Plans for in situ experiments in New Caledonia during the SWOT fast-sampling phase

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Associated projects

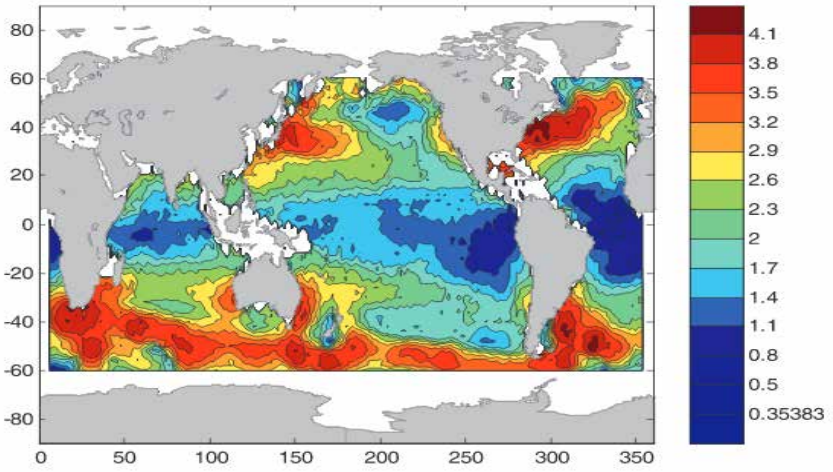
SWOT-ROSES / TOSCA Project (2016-2019)

« SWOT in the Tropics : a case study in the SouthWest Pacific» (poster #41)

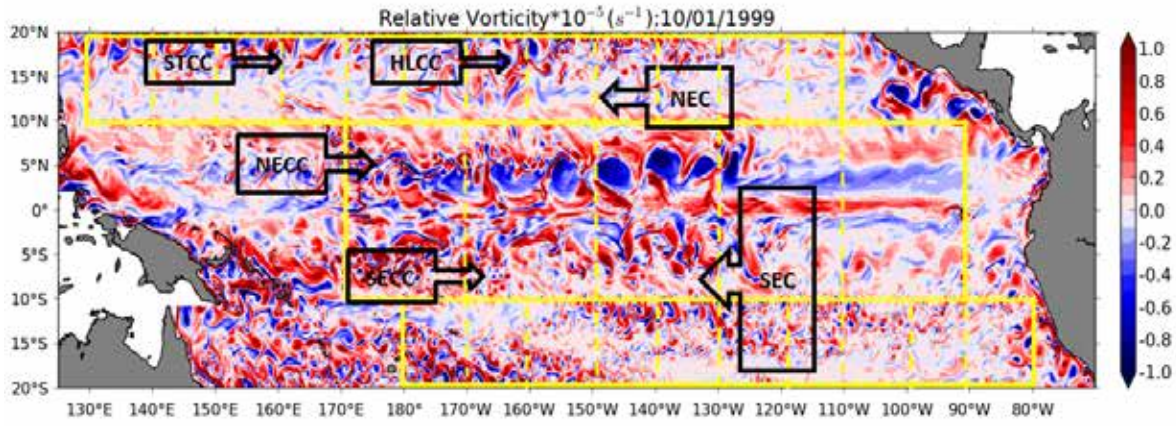
1. SWOT observability in the Tropics

• SSH spectral signature of the tropical dynamics

SSH spectral slopes in the 70-250 km band from altimetry (Xu and Fu, 2011)



Snapshot of relative vorticity in a 1/12° global NEMO simulation (no tide)

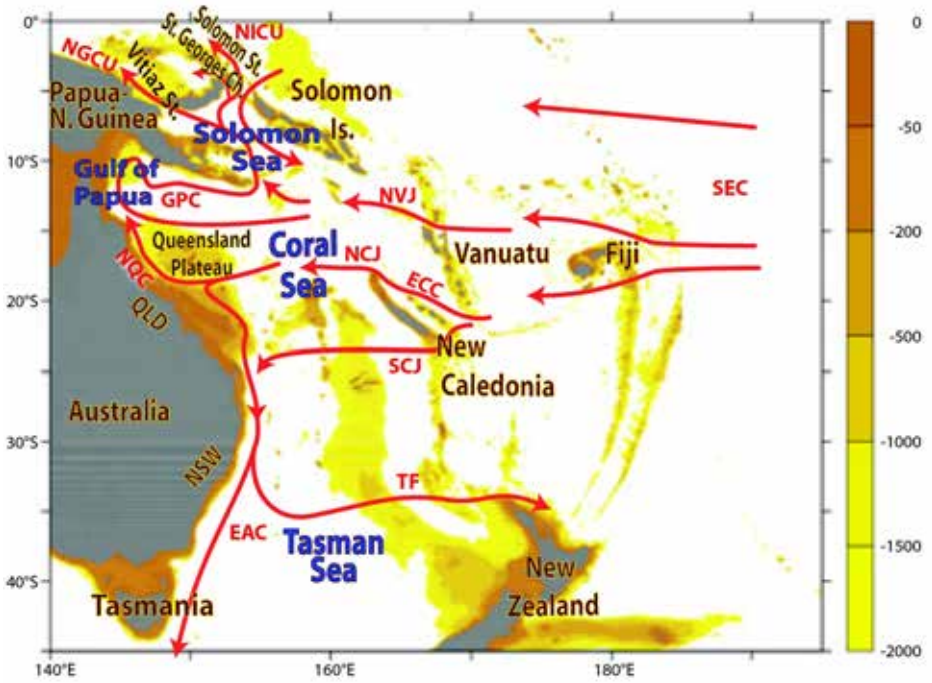


- **sensitivity of the windowing / tapering for spectral computation**
- **strong anisotropy in the equatorial band (10°S-10°N)**
- **role of the (coherent and incoherent) tides for the flattening of SSH spectra in the tropics**

