Coastal altimetry vs multi-platform in-situ observations over the Ligurian Sea

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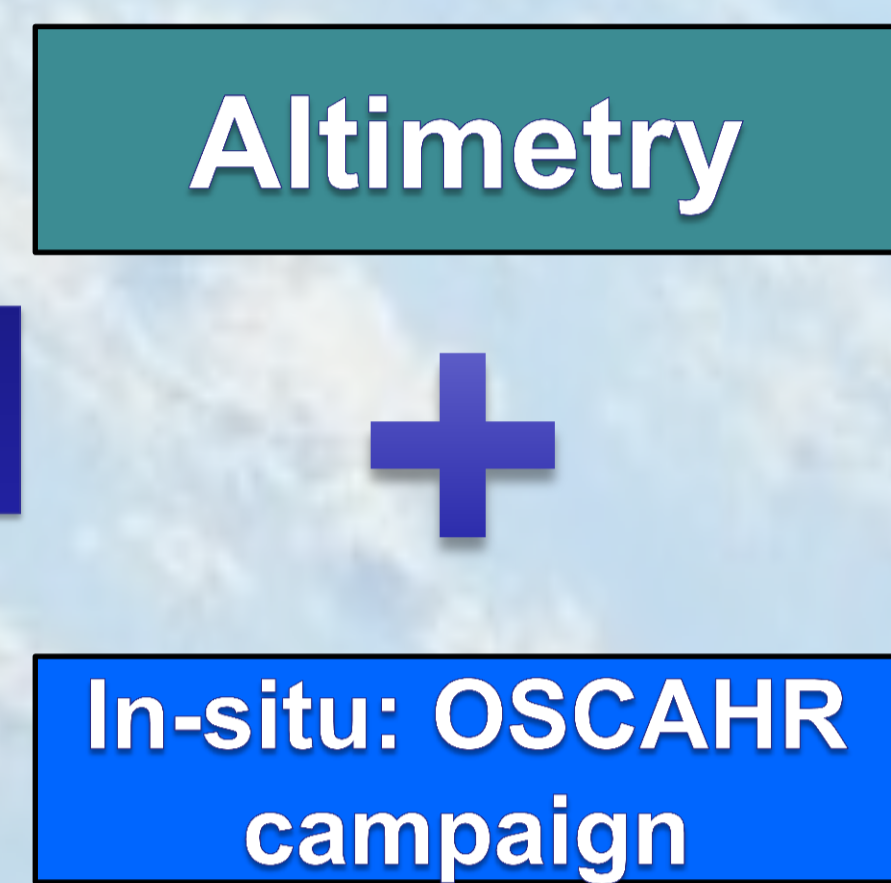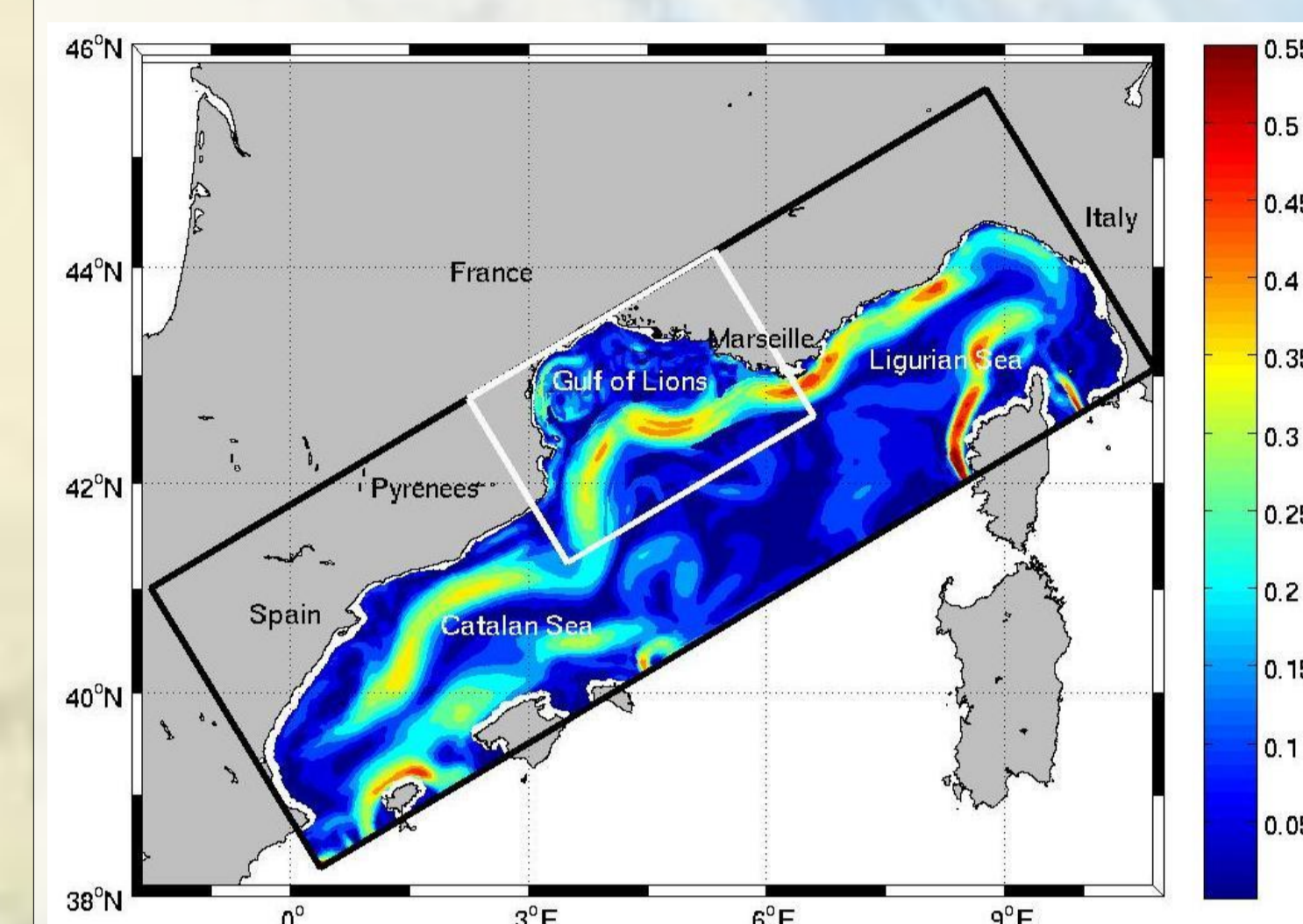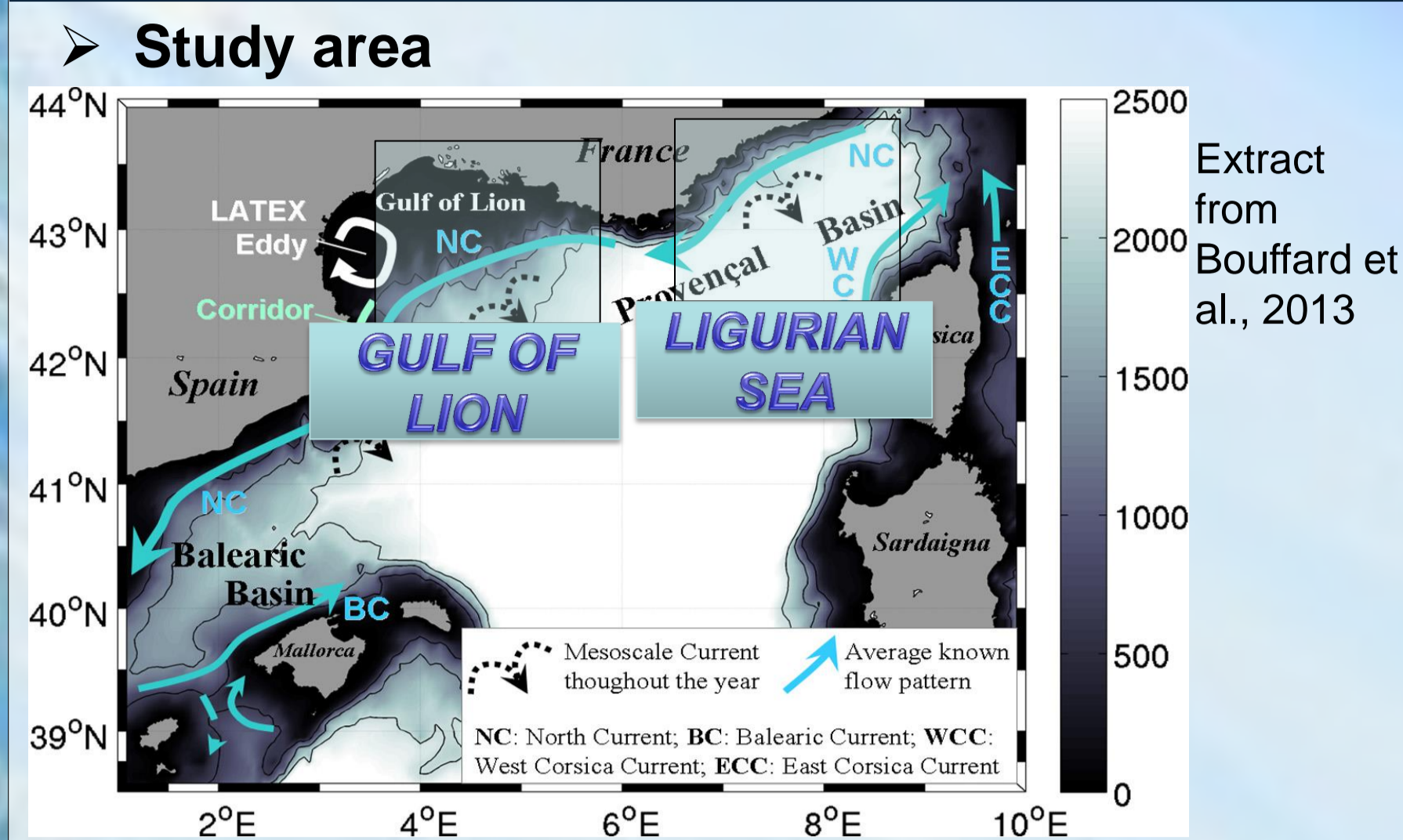
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Context and Objectives

