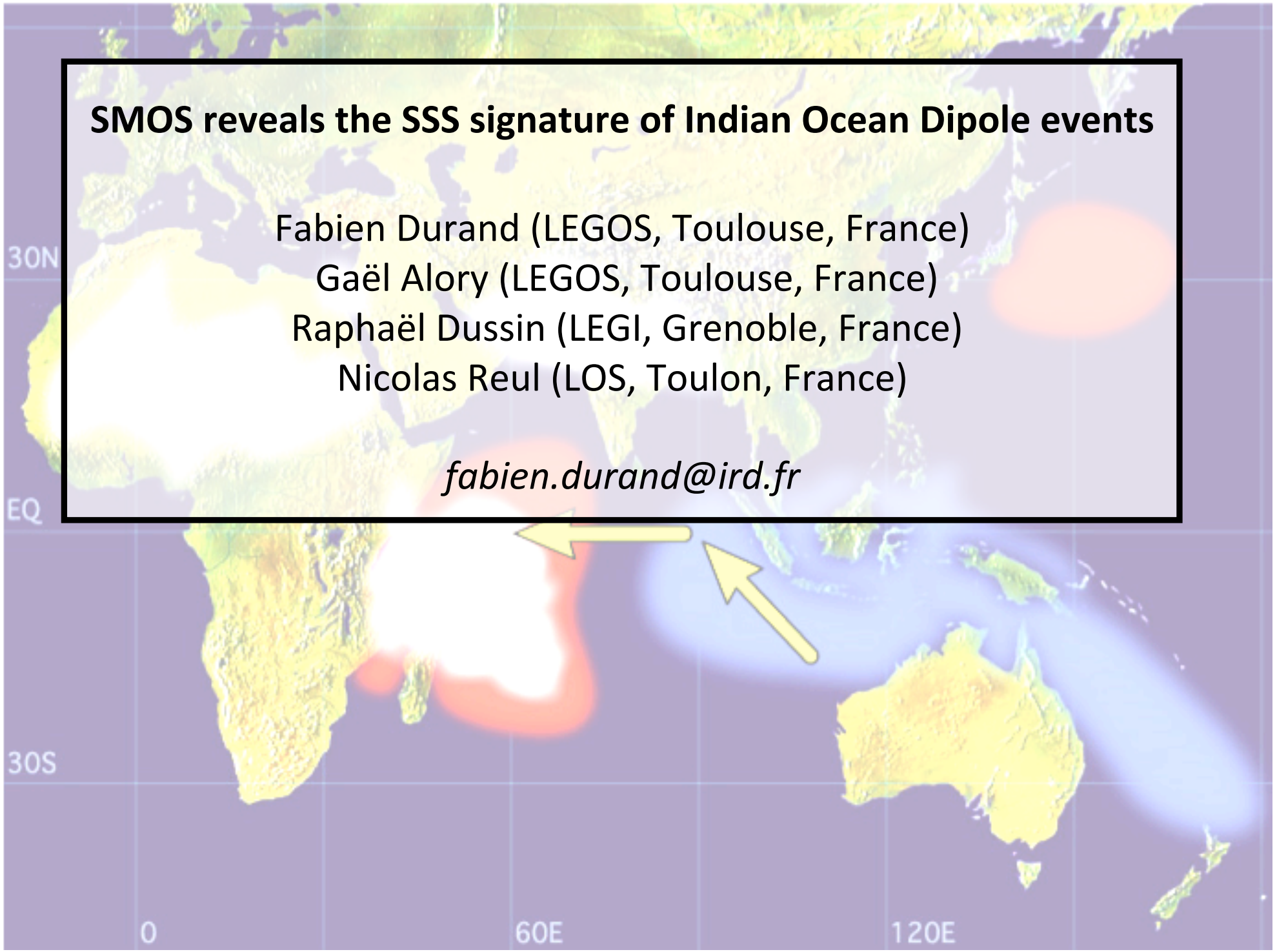
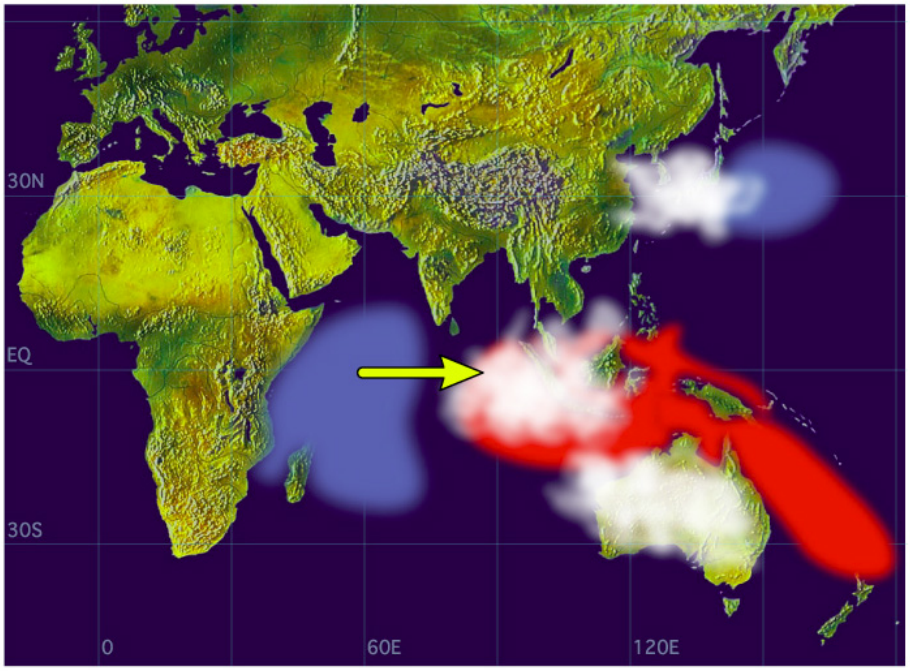
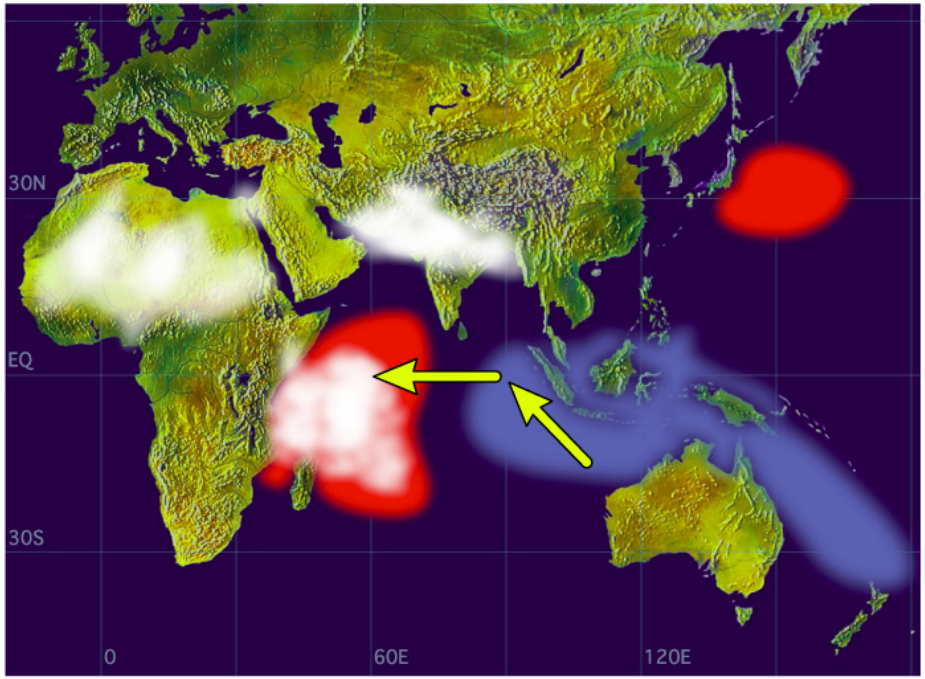