Associated projects

SWOT-ROSES / TOSCA Project (2016-2019) : « SWOT in the Tropics »

2. Focus on the South-Western Pacific



Ganachaud et al. (2014)

2a : Solomon Sea

(1/36° NEMO simulation including tides)

- SSH observability
- properties of internal tides
- impact of mesoscale and internal waves on large-scale cirulation (e.g mixing)

2b : New Caledonia

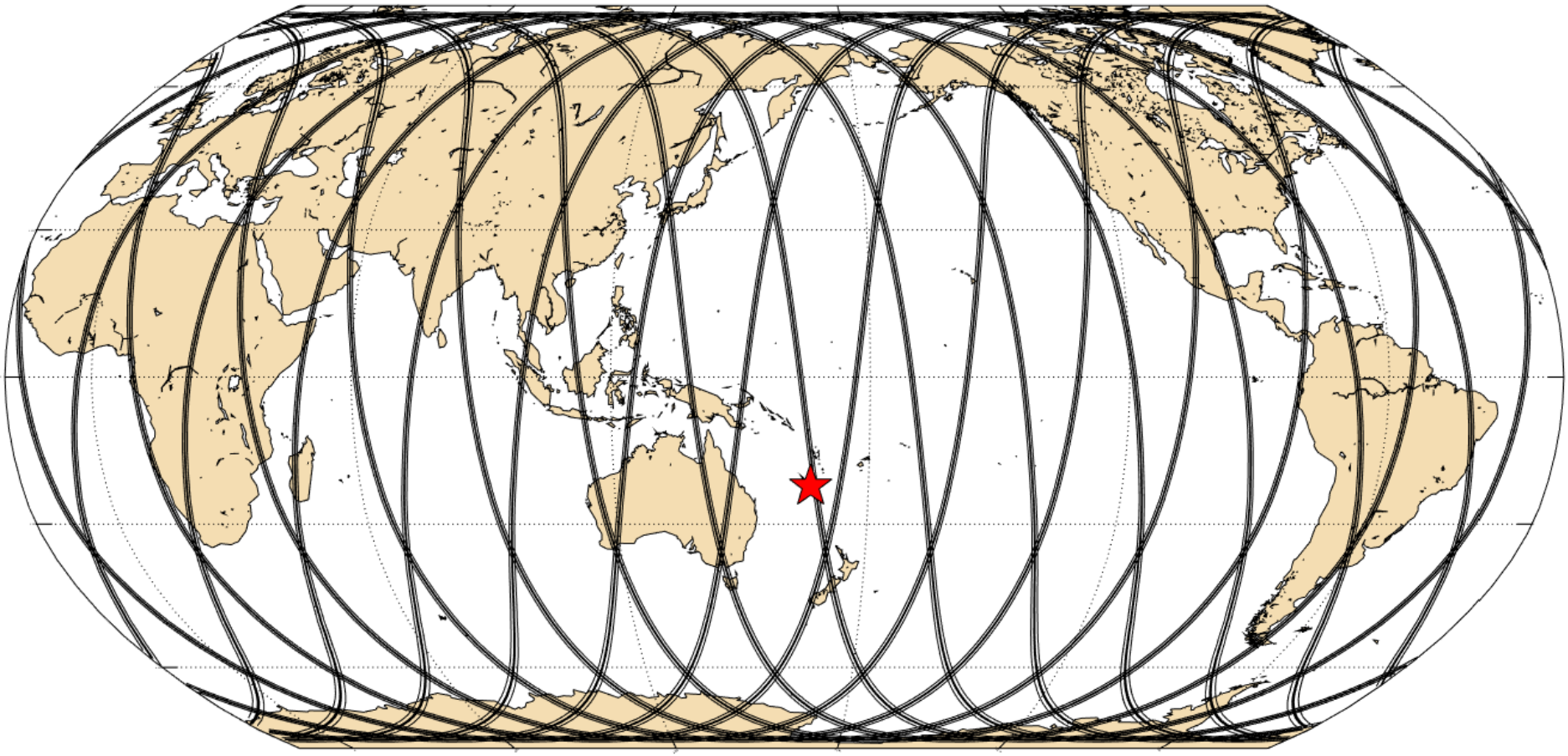
(in situ observations)

- preparation of an in situ experiment during the SWOT fast sampling phase

OSTST SARAL / MANCAS Project (2017-2020)