➤ **Context:**
- Slope current and coastal mesoscale plays a key role on the across-shore transport and mixing of natural and anthropogenic elements.
- Critical importance to monitor and forecast the variability of regional dynamics.

➤ **Technical challenge for coastal altimetry:**
- Isolate small scale signals wrt Altimetric noise.
- Use relevant diagnostics to properly evaluate new CA processing and corrections.

➤ **Study objectives:**
- Statistically characterize the NC position and intensity over the NWMed Sea
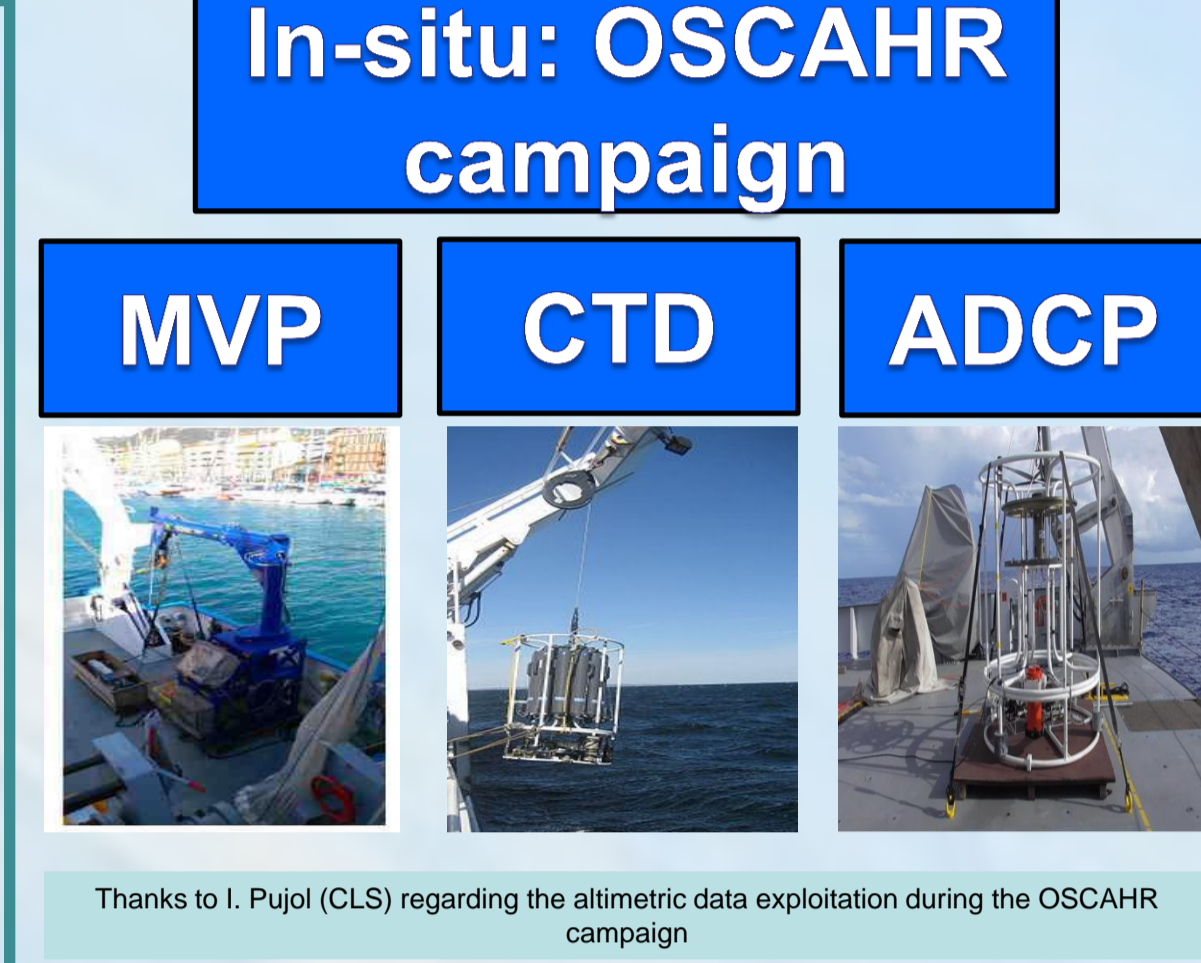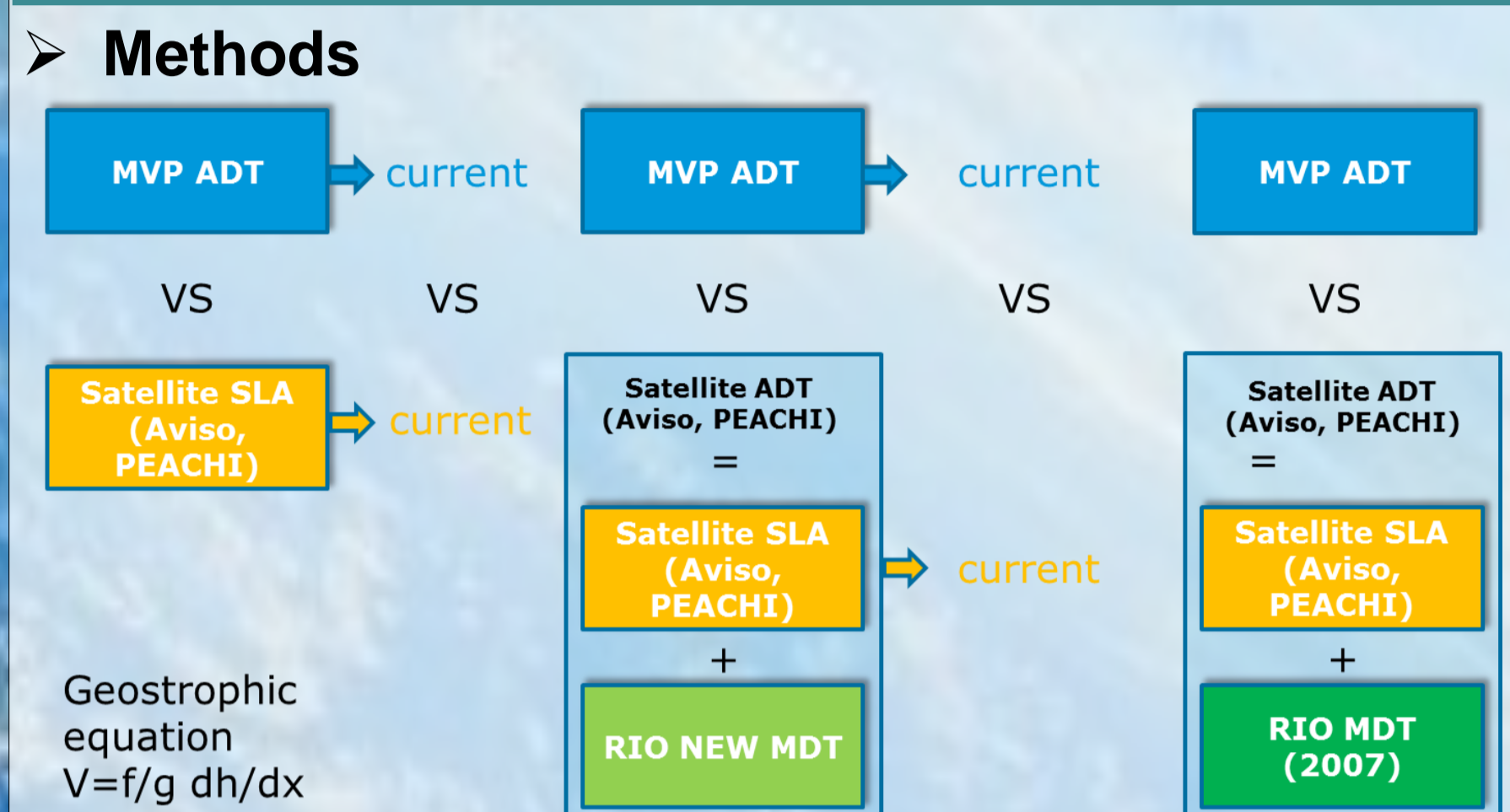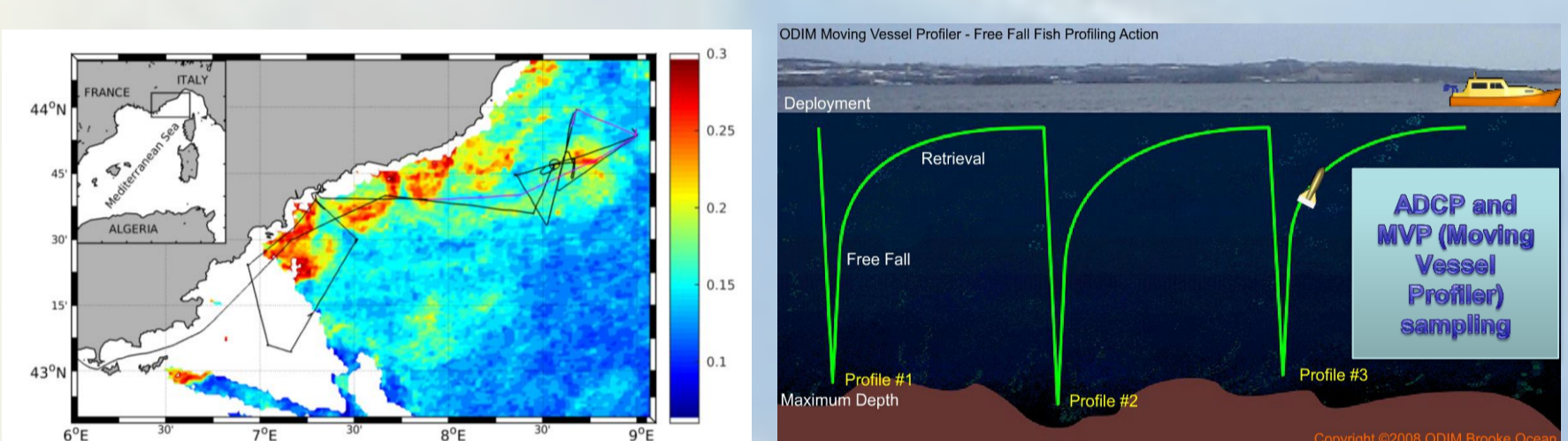- Develop New science oriented diagnostics for coastal altimetry