Indian Ocean Dipole

Negative Dipole Mode



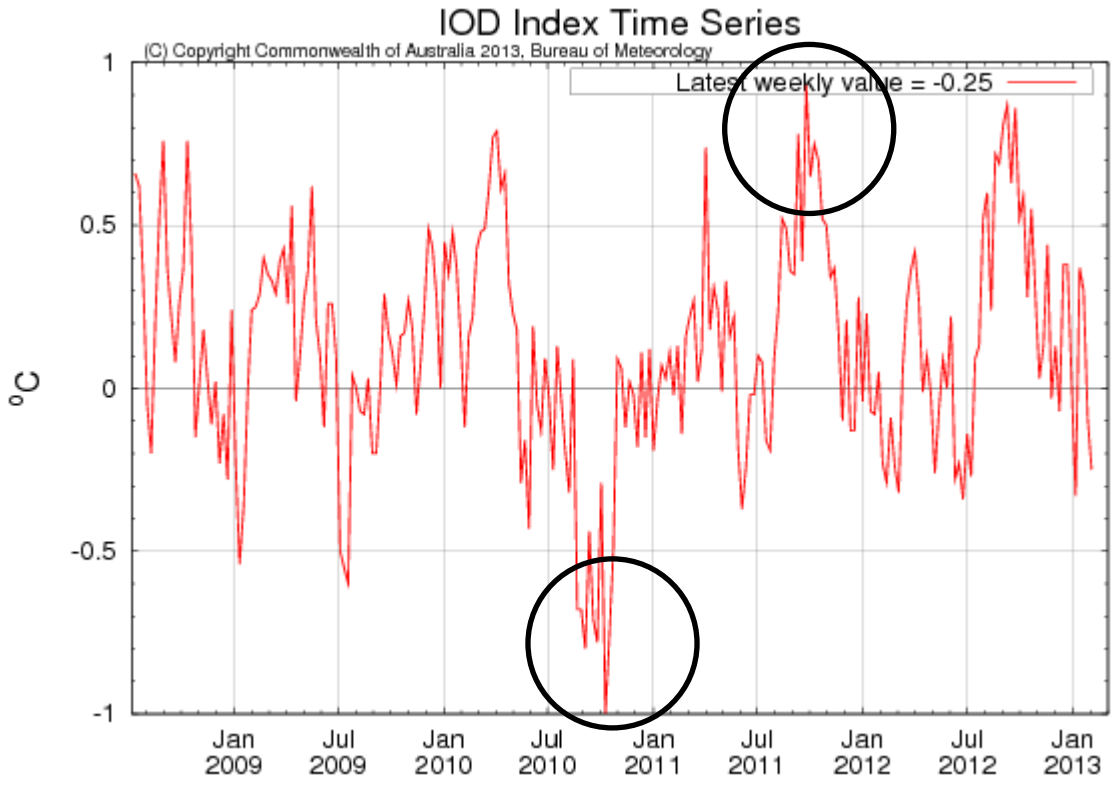
Positive Dipole Mode



Reverdin et al., 1986; Webster et al., 1999; Saji et al., 1999

IOD: the dominant mode of climatic variability in the Indian Ocean

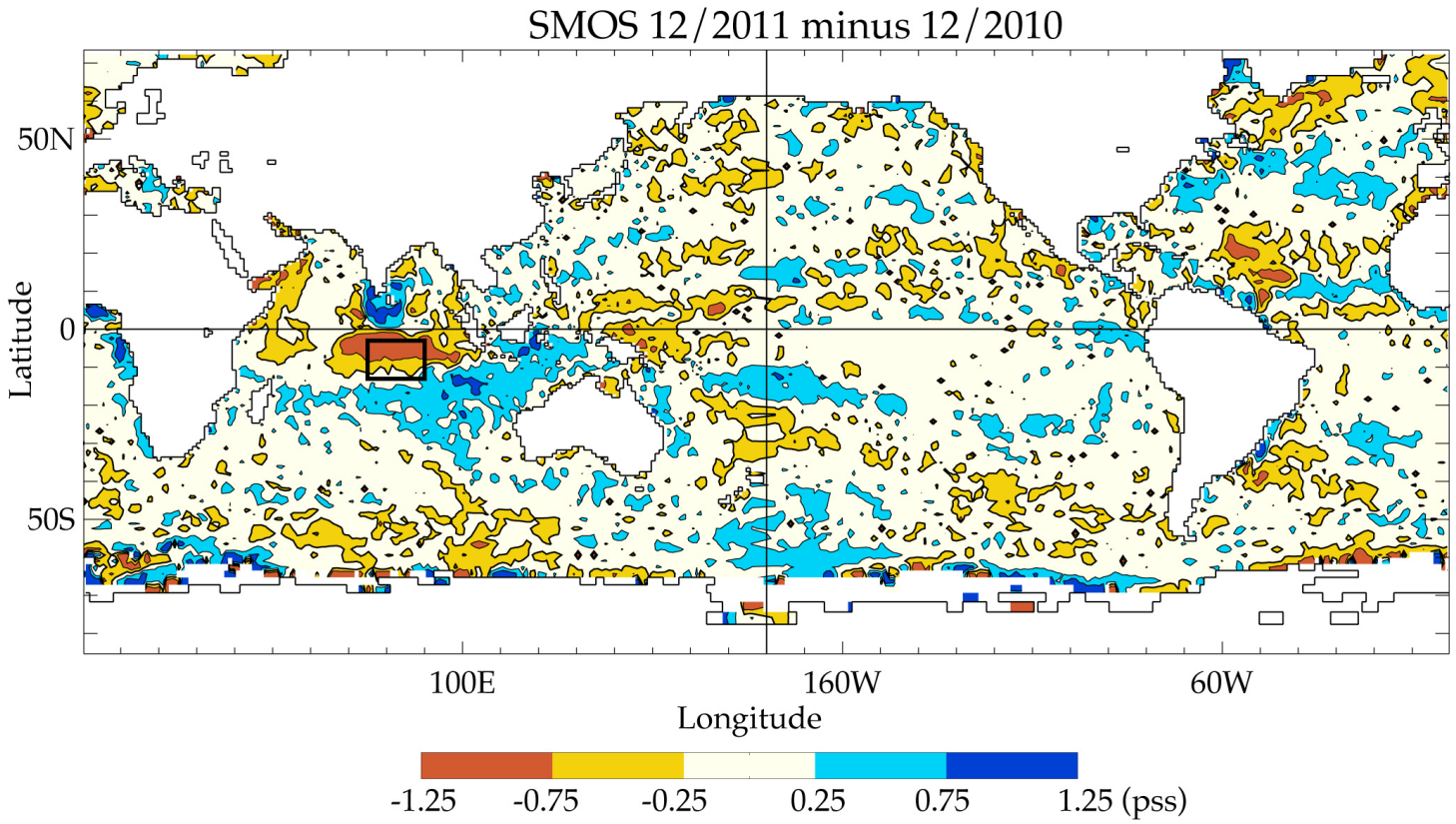
IOD events in 2010-2011



IOD-/IOD+ peaks in november 2010/2011