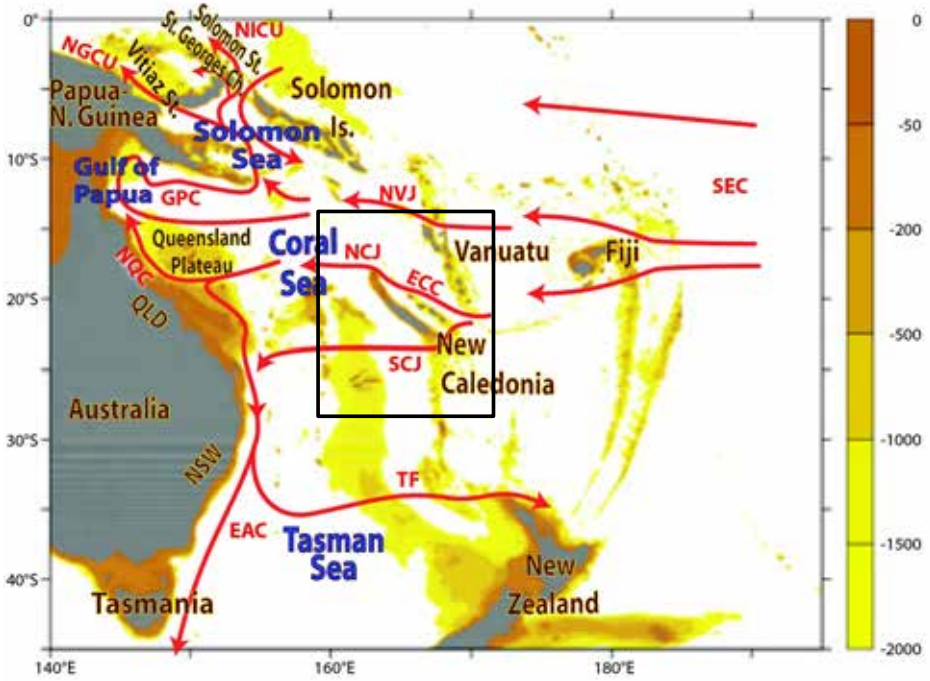
« Meso-Scale Activity around New Caledonia : from AltiKa to SWOT »

1. Describe the the spatio-temporal variability of meso-scale activity around New Caledonia
2. Quantify the respective roles of meso-scale activity and internal gravity waves for SSH observability in the region

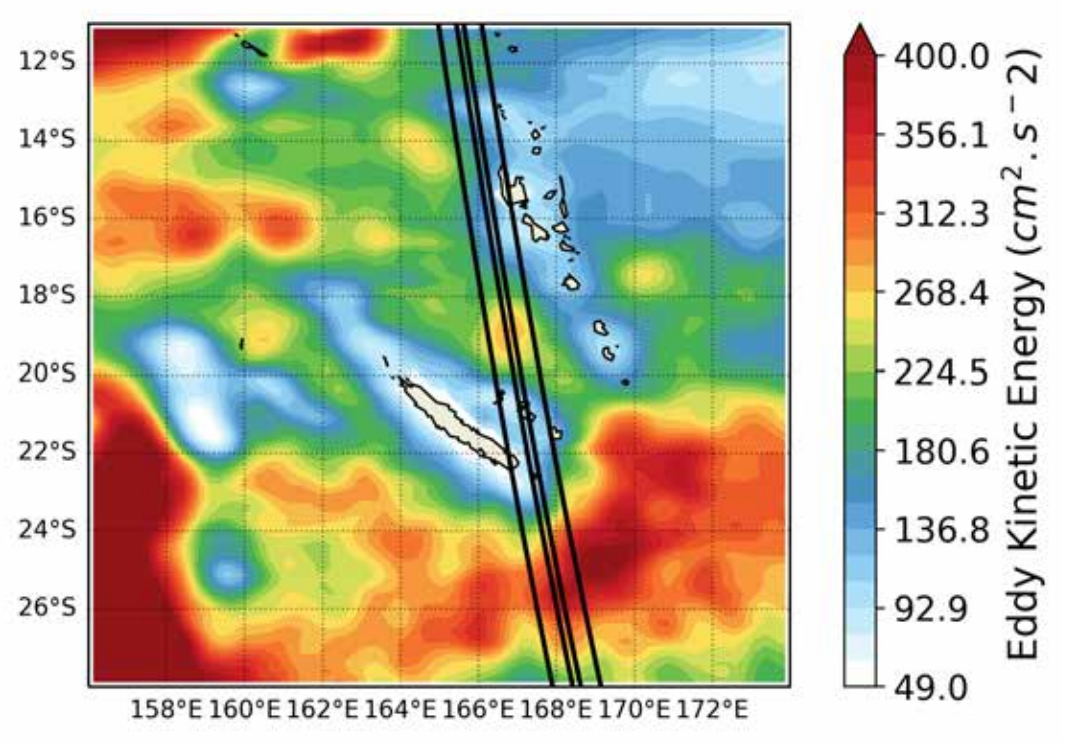


Dynamical context of South-Western Tropical Pacific (and New Caledonia)