Altimetry + **In-situ: OSCAHR campaign**

Dataset and Methods

➤ **Study area**

Extract from Bouffard et al., 2013

NC: North Current; BC: Balearic Current; WCC: West Corsica Current; ECC: East Corsica Current

➤ **Datasets**

AVISO Altimetry

PEACHI Altimetry

Periods:	Period 1:	Period 2	Period 3:	Period 4:	Period 5:	Period 6:	Total
	10/2002 - 09/2005	10/2005 - 09/2008	10/2008 - 11/2010	12/2010 - 03/2012	04/2012 - 09/2012	11/2015	10/2002 - 11/2015
Used satellites and associated temporal sampling (in days):	4 satellites: T/Pn (10) GFO (17)- J-1(10) EN (35)	3 satellites: J-1(10) GFO(17)- EN(35)	3 satellites: J-1n(10), J2(10) EN(35)	3 satellites: J2(10) EN(35) J1(10)	1 satellite: J-2 (10)	2 Satellites: J-2 (1) Altika	6 satellites

Thanks to G. Valladeau (CLS) for PEACHI products data provisioning.

In-situ: OSCAHR campaign

MVP **CTD** **ADCP**

Thanks to I. Pujol (CLS) regarding the altimetric data exploitation during the OSCAHR campaign

➤ **Methods**

MVP ADT → current VS MVP ADT → current VS MVP ADT

VS VS VS VS VS

Satellite SLA (Aviso, PEACHI) → current VS Satellite ADT (Aviso, PEACHI) = Satellite SLA (Aviso, PEACHI) + RIO NEW MDT → current VS Satellite ADT (Aviso, PEACHI) = Satellite SLA (Aviso, PEACHI) + RIO MDT (2007)
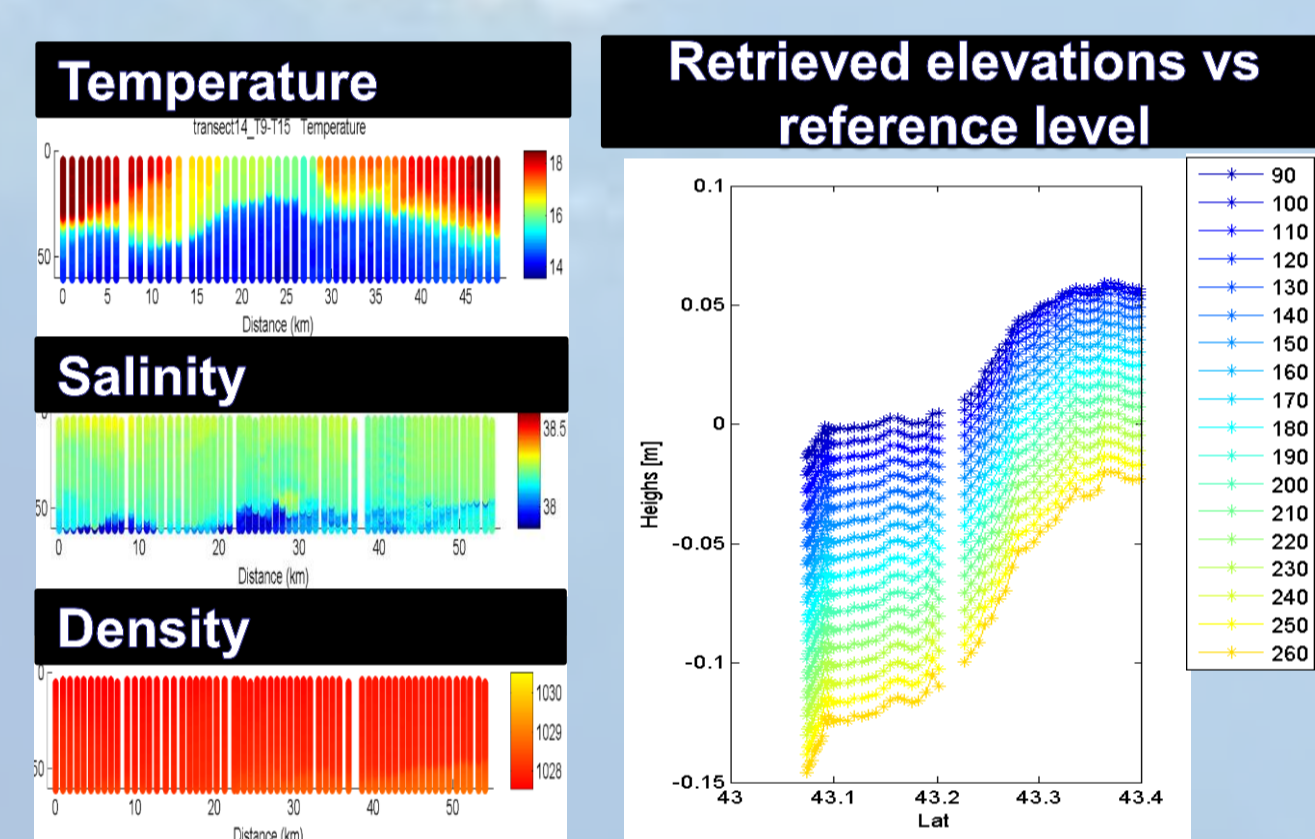
Geostrophic equation V=f/g dh/dx

