Observation of surface horizontal thermohaline variability from space in the Azores current/front region

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EGU general assembly
Vienna, 27 April – 2 May 2014

Introduction

- Surface horizontal thermohaline variability at all scales key parameters :

  Relative contribution of temperature and salinity gradients → density gradients → currents and physical processes

- **Argo interpolated products** are the only source of 2D SST/SSD products (see Johnson et al., 2012),
  - **but actual resolved scales ~ 500 km**

Can we do better with SMOS ?

- **SMOS resolution ~50-100 km**
- Mesoscale thermohaline structure visible in SMOS ?
  - Yes, in large salinity contrast area >1-2 pss (Gulf stream, Amazon plume) (Reul et al., 2013)
  - In region less contrasted in open ocean?
  - Azores current/front

Tool

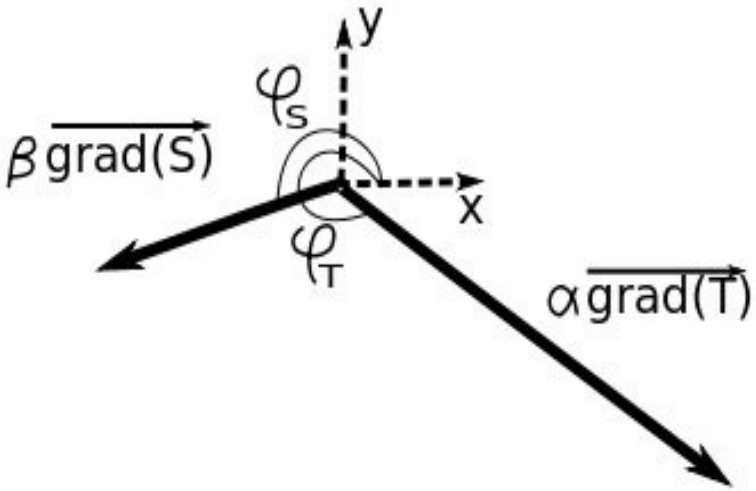
- Horizontal density ratio 2-D (complex)

$$R_H = \frac{\alpha\left(\partial_x \theta + i.\partial_y \theta\right)}{\beta\left(\partial_x S + i.\partial_y S\right)}$$