Mean regional circulation



EKE from AVISO

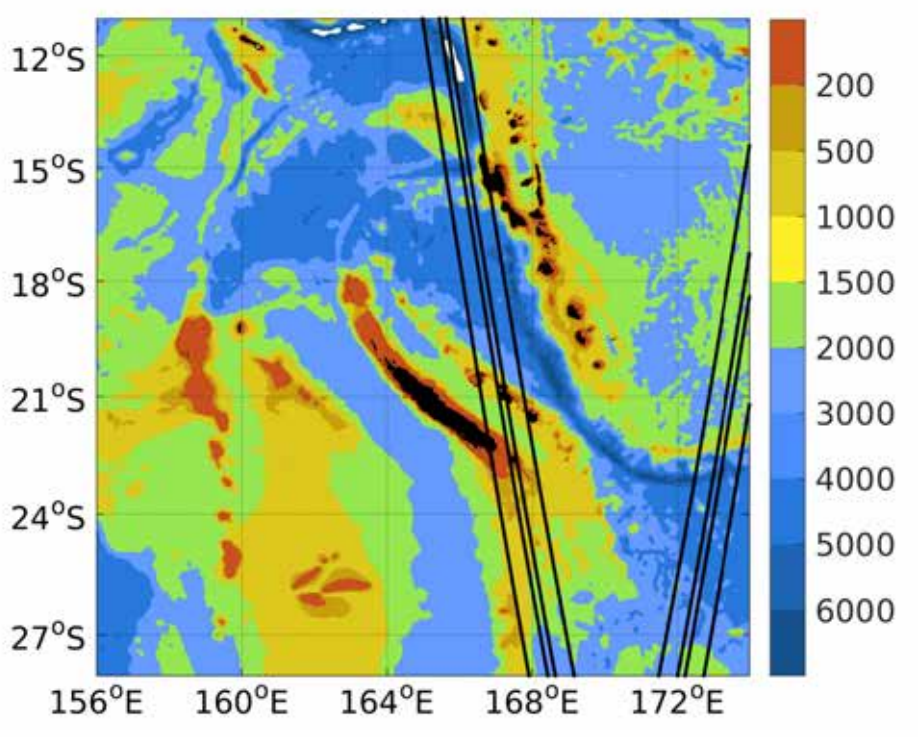


Ganachaud et al. (2014)

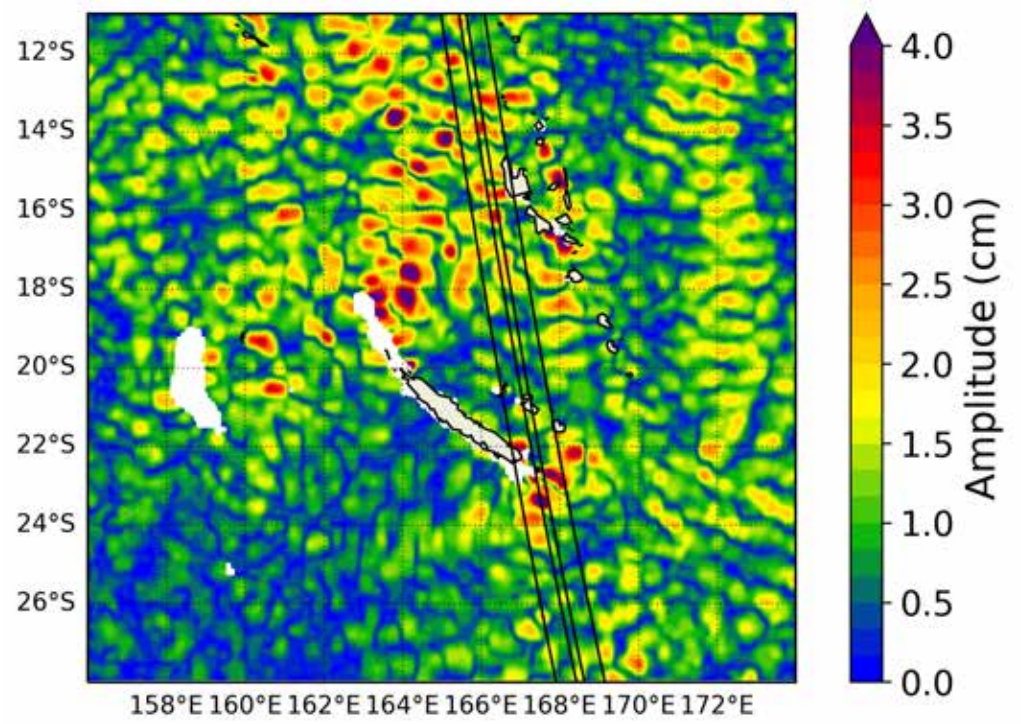
- **strong mesoscale activity (intense coherent eddies)**
  (associated with the main currents of the regional circulation)

Dynamical context of South-Western Tropical Pacific (and New Caledonia)