OSCAHR (Observing Submesoscale Coupling At High Resolution) vs Altimetry
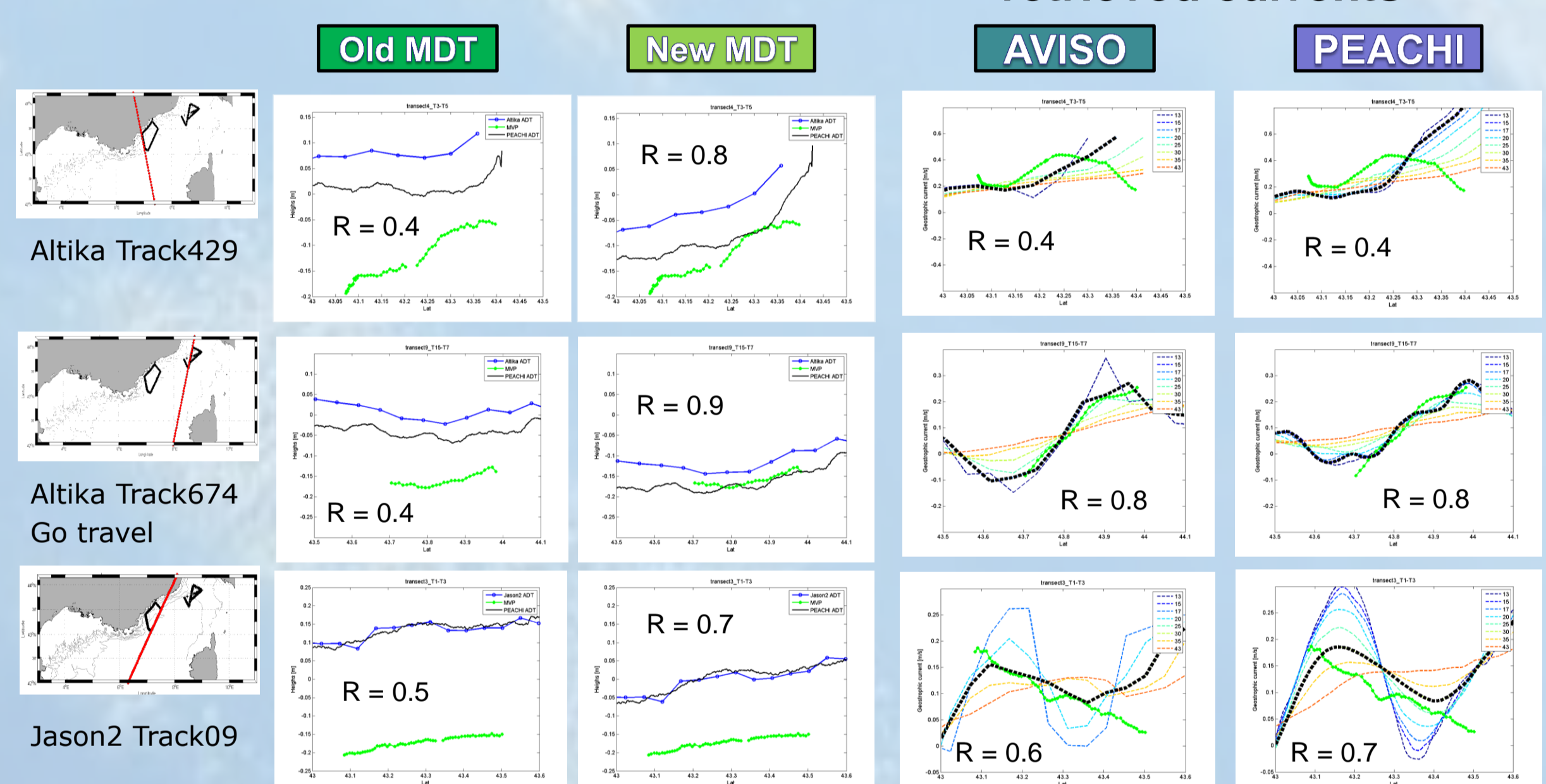
➤ **2015 OSCAHR campaign** Explore the link between fine-scale physics and phytoplankton diversity (MIO, Doglioli et al.)
