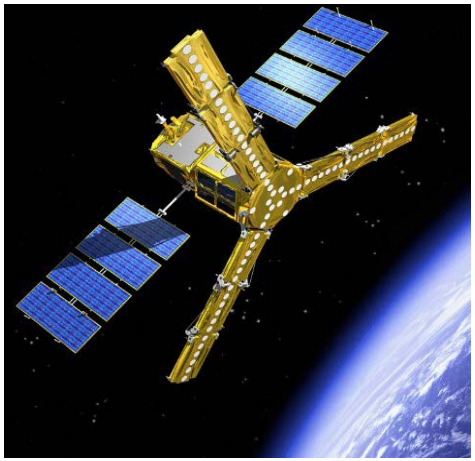
# Utilisation d'ARGO pour la validation et l'interprétation des mesures SMOS

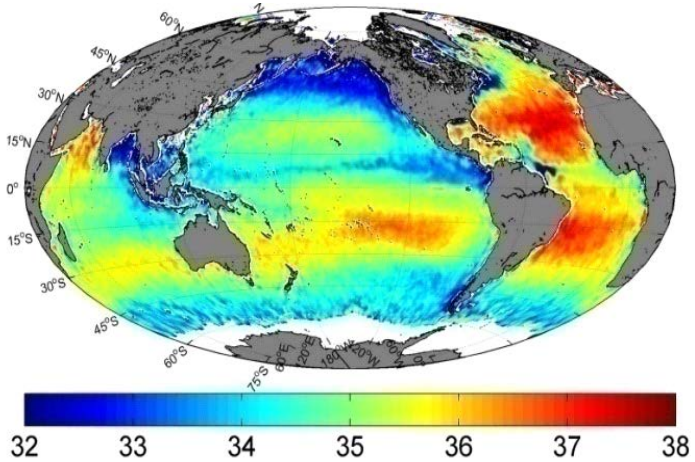
J. Boutin (LOCEAN) et N. Reul (IFREMER)

*+ Contributions des participants aux projets GLOSCAL, CATDS, ESA-ESL*



SMOS: Vue d'artiste
Proposition ESA
acceptée 1999

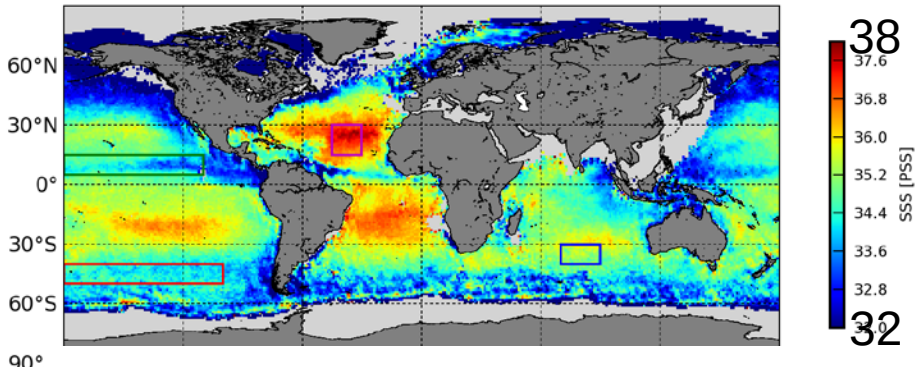
SMOS: lancement
2 Nov. 2009



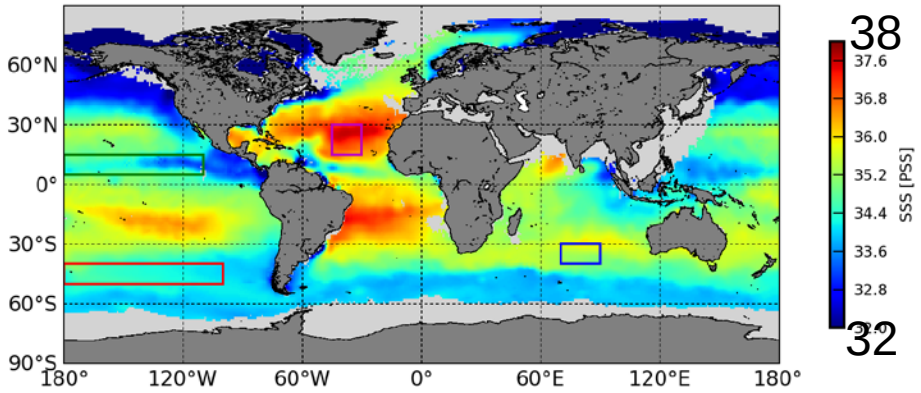

SMOS: Salinité de surface
CATDS-CEC v1 Août 2010

# SMOS SSS & ARGO SSS maps (optimal interpolation)

SMOS SSS (ESA v550) – Sept 2011




ISAS v6 SSS (ARGO Obj. Interp., LPO)