Bathymetry around New Caledonia



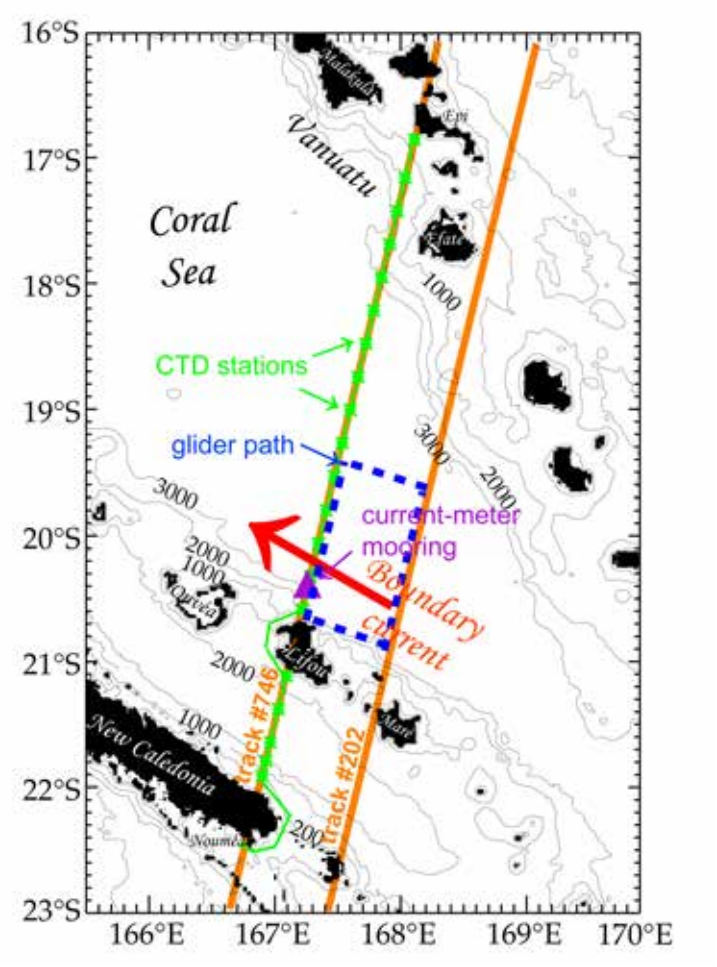
Amplitude of coherent M2 internal waves



- **strong mesoscale activity (intense coherent eddies)**

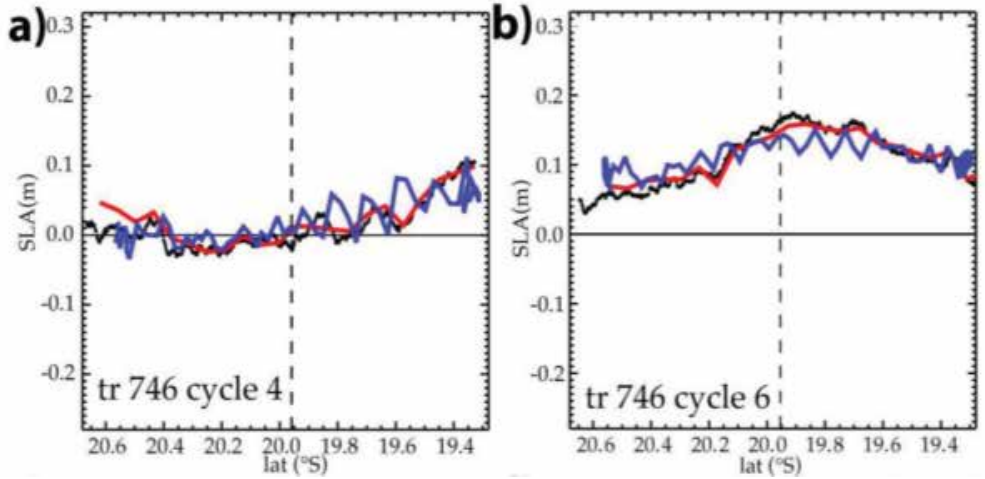
- **strong SSH signature of internal waves (> 4 cm)**
  (in particular North and South of Caledonia)