Compensation =

Norm of the ratio: |R| ~ 1

Alignement: φ ~ 0°



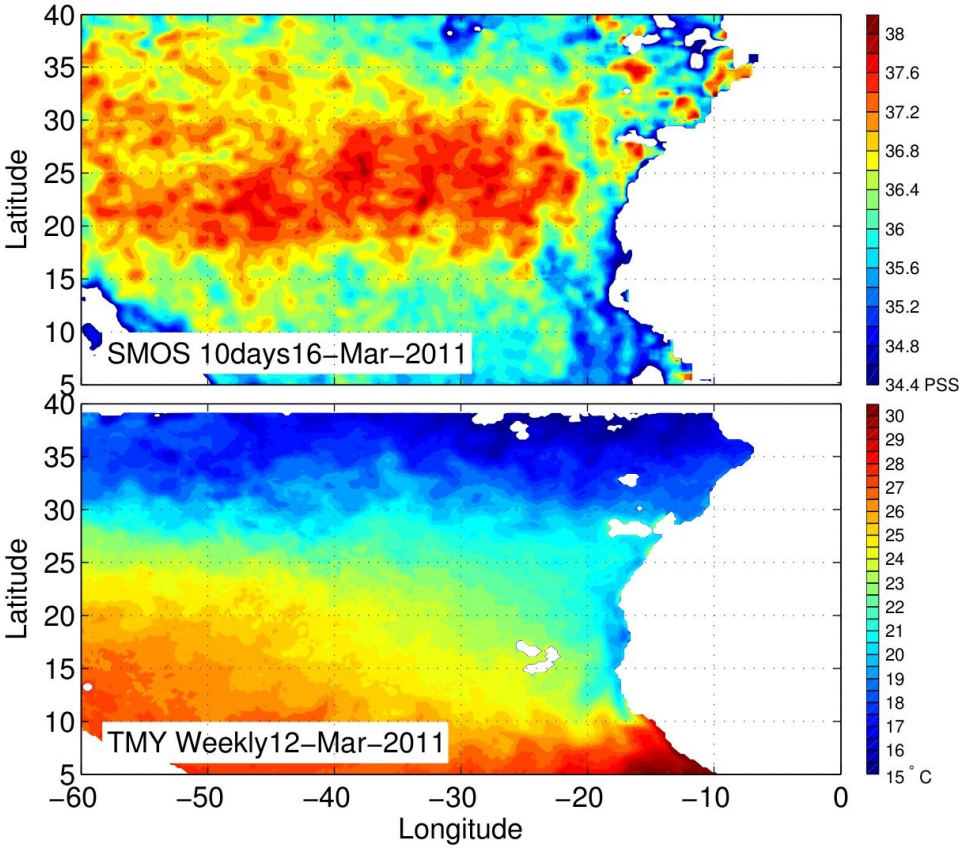
Satellite data

SMOS Resolution :
- 100x100 km^2
- 1 month
- Uncertainty ~0.15-0.20 pss

(*Hernandez et al.*, 2014)

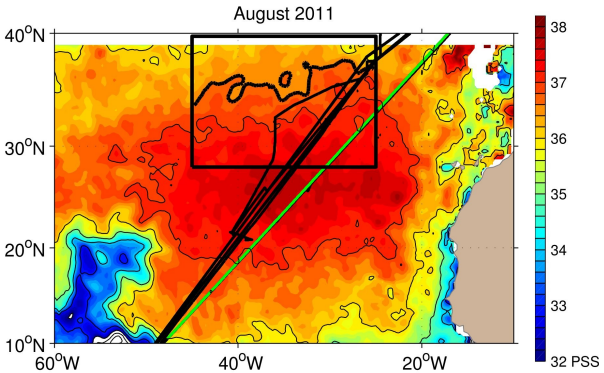
SST TMI
- .25°x.25°
- 1 month
- Uncertainity ~ 0.57°C

(*Gentemann et al*., 2004)