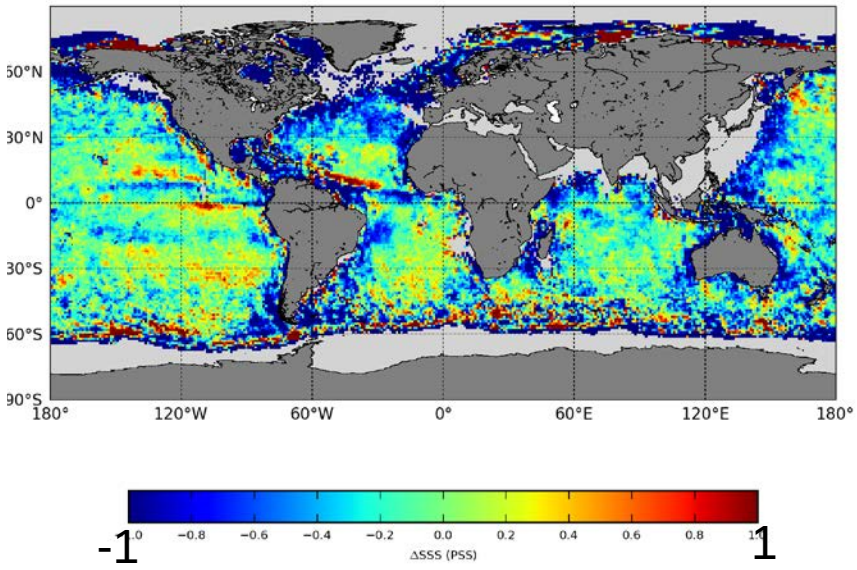



**SMOS versus ARGO OI map**:

-Large scale SSS variation OK

-Small scale SSS gradients well resolved by SMOS (e.g. Amazone plume)

SMOS –ARGO OI map




**SMOS issues**:

-Biases close to land (image reconstruction)

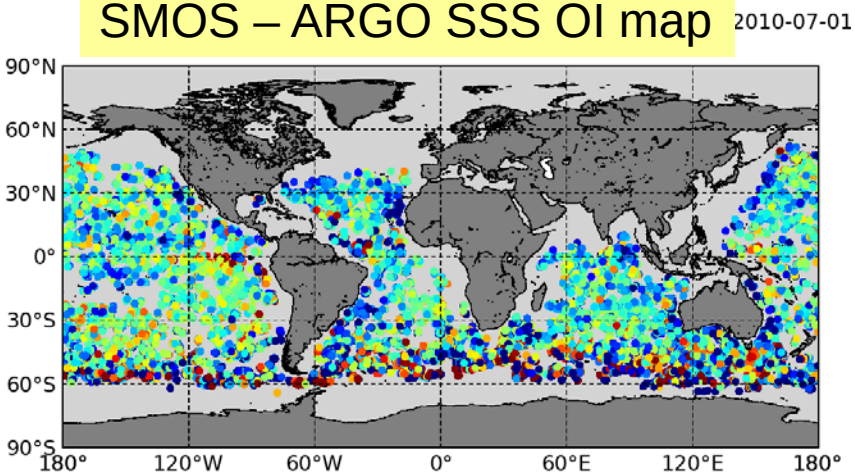
-RFI (N. Atl., Asian coasts)

-Ice edge

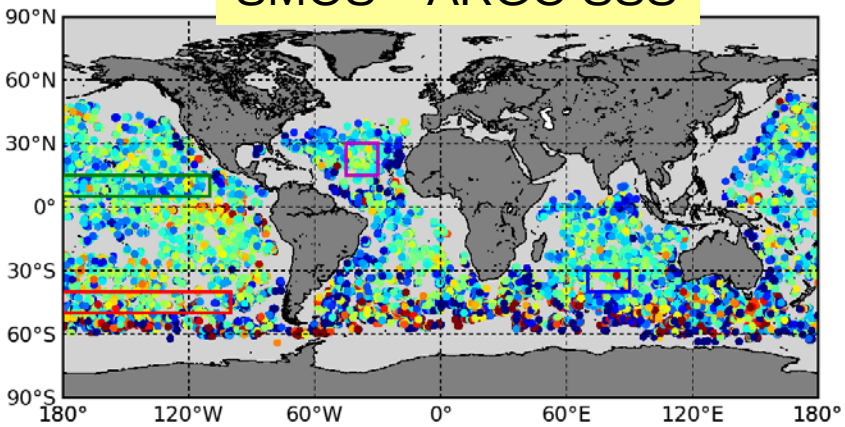
-Rainy regions?