SMOS SSS variability in 2010-2011

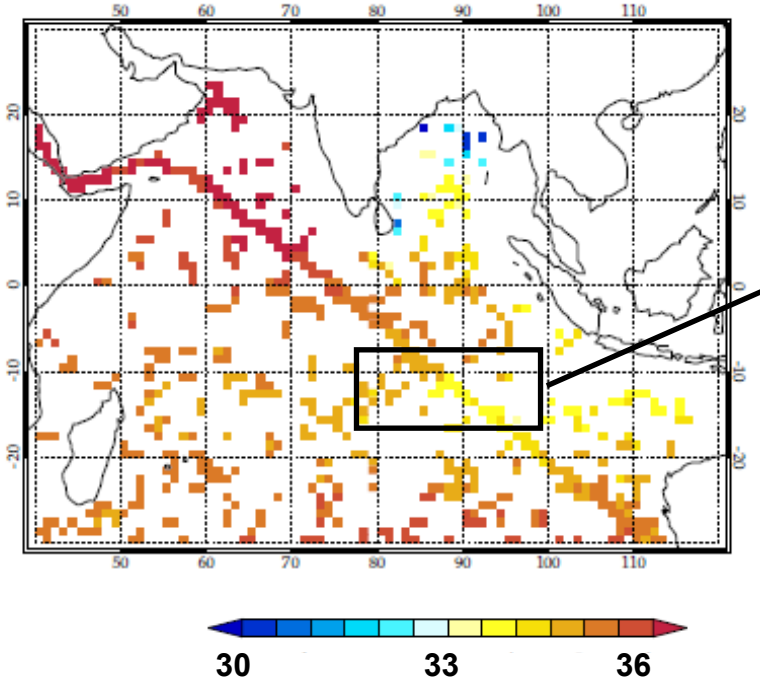
Product: Level3,1°×1°×1month from CATDS-CPDC

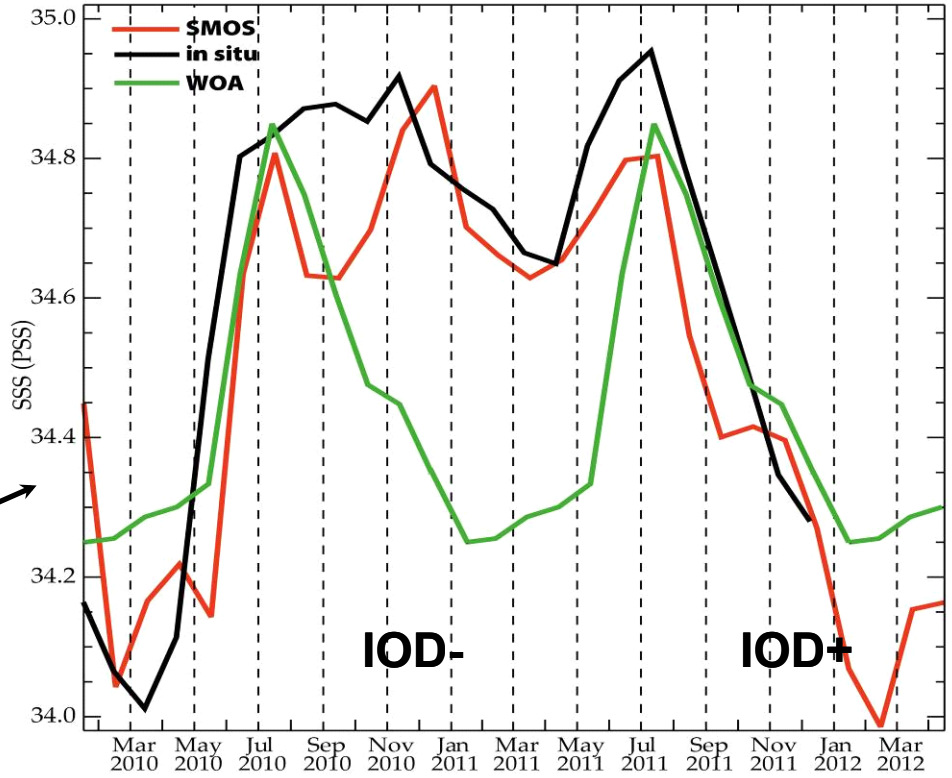


SMOS SSS difference between 12/2011 and 12/2010 in the Indian Ocean : the largest, longest-lasting year-to-year observed signal over SMOS period