context : in situ validation of SARAL/AltiKa data

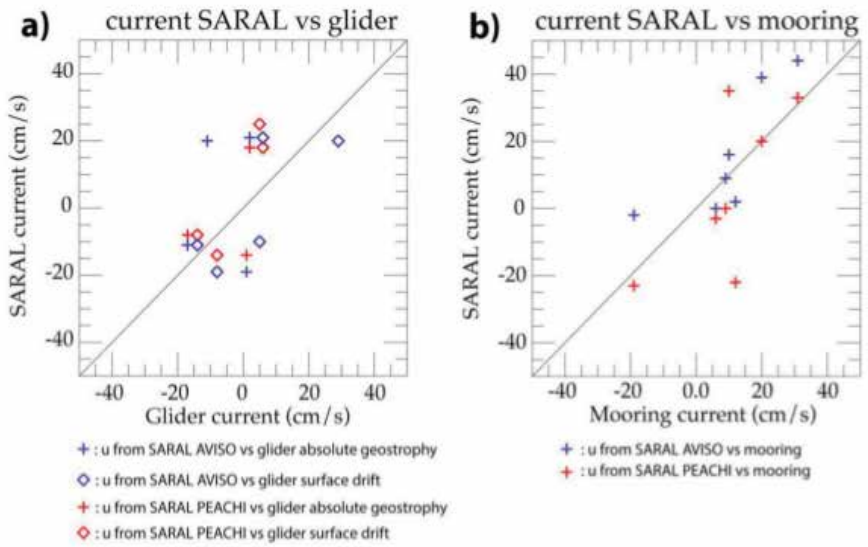


in situ observational platform

for the AltiGlidEx project

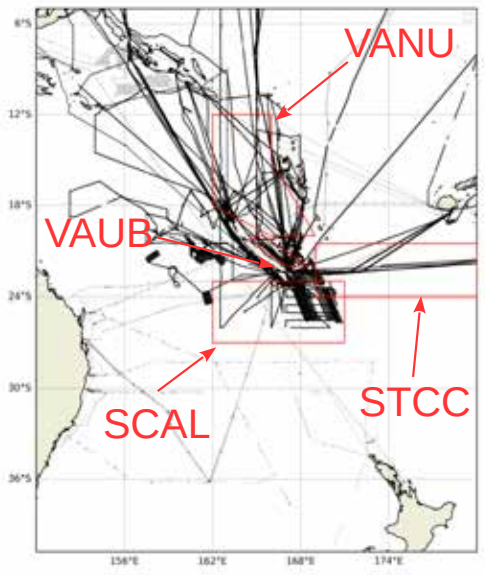


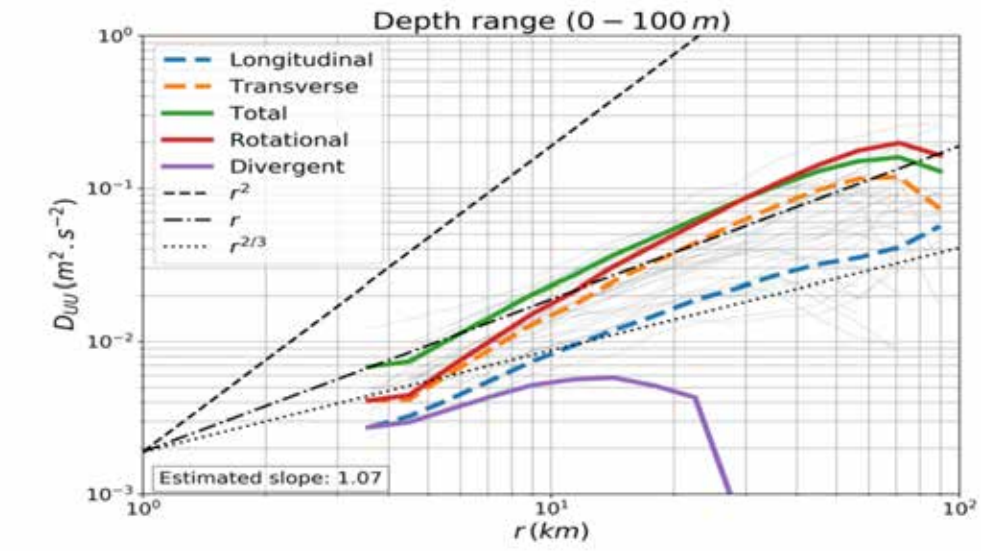
Comparison AltiKa SLA vs dynamic height from gliders (Durand et al. 2017)

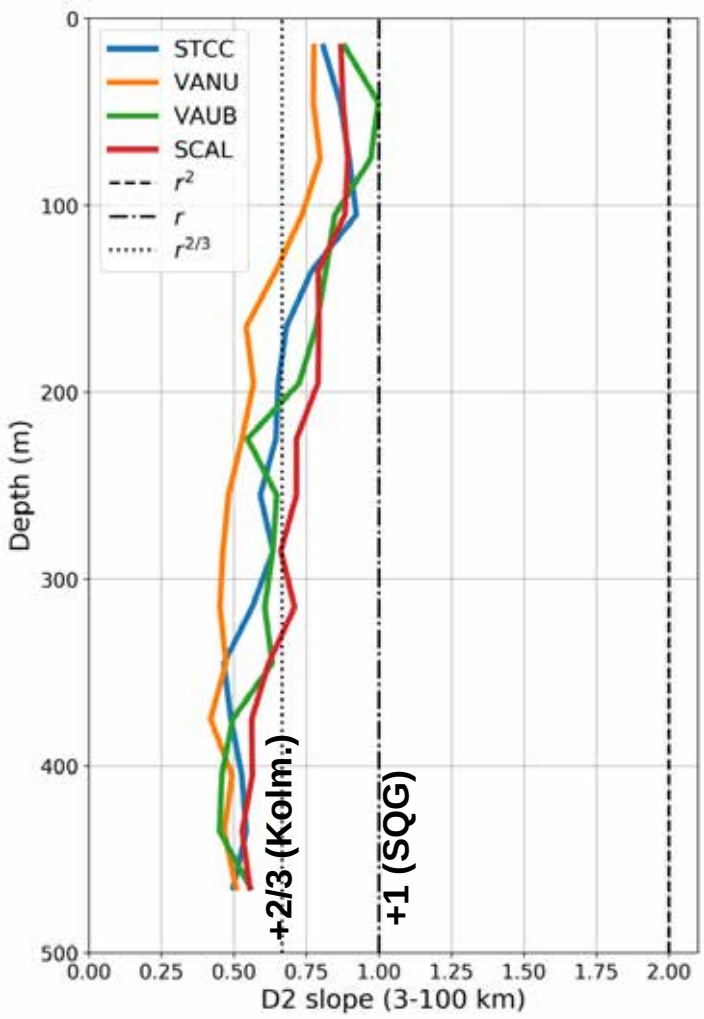


Comparison geostrophic velocities from AltiKa and glider, and surface velocities from currentmeter mooring (Durand et al. 2017)