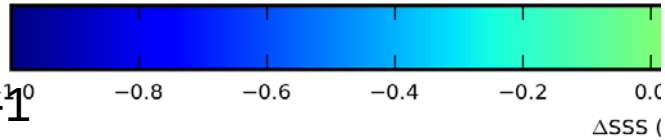
# SMOS 100km-10day and ARGO SSS colocations

SMOS – ARGO SSS OI map

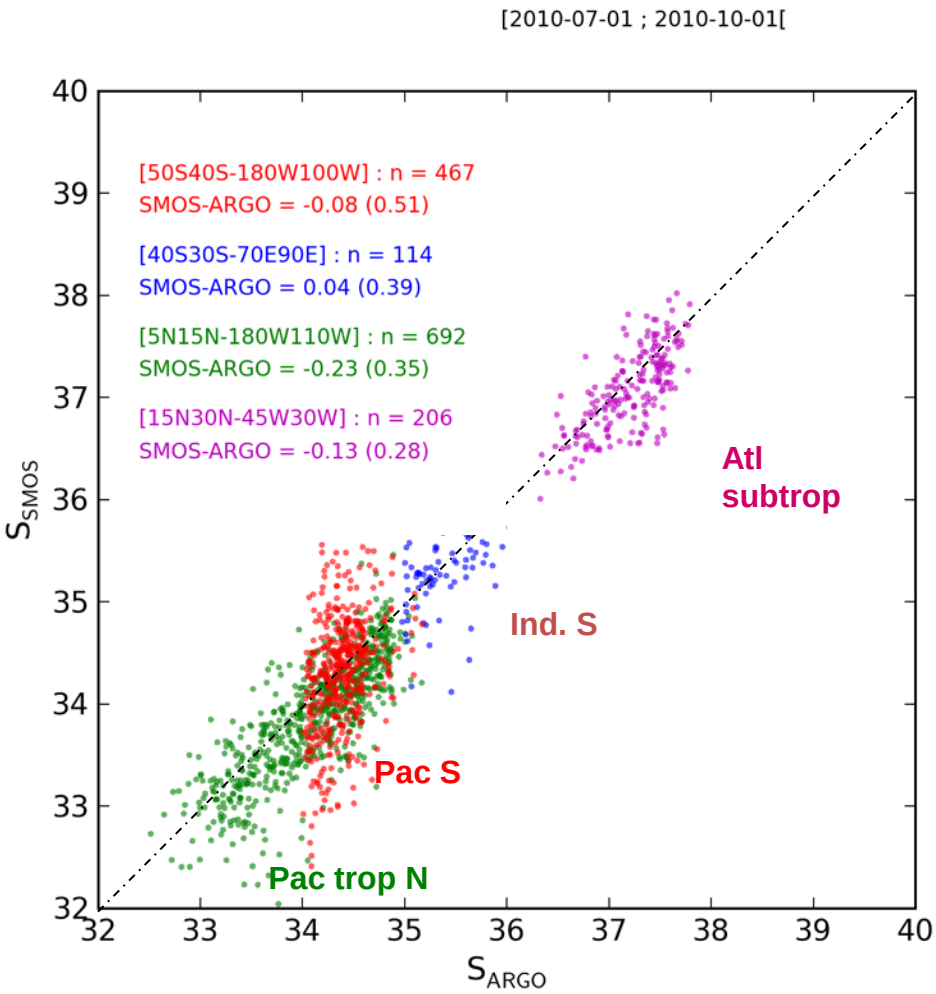



SMOS – ARGO SSS



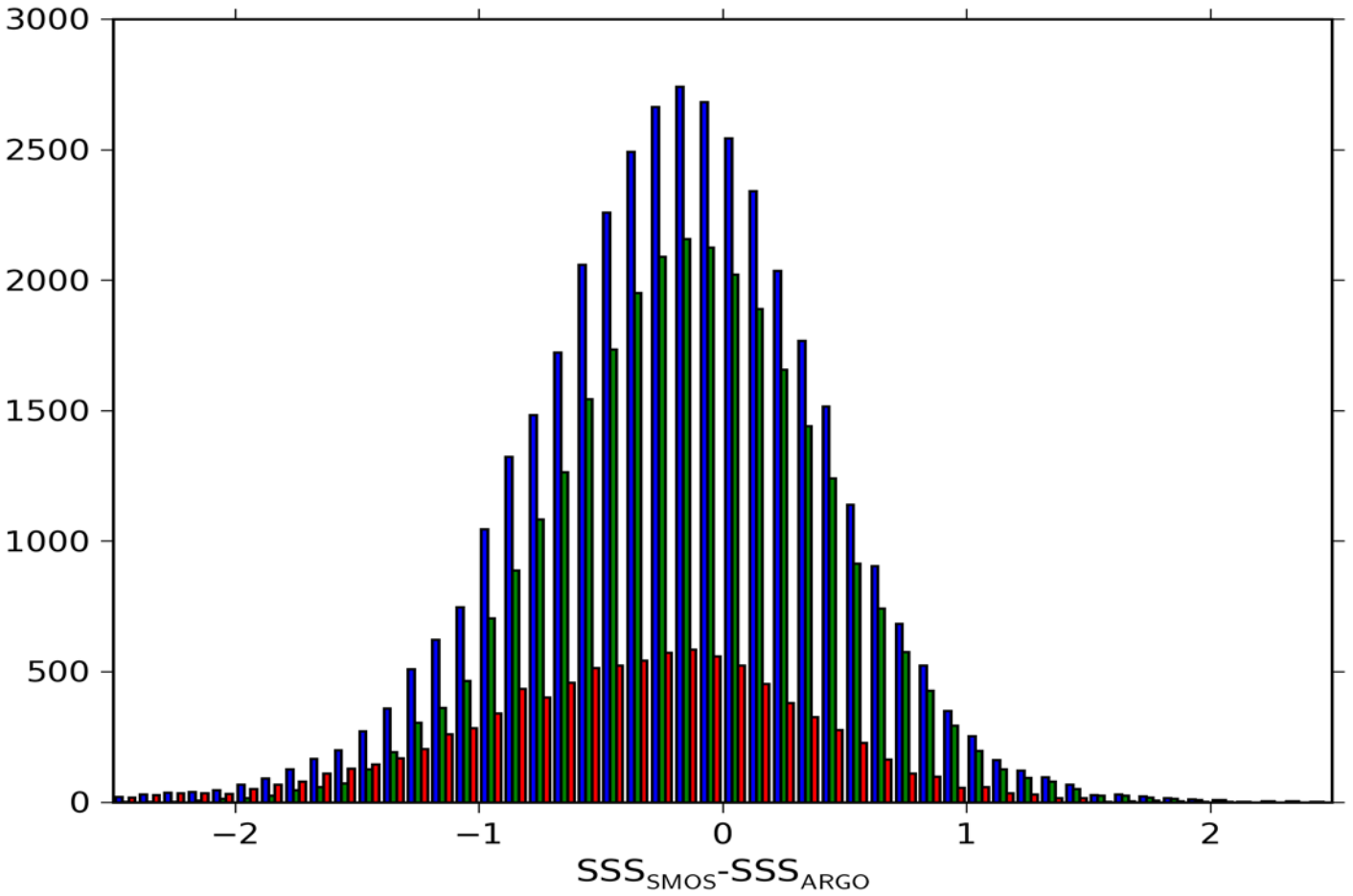

-1




Precision of SMOS SSS: ~0.3 in tropical regions but regional biases (~0.1 fresher in tropical Pacific: RAIN?)