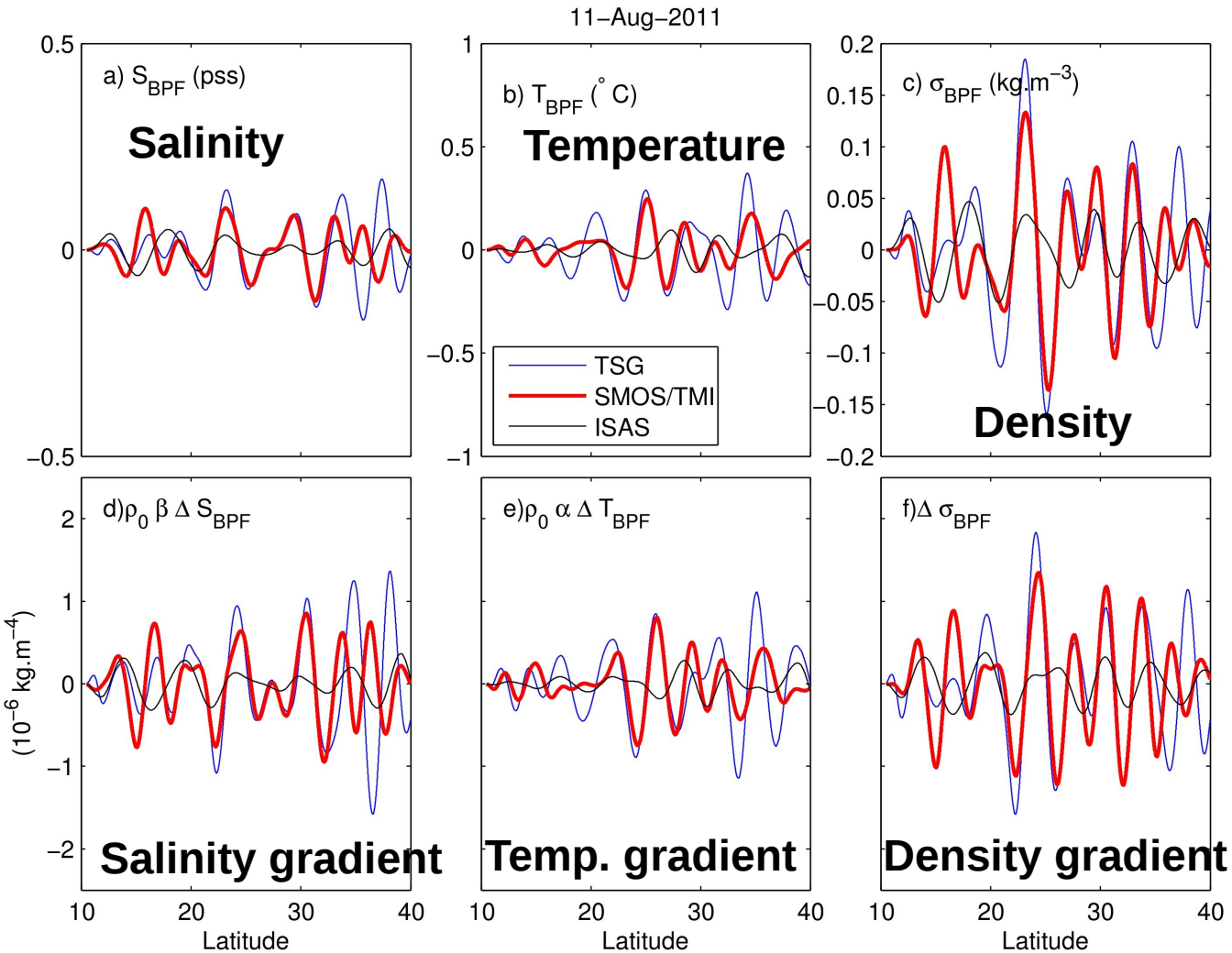
Mesoscale validation

- Comparison with TSG in situ data and monthly satellite data
- Bandpass Butterworth filtered of αΔT and βΔS
- **horizontal gradients**
- Scale 200-500km