SMOS SSS : validation

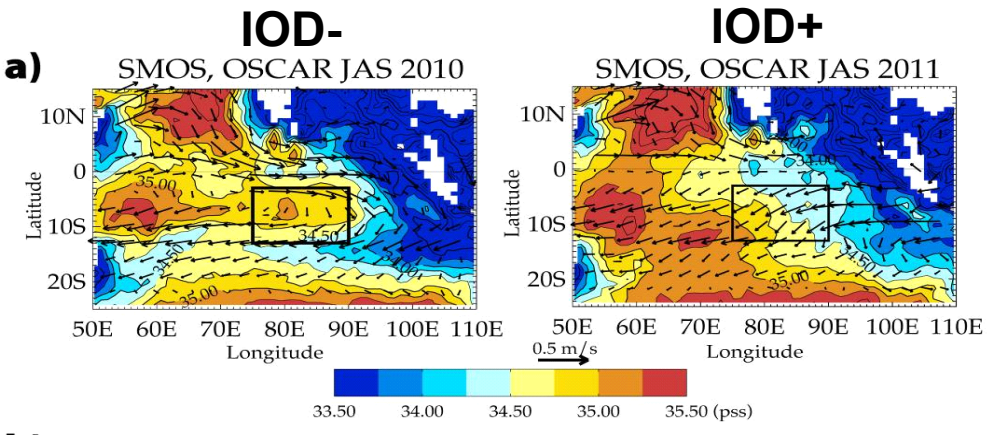
dec 2010 in situ SSS
(Argo+RAMA+TSG)





- **Good agreement between SMOS and in situ SSS in the central Indian Ocean**
- **No seasonal freshening in ASOND in 2010 (IOD-)**

SSS anomalies: forcing factors ?



- SMOS SSS (contours) and OSCAR surface current (vectors) averaged during July-September 2010 (left) and during July-September 2011(right).

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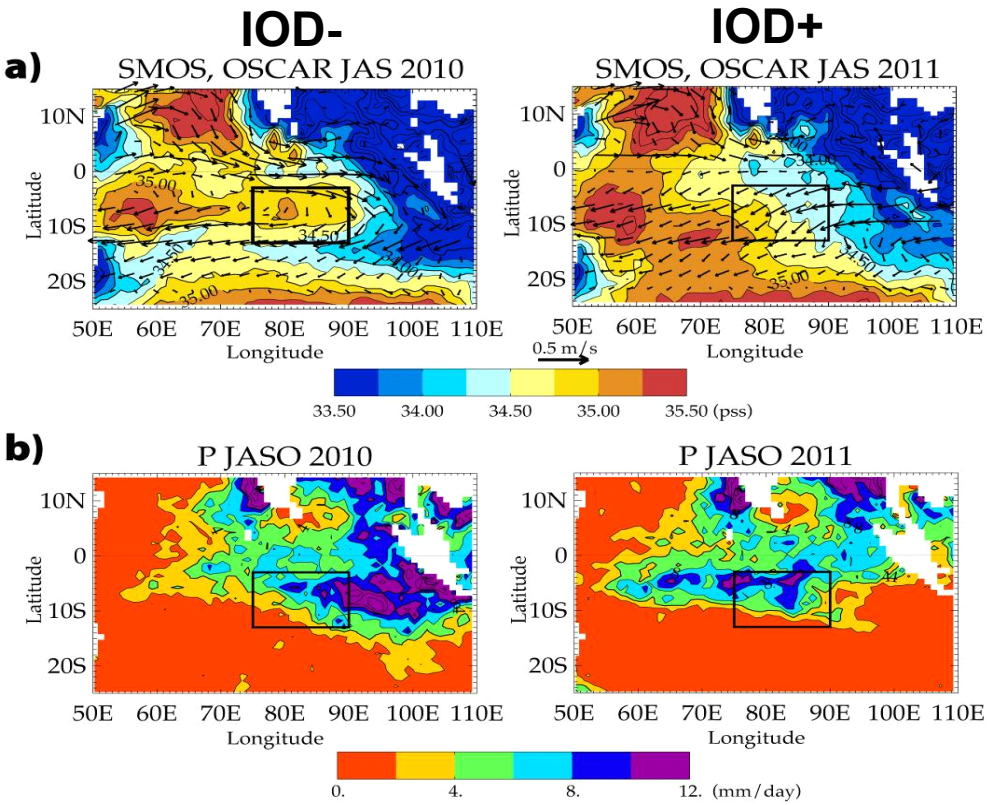

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- TMI precipitation averaged during July-October 2010 (left) and during July-October 2011 (right)