1

# Statistical distribution SSS SMOS-SSS Argo with/without rainy measurements (Tropical Pacific; July-Sep 2010)



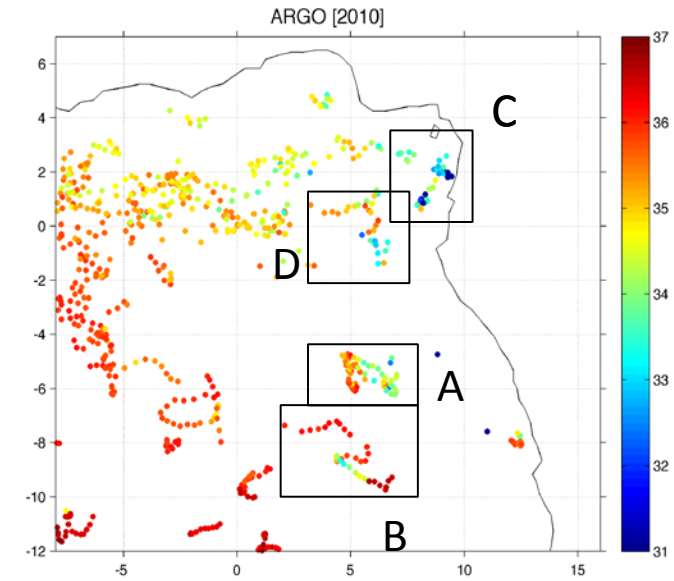

RAIN+NORAIN
n=38543
mean=-0.19565
std=0.62097
median=-0.17000
skew=-0.38115
kurtosis=1.41858