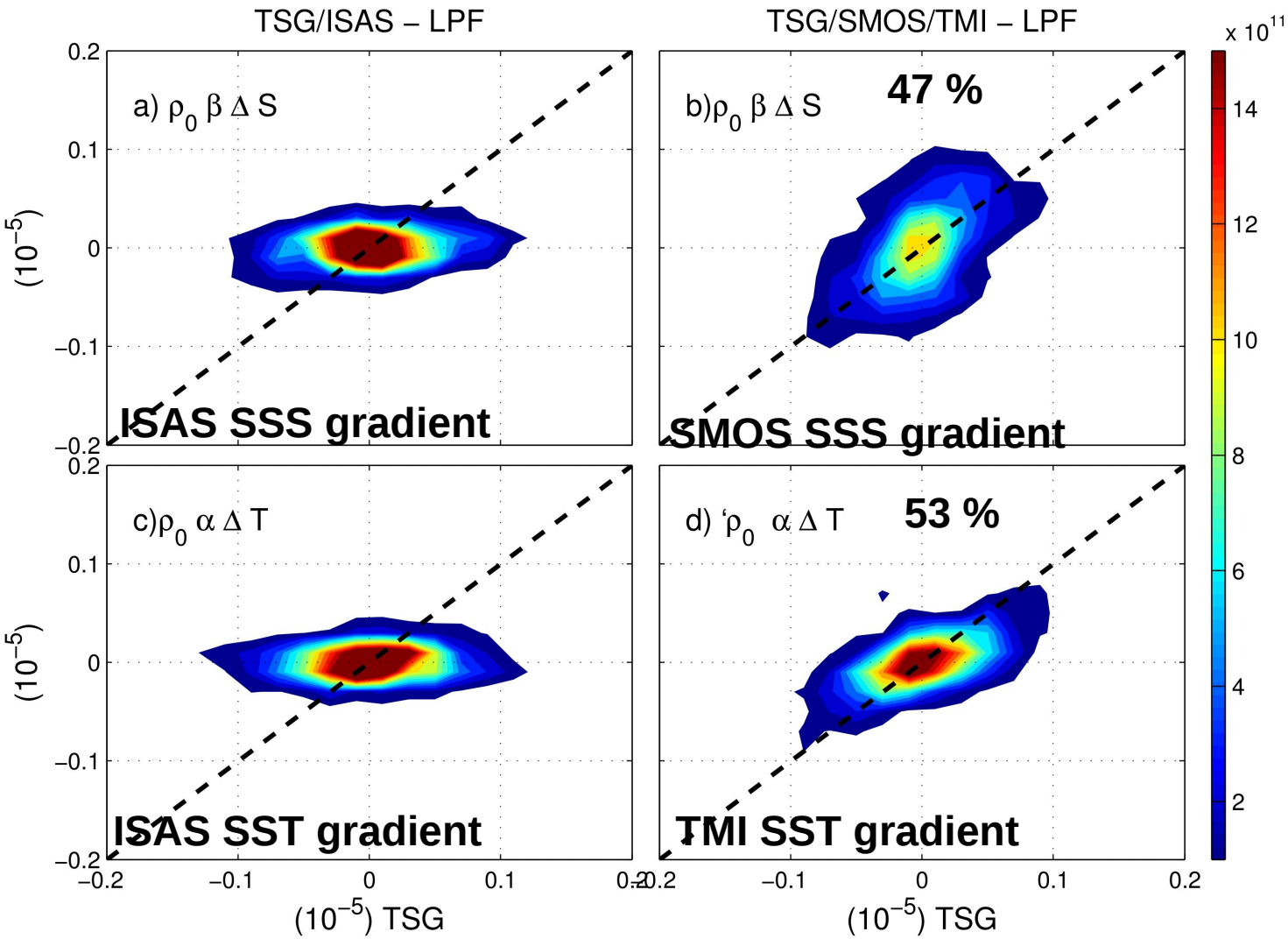
7-15 August 2011

SMOS/TMI
TSG
ISAS/Argo interpolated



Mesoscale validation

- Comparison with TSG in situ data and monthly satellite data
- Bandpass Butterworth filtered of αΔT and βΔS
- Scale 200-500km → mesoscales



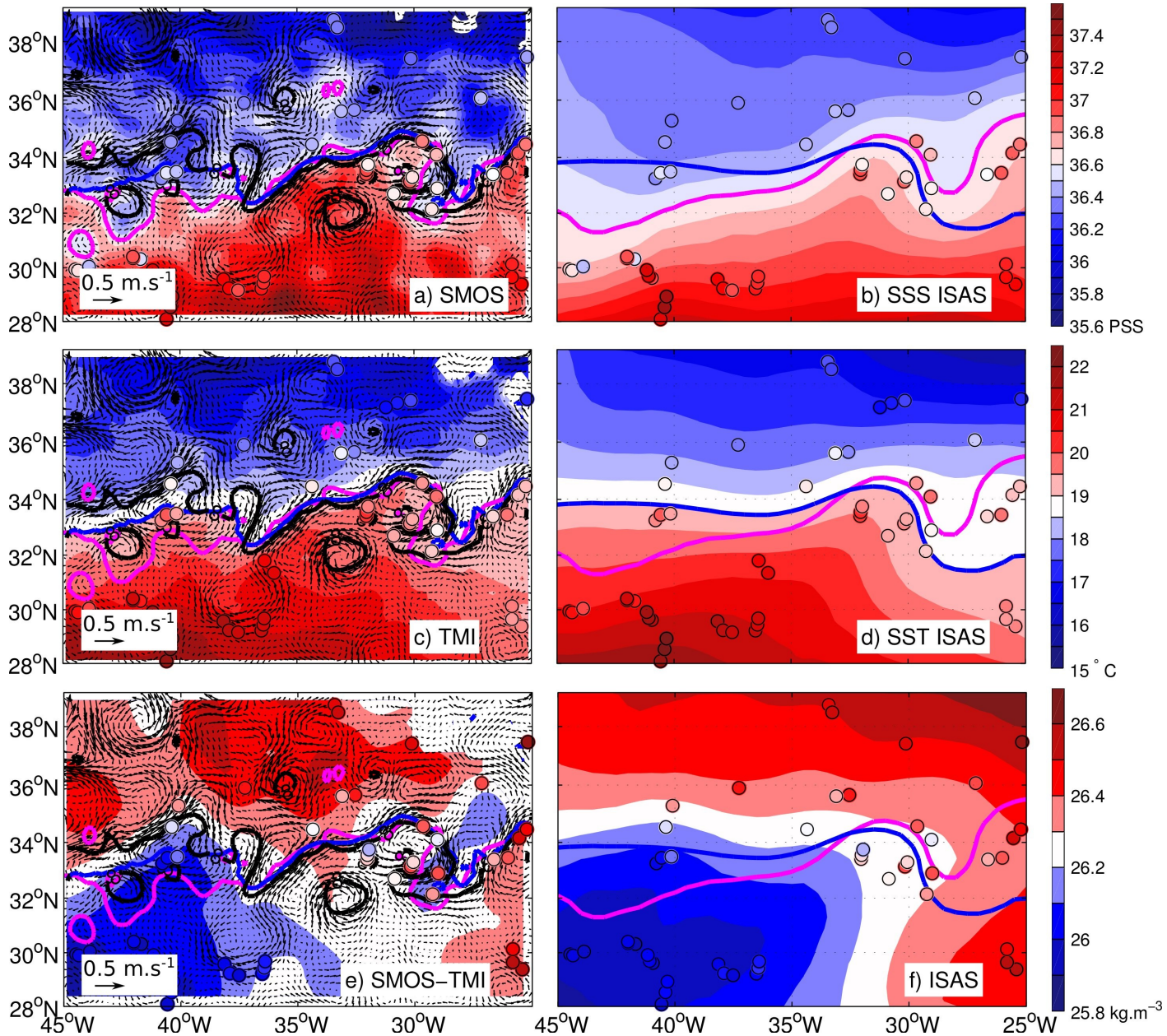
Late winter Azores front/current (March 2012)