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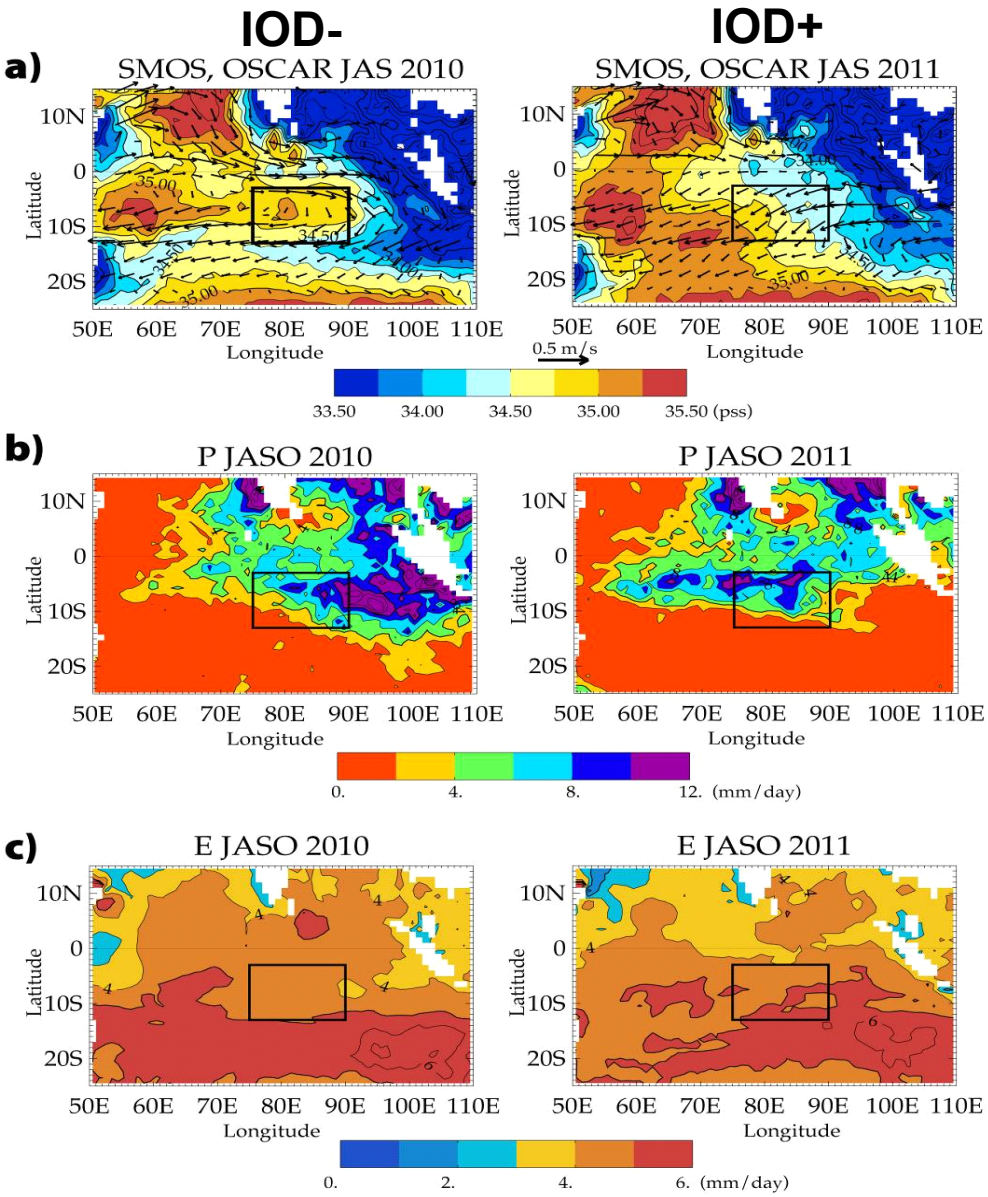

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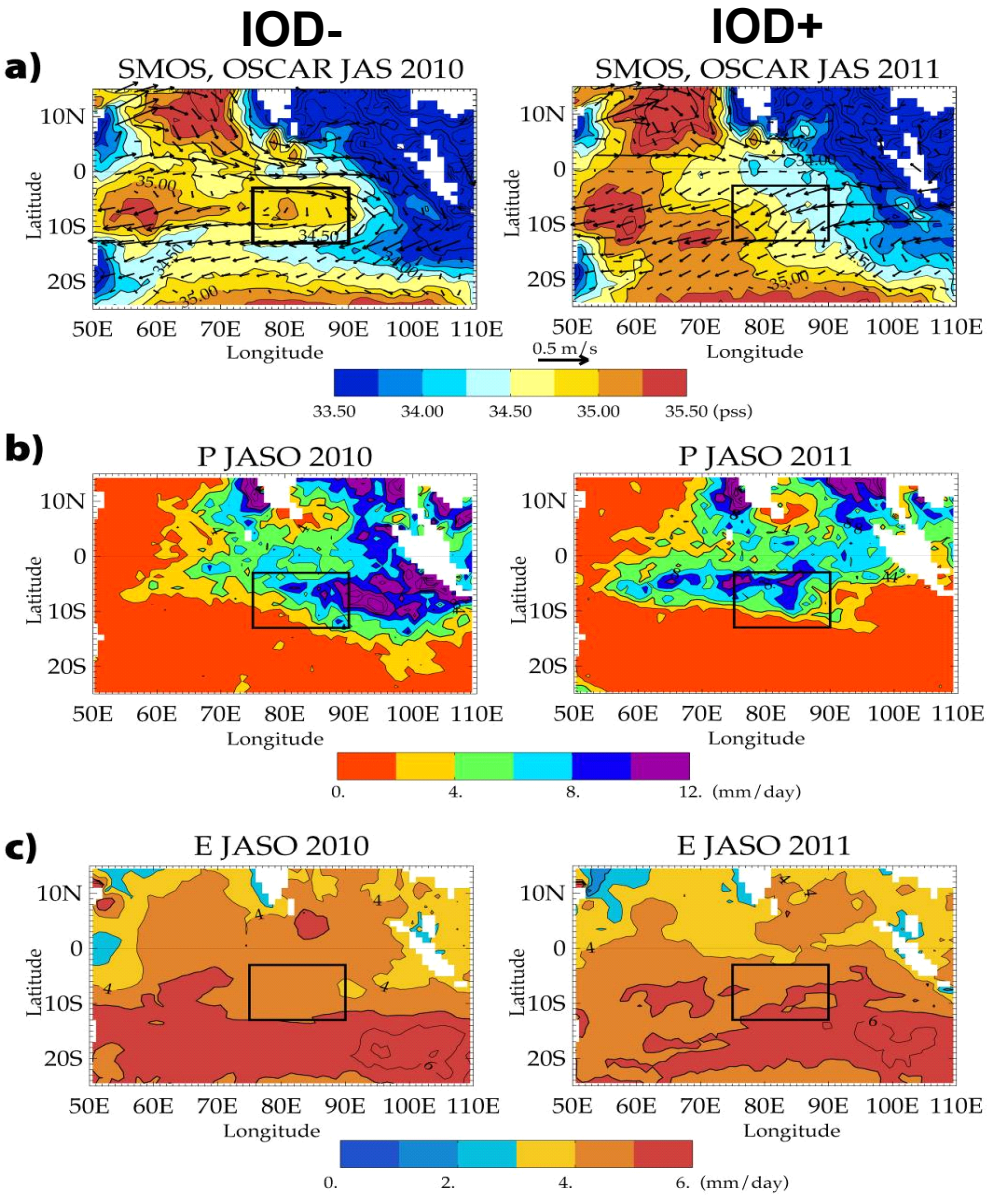