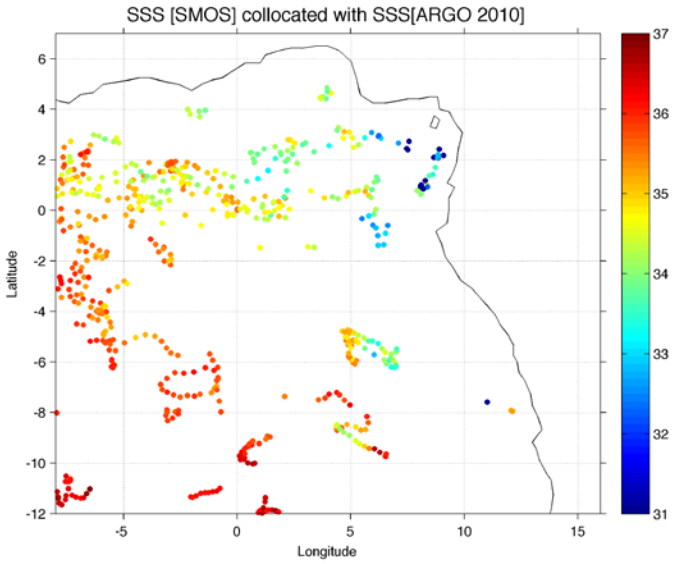
NORAIN
n=29084
mean=-0.12810
std=0.56361
median=-0.12565
skew=0.00187
kurtosis=0.55808

RAIN
n=9459
mean=-0.40336
std=0.73306
median=-0.34300
skew=-0.57884
kurtosis=1.21110

=> freshening of the sea surface linked to precipitations
+ Artefact of L-band radiometer measurement linked to rain: ~15%
Need for surface in situ measurement

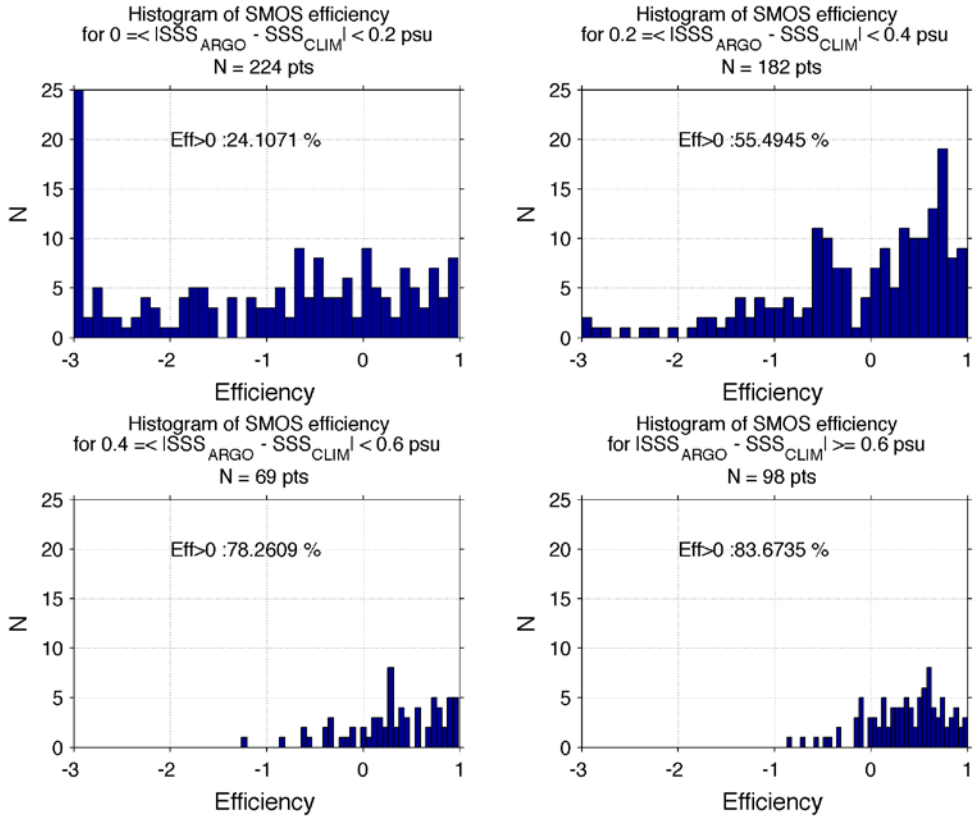
# Efficiency of SMOS observation With respect Climatology & Argo




Eff= | SSS_Argo – SSS_clim | - | SSS_ARGO – SSS_SMOS | / | SSS_Argo – SSS_clim |

The more Argo SSS is far from climatological values
The closer match between SMOS & ARGO SSS