Satellite **ISAS**

Salinity

Temperature

Density



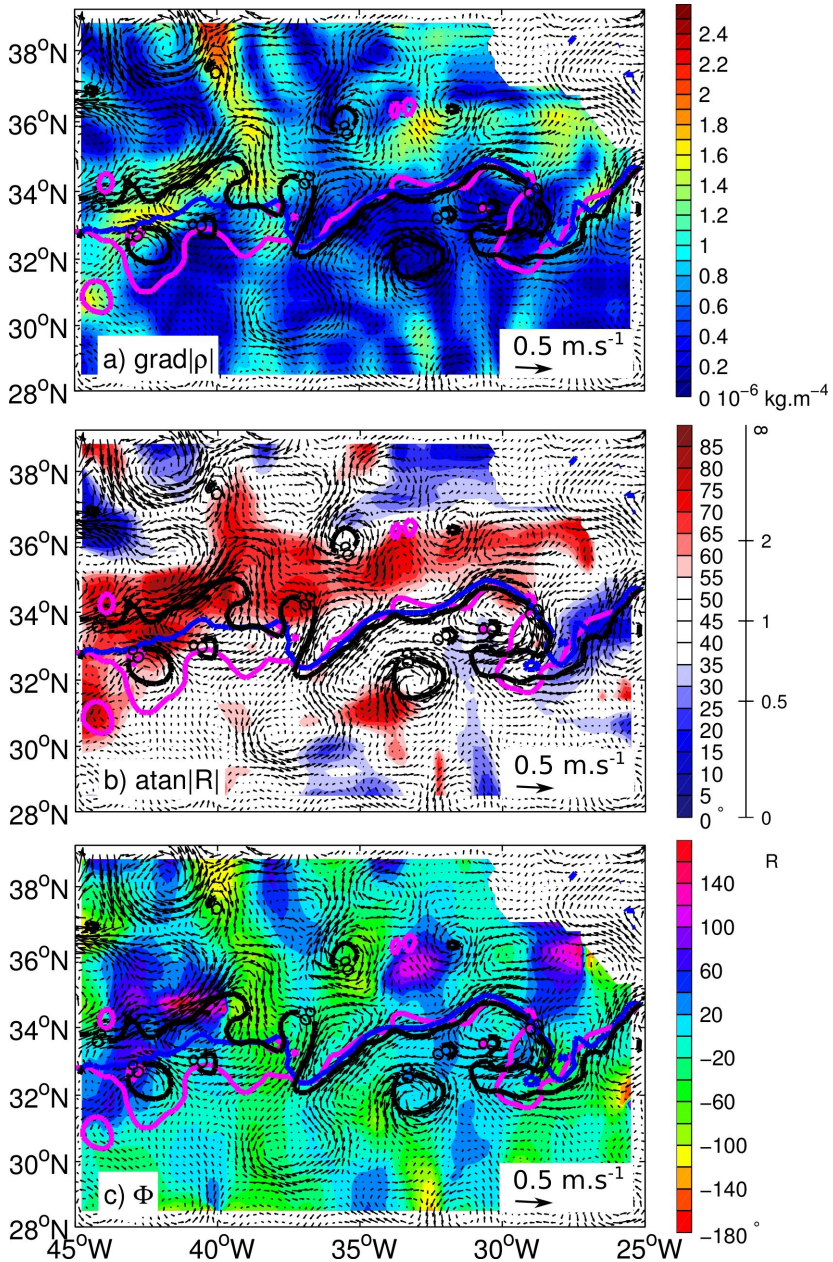
Late winter Azores front/current (March 2012)