Structure functions from historical S-ADCP observations







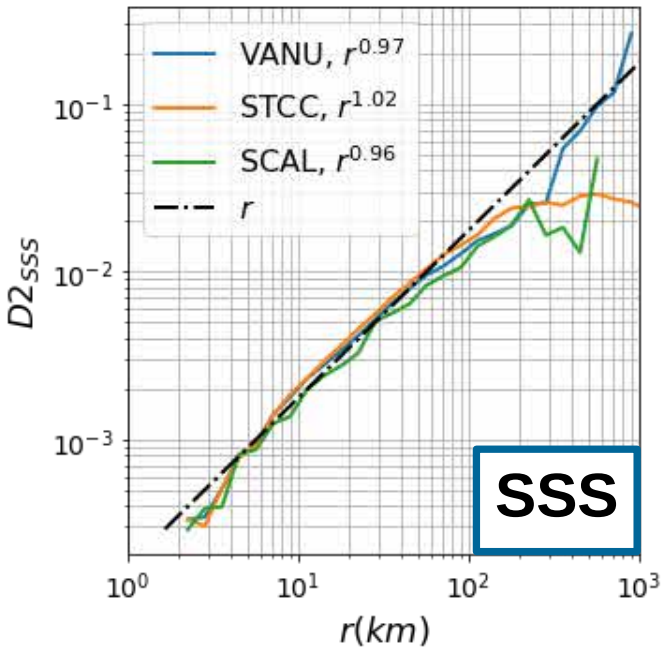
Near surface :

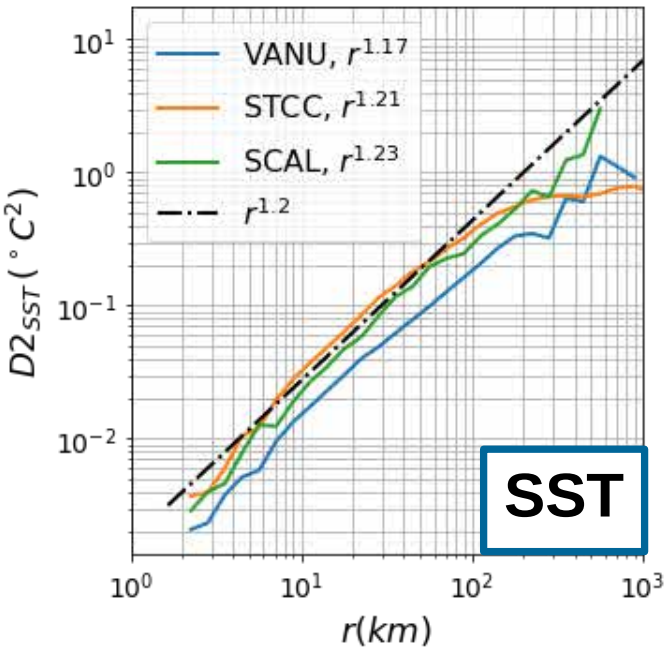
- **dominance of rotational motions (2-100 km)**
- **in overall agreement with a SQG regime**

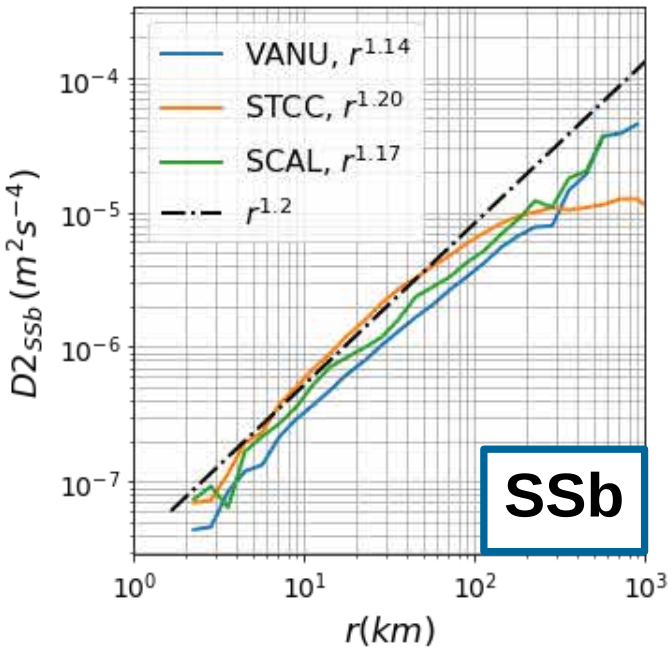
Vertical structure :

Transition from a near-surface SQG regime (< 100m) to an interior regime (> 200m)

Surface tracers spectra : SST, SSS and buoyancy (from TSG)