=>Consistency of SMOS & ARGO for the large SSS anomalies

# Ocean surface response to hurricane Igor Over the Amazon-orinoco Plume

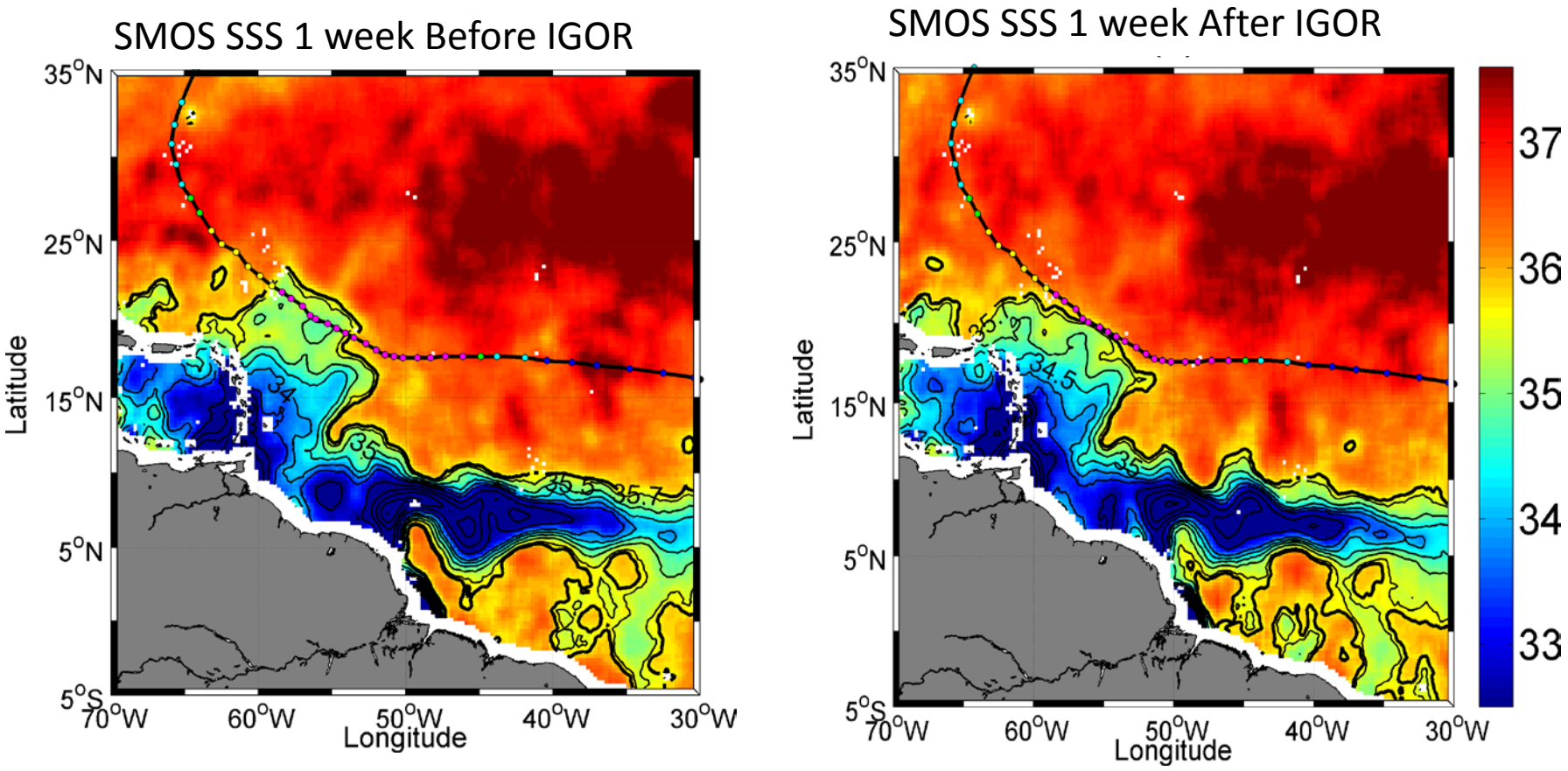
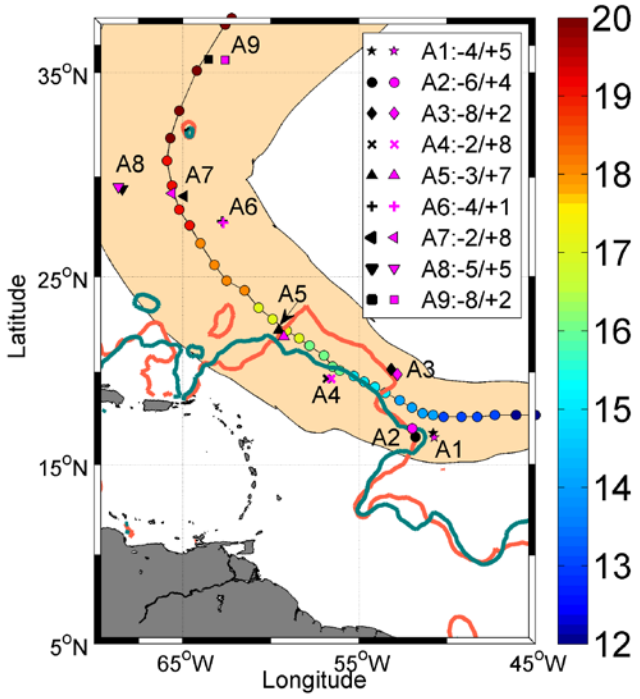



**Figure 2:** Two SMOS microwave satellite-derived SSS composite images of the Amazon plume region revealing the SSS conditions (a) before and (b) after the passing of Hurricane Igor, a category 5 hurricane that attained wind speeds of 136 knots in September 2010. Color-coded circles mark the successive hurricane eye positions and maximum 1-min sustained wind speed values in knots. Seven days of data centered on (a) 10 Sep 2010 and (b) 22 Sep 2010 have been averaged to construct the SSS images, which are smoothed by a 1° x 1° block average.