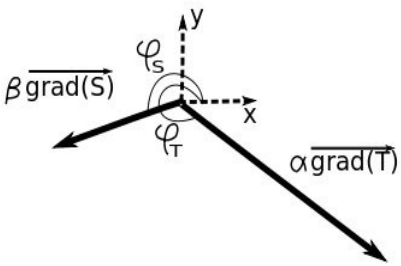
Satellite

Density gradient

Density Ratio

Density Ratio angle





Summer Azores front/current (July 2011)

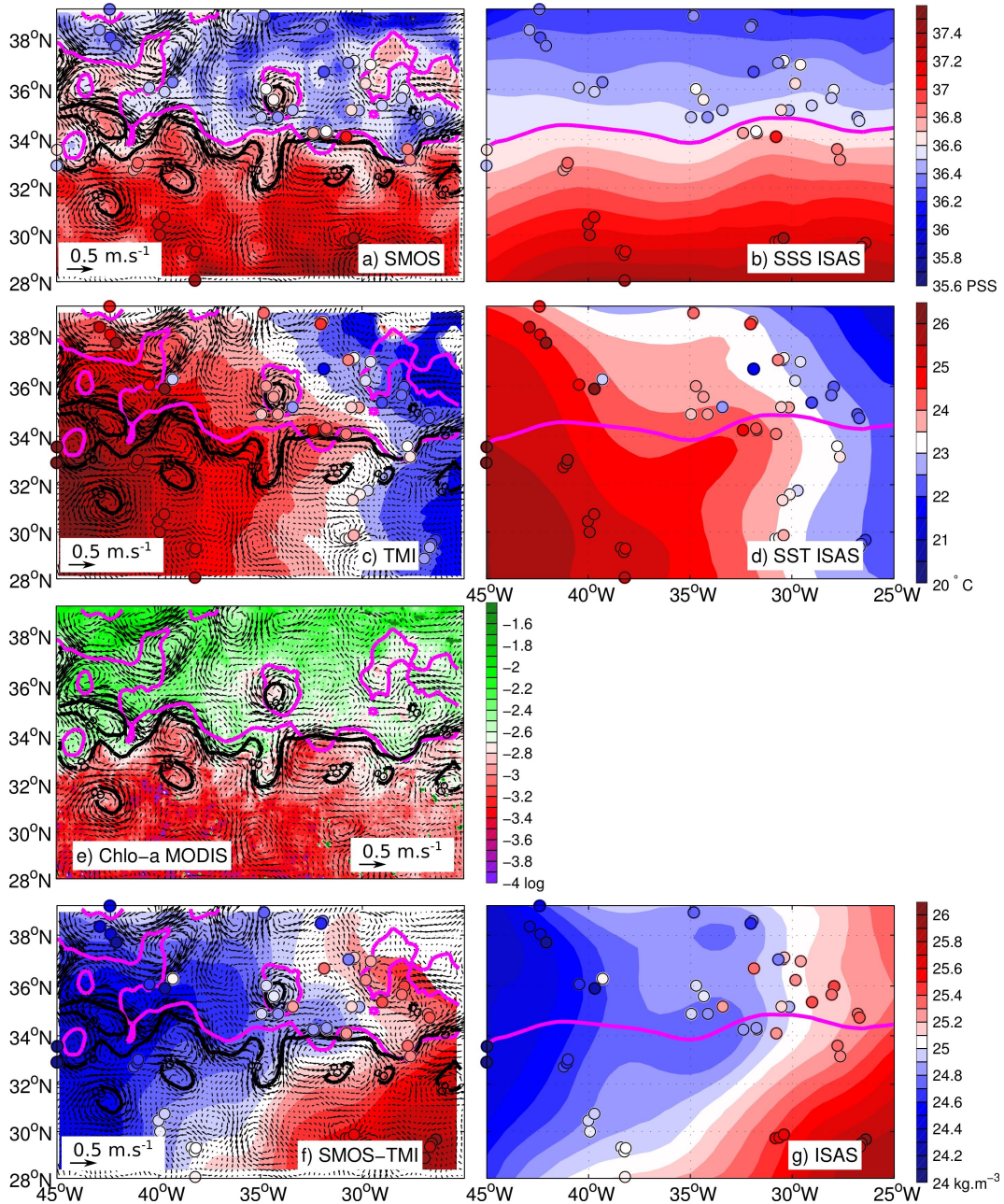
Satellite **ISAS**

Salinity

Temperature

Chlorophyll-a

Density



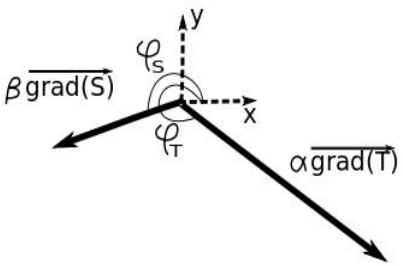
Summer Azores front/current (July 2011)