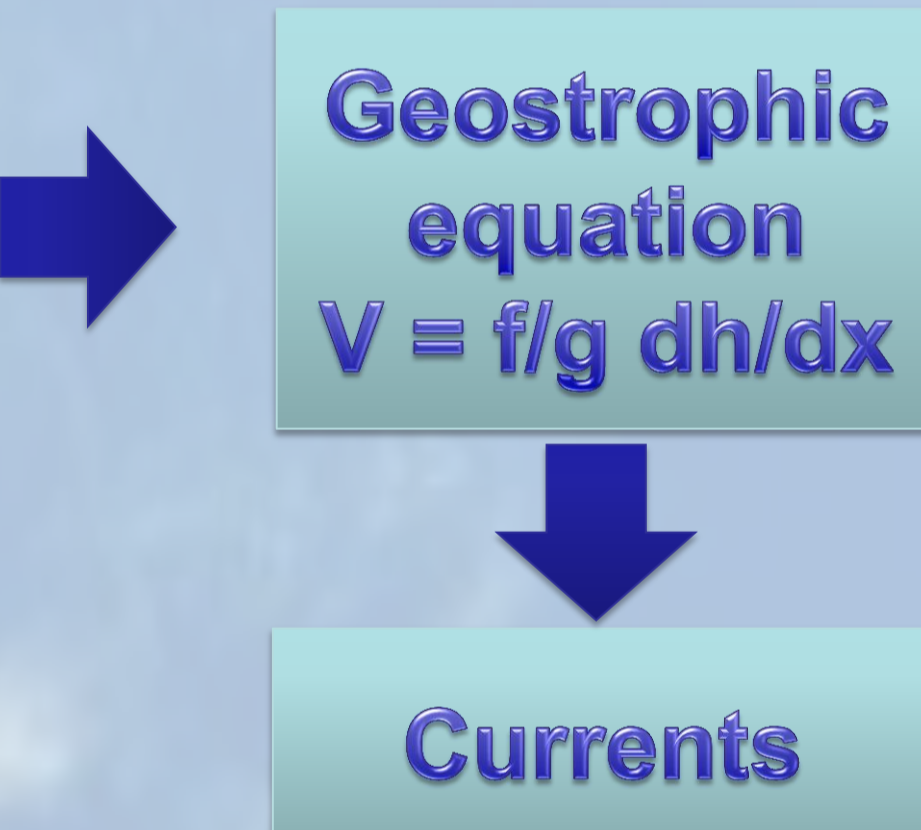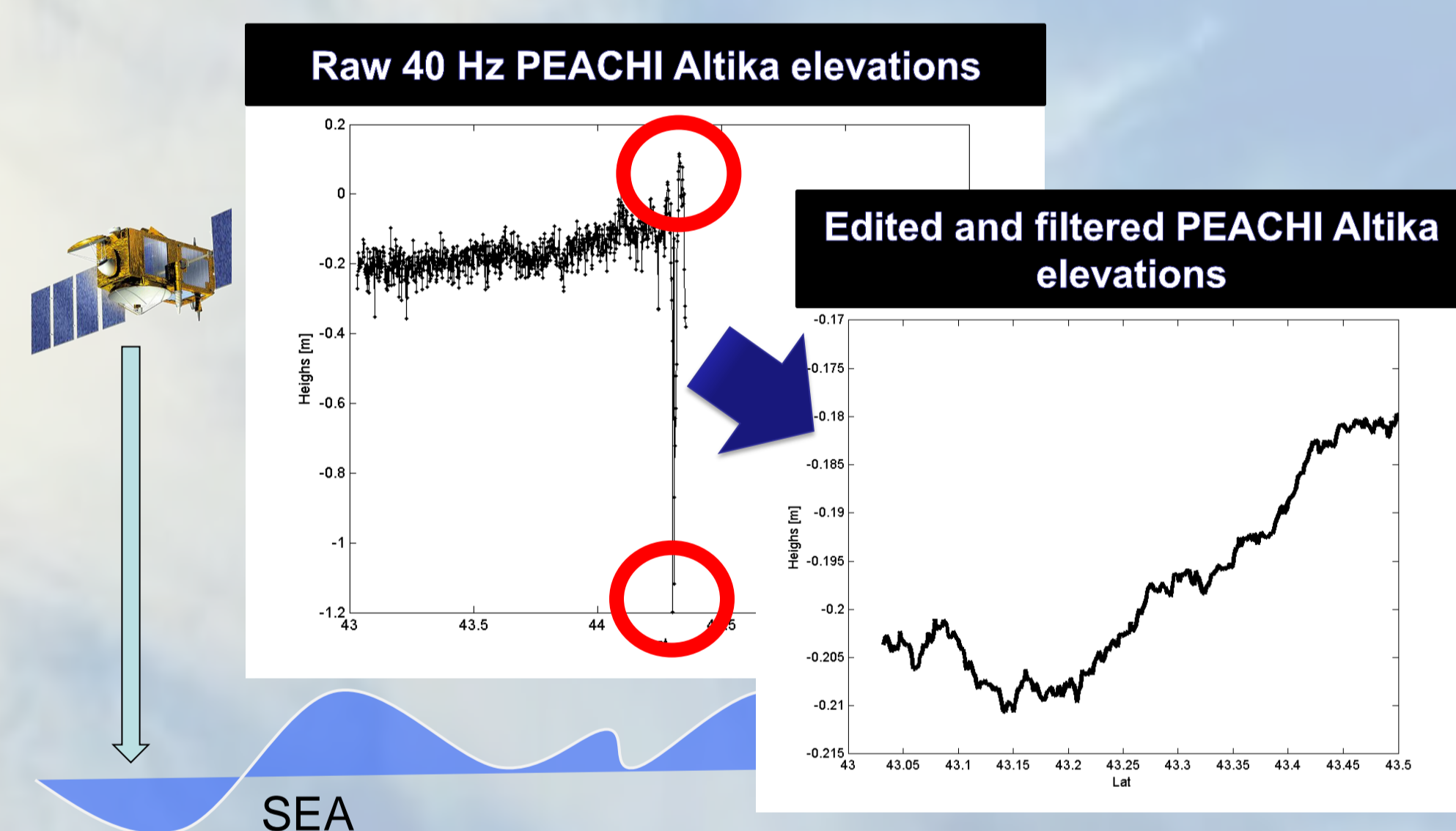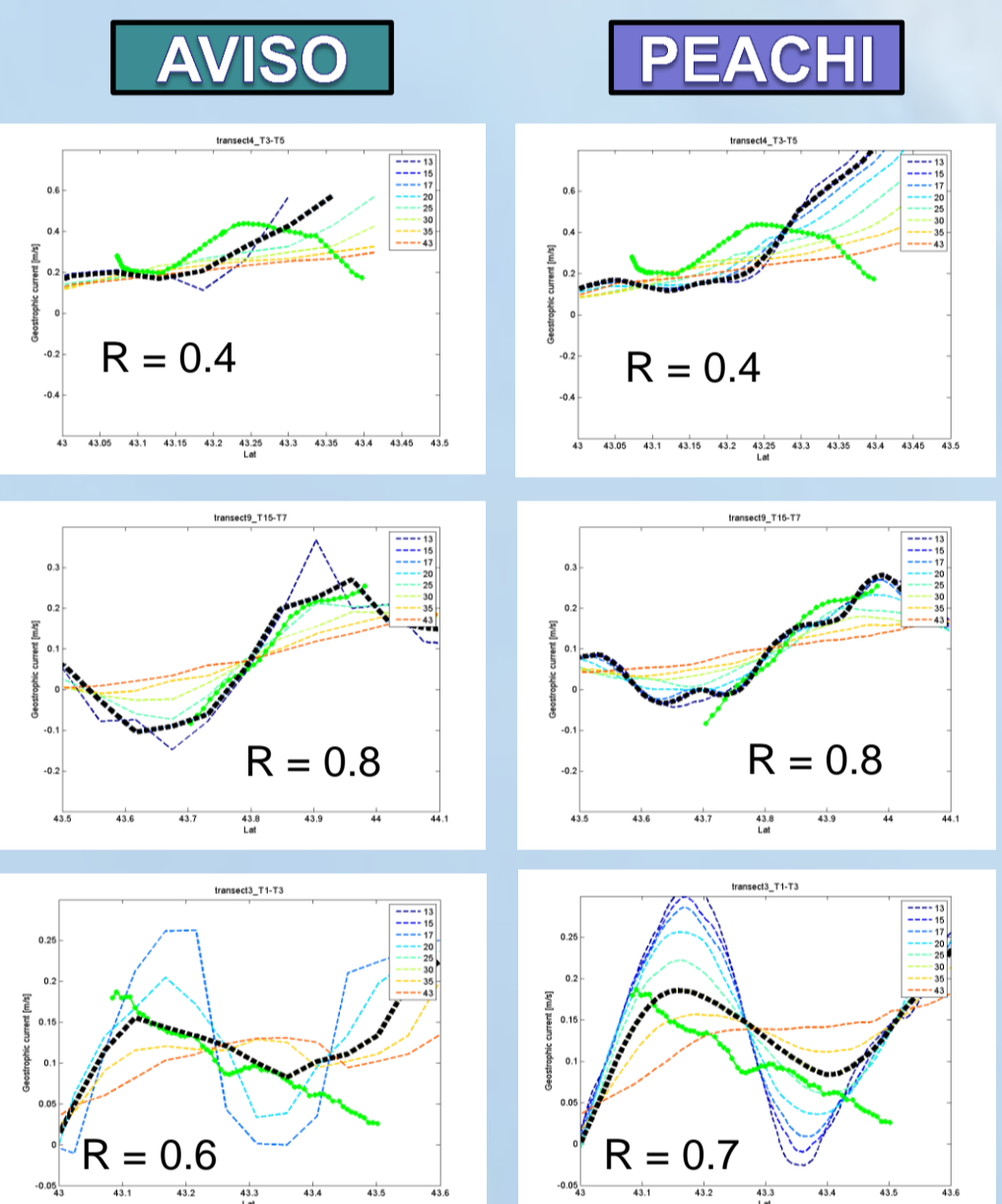
➤ **MVP dynamic heights and Current retrieval algorithm**