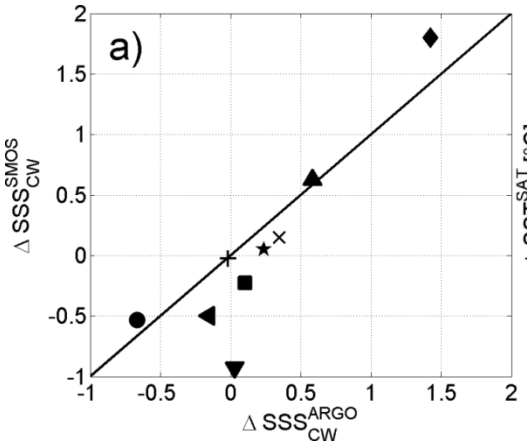
# Validation with ARGO SSS

In situ sampling of Igor high wind wake by ARGO floats

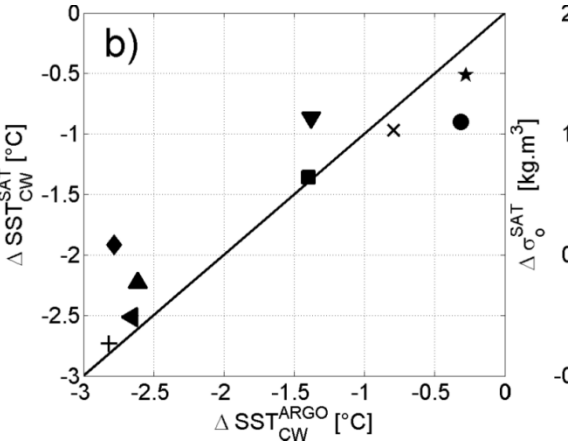



Satellite estimates of the ocean surface response (1cm penetration depth) to IGOR versus ~5 m depth Argo measurements