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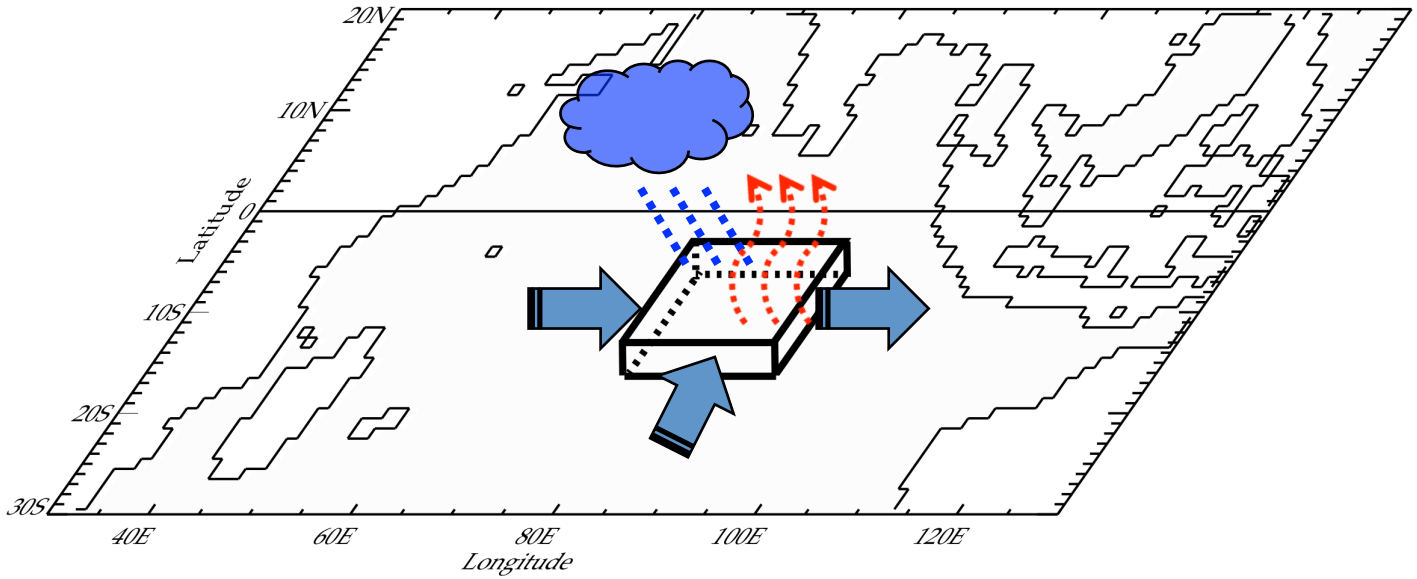
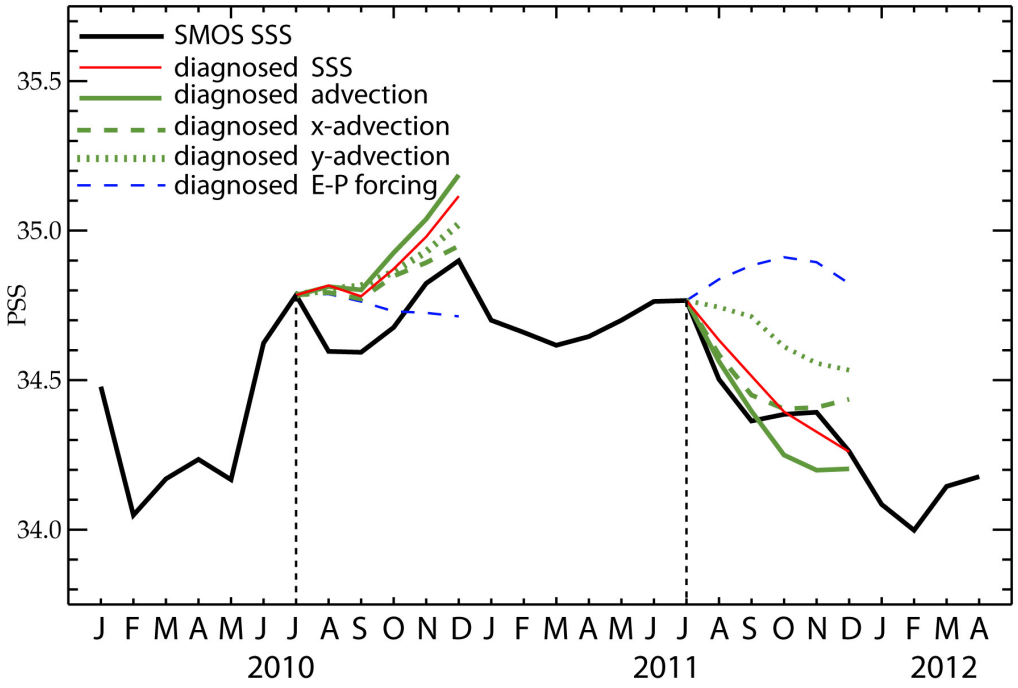
One good candidate: horizontal currents

SSS budget in the Central Indian Ocean

$$\frac{dS}{dt} = \frac{1}{h \times A}\left[\iint_{lateral\ boundaries} u_{normal} \times (S_{boundary} - S)ds + \iint_{ocean\ surface}(E - P) \times Sds\right]$$