Temperature / Salinity / Density

Retrieved elevations vs reference level

Raw 40 Hz PEACHI Altika elevations

Edited and filtered PEACHI Altika elevations

SEA

Geostrophic equation V = f/g dh/dx

Currents

➤ **Impacts of the MDT on altimetric ADT**

| Old MDT | New MDT |

Altika Track429 — R = 0.4 / R = 0.8

Altika Track674 Go travel — R = 0.4 / R = 0.9

Jason2 Track09 — R = 0.5 / R = 0.7

Better agreement using the new MDT

➤ **Impacts of the post-processing on the retrieved currents**

| AVISO | PEACHI |

R = 0.4 / R = 0.4

R = 0.8 / R = 0.8

R = 0.6 / R = 0.7

No clear improvement from PEACHI but…

➤ **Impacts of the Reference depth and Physical content: (ADCP – MVP) Surface Current vs Deep ADCP Current (> 360 m)**

↑ 0.03 m/s

A

B

Big differences over areas of strong deep currents

Better agreement between ADCP and Altimetry PEACHI wrt MVP

Transect	Corr. ADCP MVP	Corr. Sat. MVP	Corr. Sat. ADCP
3	0,67	0,27	0,45
9	0,68	0,96	0,63
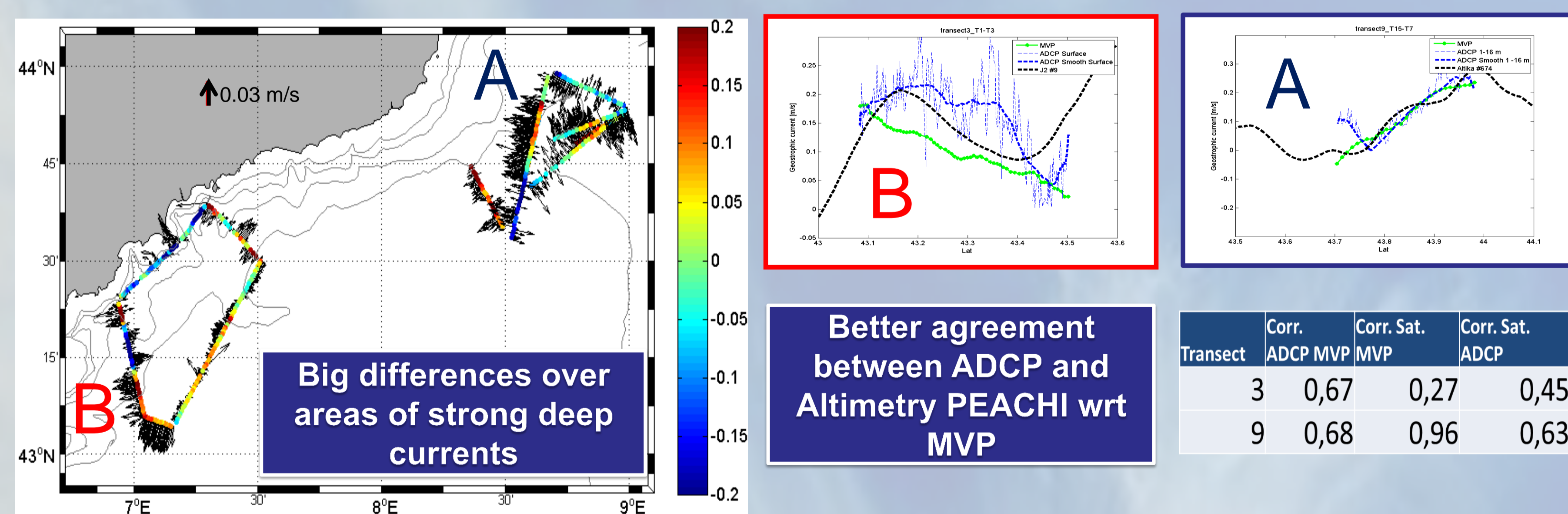
➤ **Oceanography features observed from optimized Remote-sensing data and the in situ campaigns**