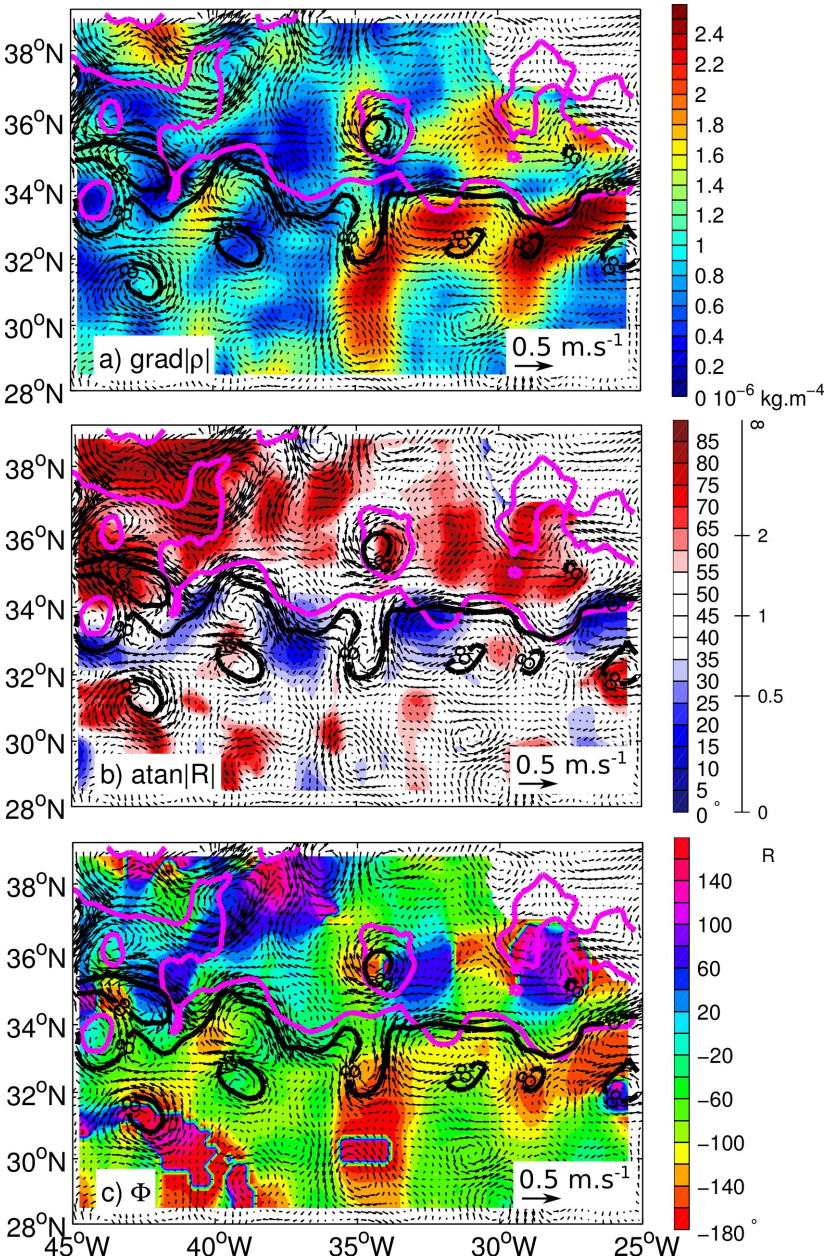
Satellite

Density gradient

Density Ratio

Density Ratio angle





Conclusion

- It is possible to observe physical thermohaline structures (200-500 km) from SMOS data and other satellite data

- Favorable case : far from the coast and RFI pollution

- Azores front/current :
  - Salinity is a good indicator of the Azores front during the whole year (better than SST, SSD …)
  - During winter : density-compensation at mesoscale

→ Poster Session S1.05 on Monday, Poster B958