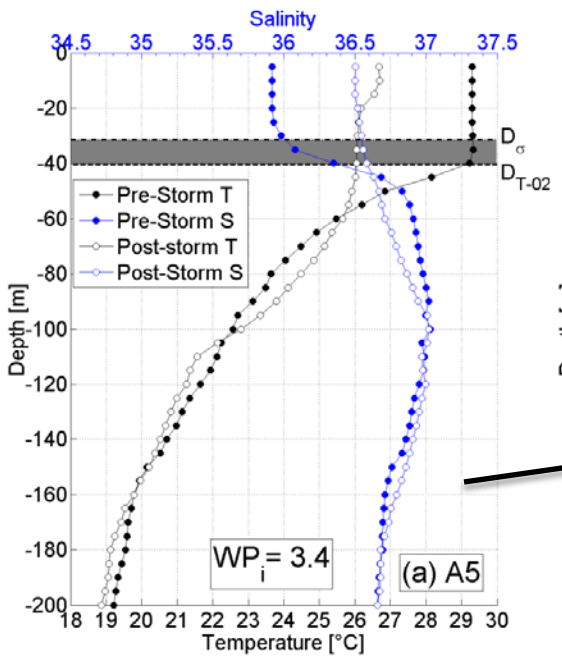
Salinity

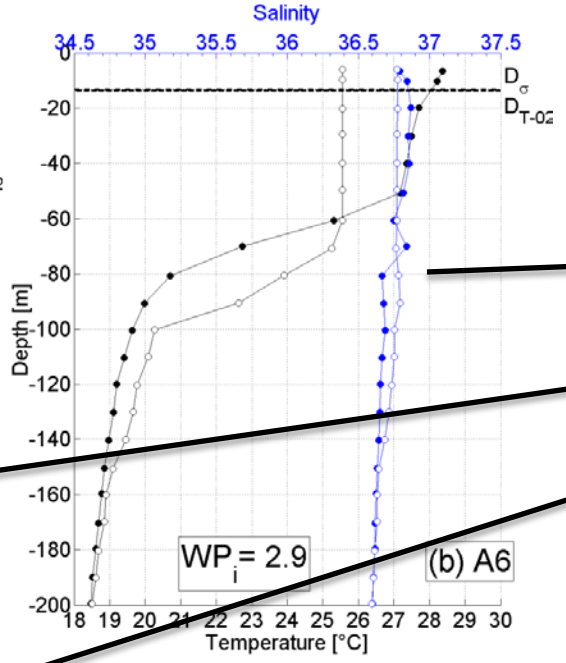


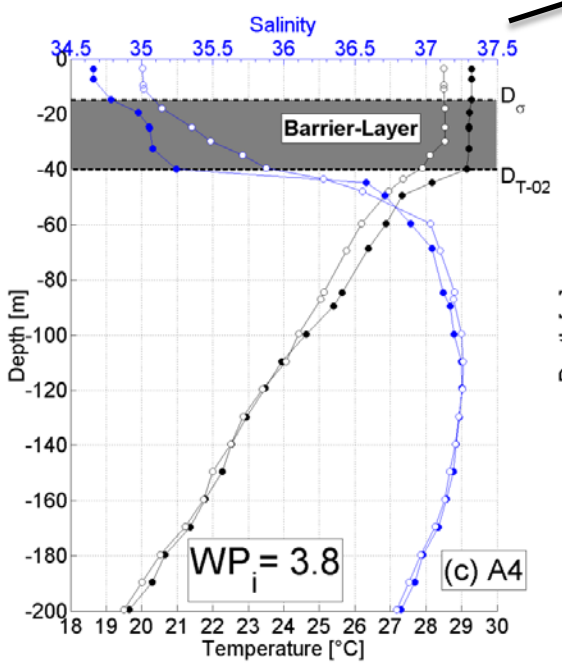

Temperature

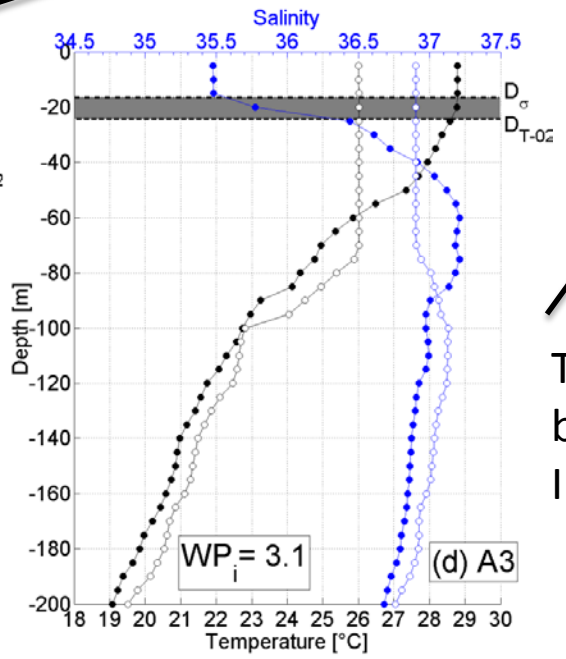


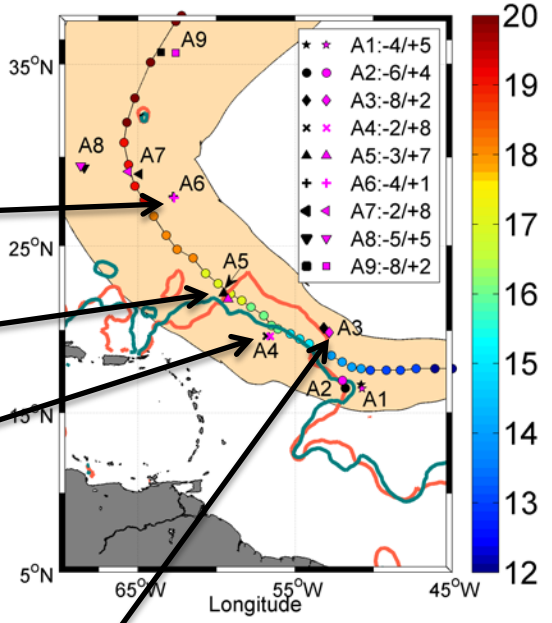

Rmse= 0.37 (SSS) , 0.4°C (SST) and 0.34 kg.m$^{-3}$ (density)




Thick BL>20m=> cooling inhibition by salt-driven stratification In the Plume

# Conclusion

- **ARGO: very useful for large scale validation and interpretation of SMOS SSS; SMOS and ARGO often agree on large SSS anomalies wrt climatology.**

- In tropical-subtropical regions, far from land, in non rainy region, **precision of SMOS SSS at 100x100km$^2$-10days ~0.3**

- Still issues on SMOS (sun aliases, land vicinity, ice edge, RFI sorting …)

- **Rain freshening** responsible for a 0.1 bias on monthly SSS averaged between 5°N and 15°N in tropical Pacific Ocean (up to -1 locally) => **a non negligible effect**


Thank you for your attention