MVP SST and ADCP currents

Satellite observations and MVP across track currents + ADCP across track currents
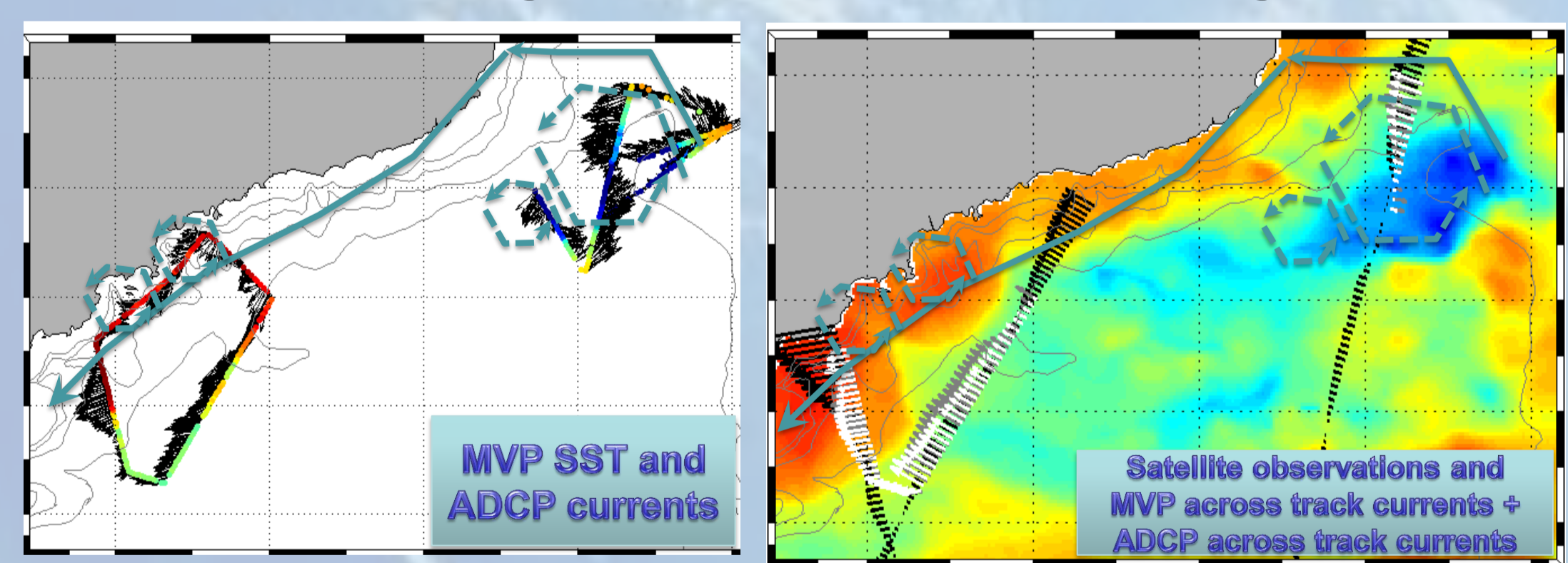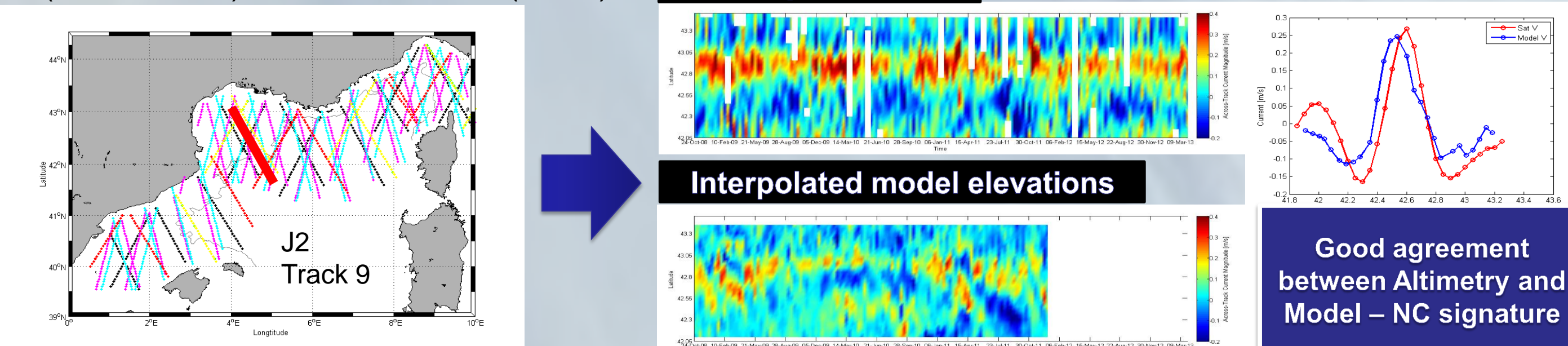
Good synergie & Observation of main Ocean Dynamics

Symphonie Model vs Altimetry

➤ Symphonie, is a 3D primitive equation, free surface, sigma coordinate ocean model.

➤ Components of current, temperature and salinity are computed.

➤ Model validated in different studies: Hu et al. (2009), Bouffard et al. (2008, TAO), Kersale et al. (2013),

On-going work!

Along – track altimetry ADT (SLA+MDT) → Interpolated model elevation → Temporal statistics per tracks / Spatial statistics per tracks → Model/altimetry agreement

Altimetry time series

Interpolated model elevations

J2 Track 9

Good agreement between Altimetry and Model – NC signature

Conclusions

Multi-Scale Analysis of Coastal Altimetry Data, Multi-Sensor Observations and Numerical Modelling Over the NWMed - Small Scale dynamics

- Analysis of IN SITU Measurements
- Impacts of Altimetry Processing
- Numerical Simulations (SYMPHONIE MODEL)

Validation of coastal altimetry Statistics + Physical Oceanography

Definition of new science oriented diagnostics particularly relevant for high resolution altimetry (Sentinel-3, Sentinel-6).