SSS budget in the Central Indian Ocean from observations



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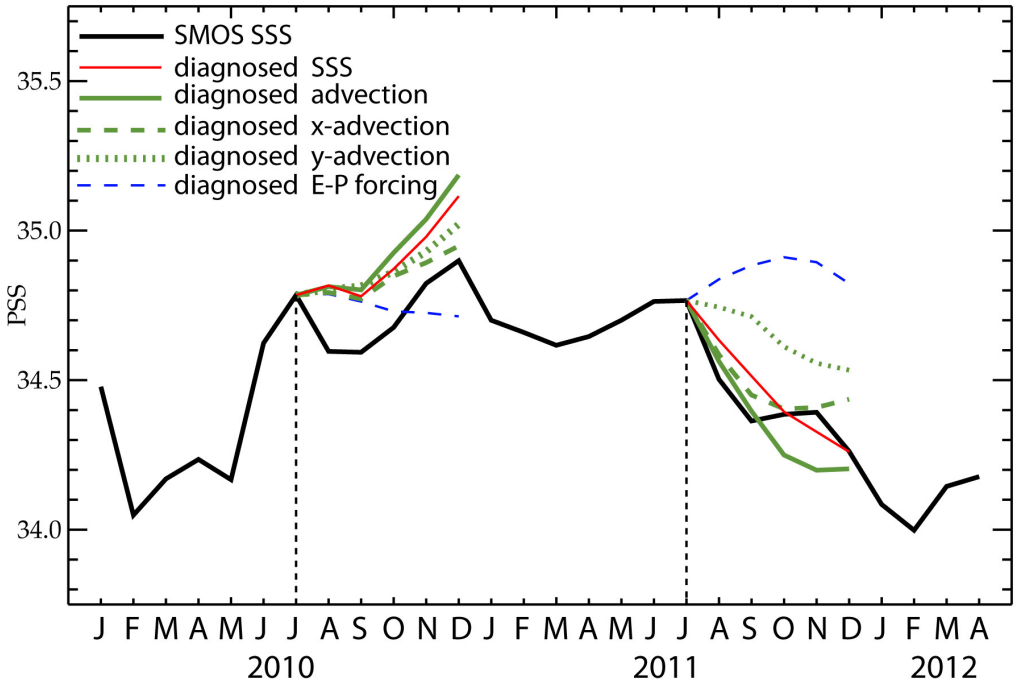
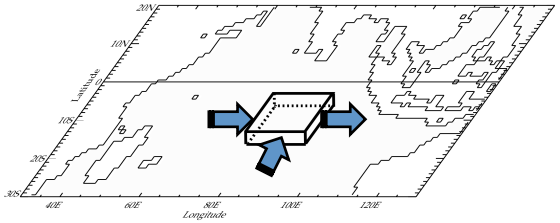


Main driver of the 2010/2011 contrast: horizontal advection

SSS budget in the Central Indian Ocean from an OGCM

Model: NEMO OGCM (1/4°, forced by ERA-i over 1990-2011, no relaxation of SSS)

$$\frac{dSSS}{dt} = horiz.advection + atm.forcing + vertic.exchanges$$



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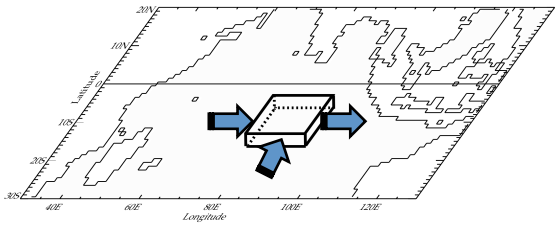

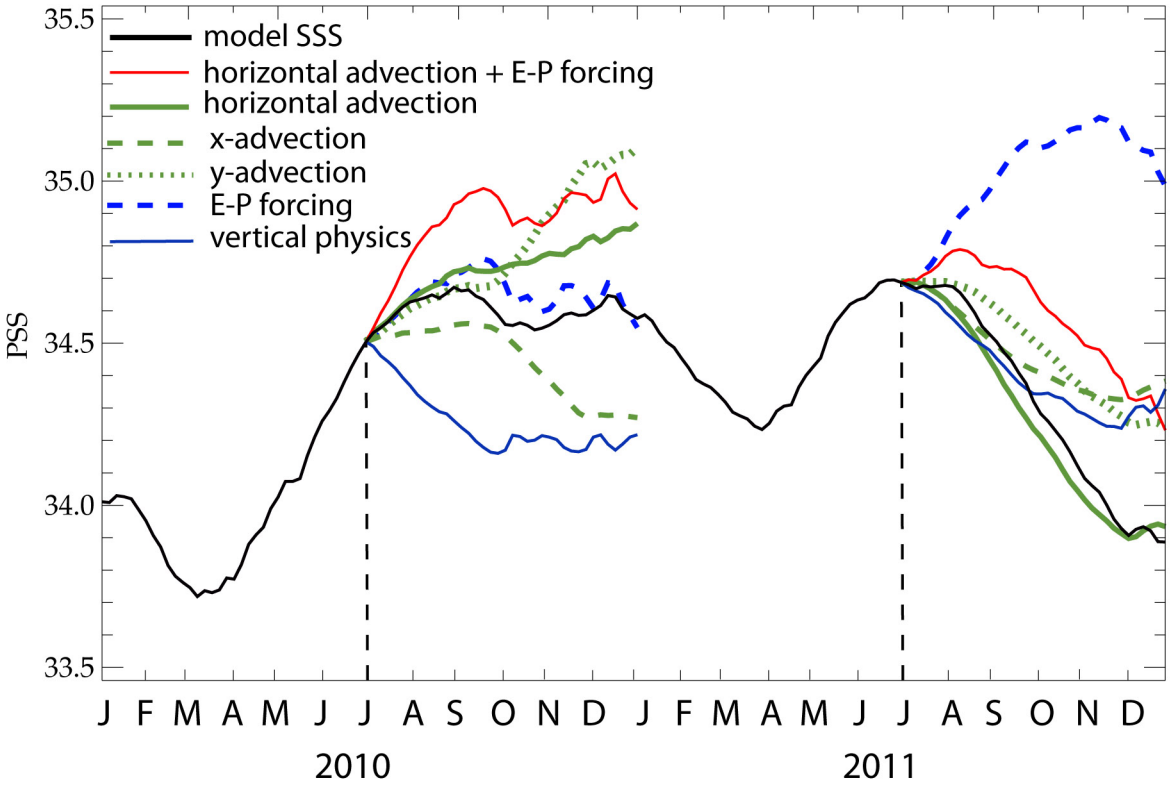

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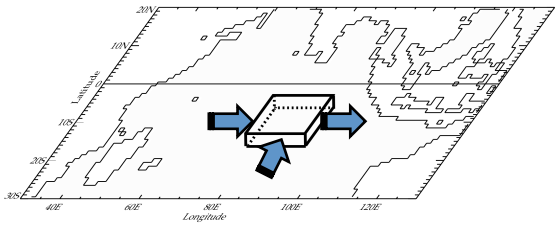
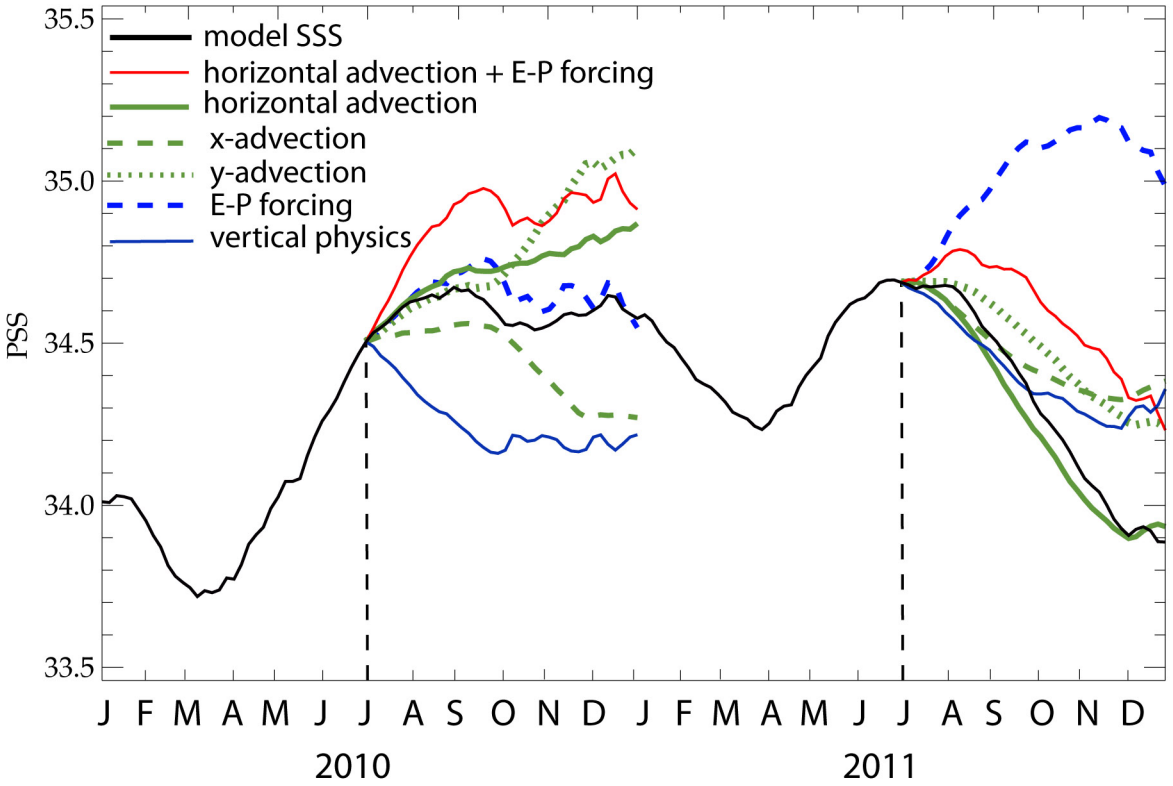




- OGCM: confirms that the main driver of the 2010/2011 contrast is horizontal advection

- But vertical physics necessary to close the SSS budget

Conclusions

- **Central Indian Ocean: strongest year-to-year anomalies of SSS over SMOS era**

- **Clear signature of IOD on SSS**

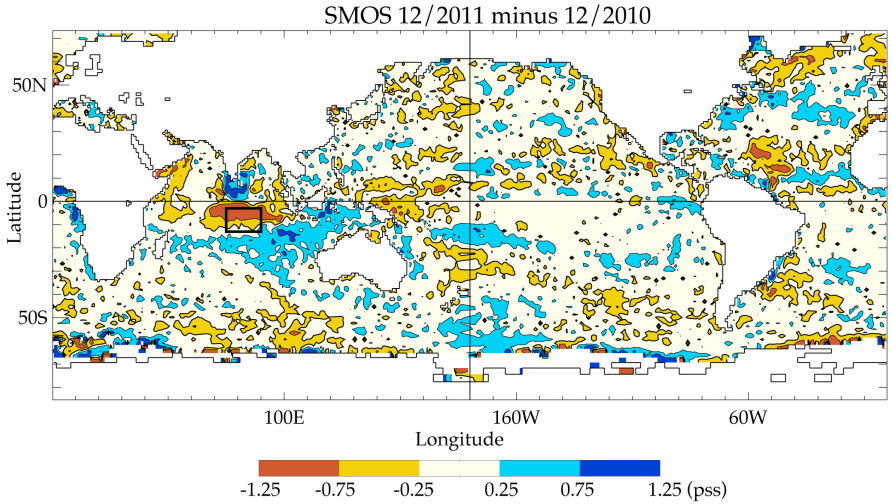
- **SMOS L3 (from CATDS-CPDC) : excellent quality in the Central Indian Ocean**

  (not in the CATDS-CEC L3v2 product !...)

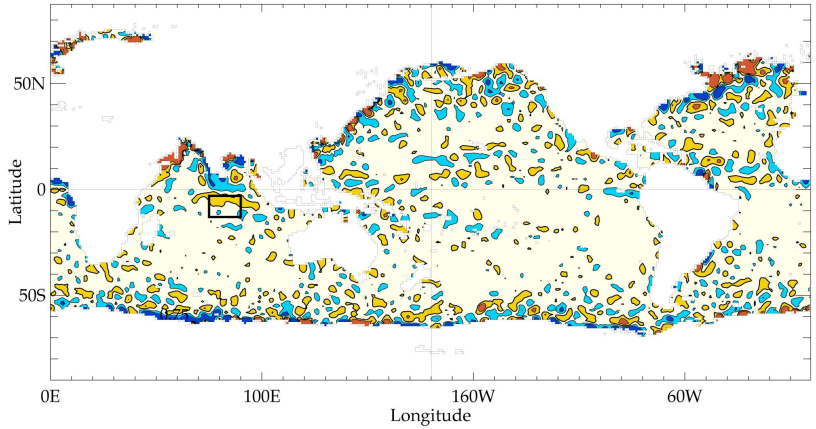
  (not in the Northern Indian Ocean, see Akhil's poster…)

- **SMOS allows to compute purely observational SSS budgets**

L3 CATDS-CPDC



L3 CATDS-CEC v2



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- *CNES for funding*
- *DRAKKAR project for numerical model framework*
- *Thierry Delcroix for fruitful discussions*
- *French SSS observation service, RAMA and ARGO projects for in situ data*