- **structure functions slope: SSS ~ 1 and SST ~ 1.2**

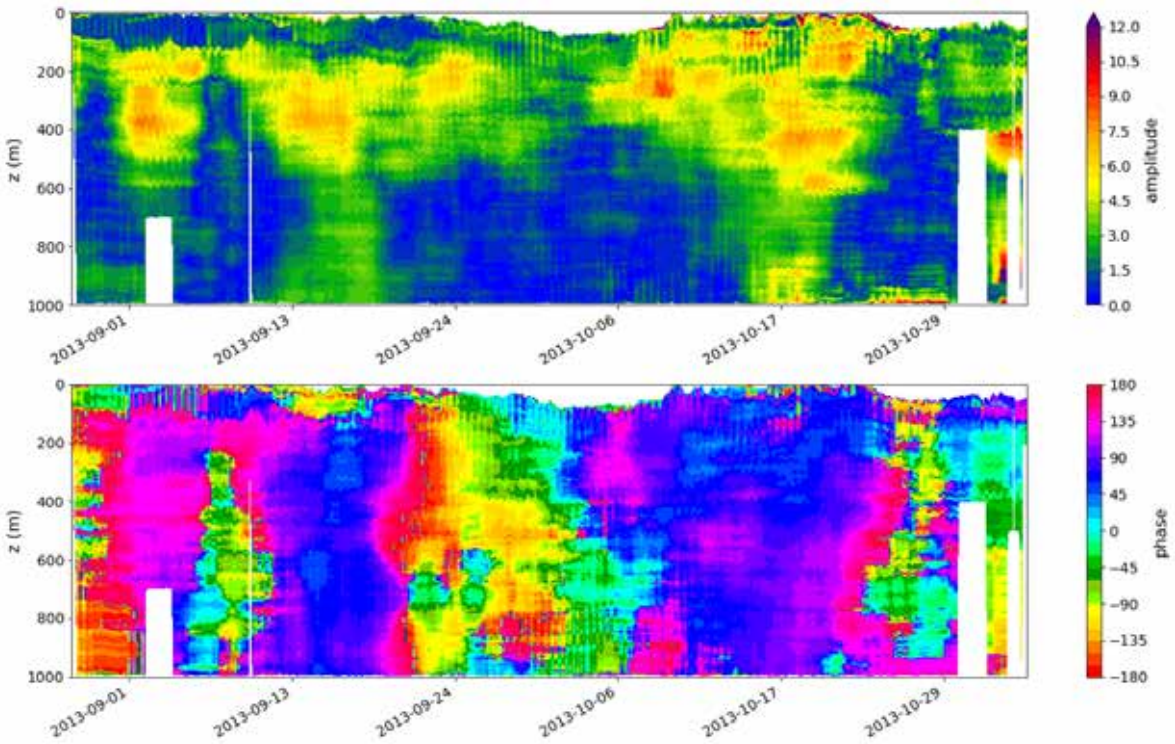
  (consistent with frontogenesis predictions for passive tracers)

- **weaker SST and buoyancy variance in the Vanuatu region**

  (consistent with weaker rotational motions)

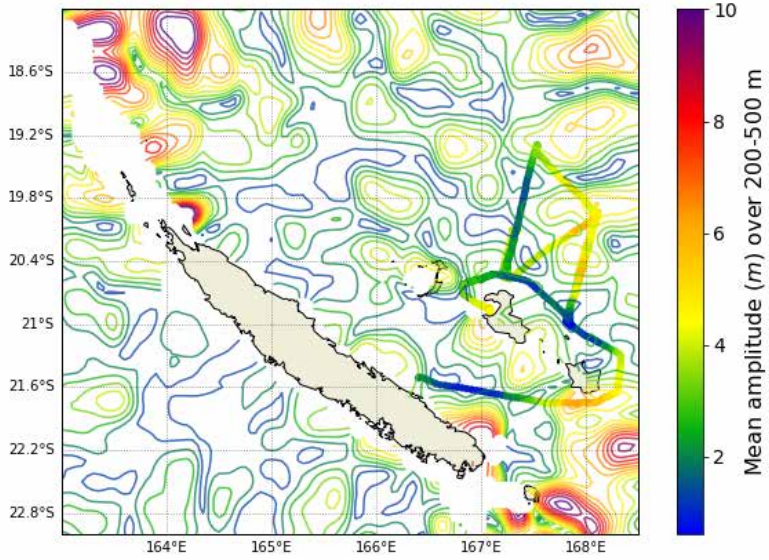
Estimation of M2 internal waves aplitude from gliders

Method : harmonic fit on the **M2** period applied to isopycnal displacements on 6-day windows (e.g. Rainville, 2013)



AltiglidEx glider section (August – November 2013)

→ **vertically-coherent signals (in phase and amplitude)**



Amplitude of M2 internal waves : 200-500m from glider vs altimetry (Ray and Zaron, 2015)

→ **geographical distribution in agreement with altimetry**

Strong potential for an in situ experiment in New Caledonia with a special focus on the observation and dynamics of internal waves

• **Pros of an in situ experiment in New Caledonia during the SWOT** *fast sampling* **phase**:

- strong SSH signature of internal waves and mesoscale activity
- follow an intense in situ effort in the framework of Saral/AltiKa validation
- logistics : Noumea IRD center and R/V Alis

• **Key questions for this SWOT cal/val site**

- Validation and analysis of the SSH signature of internal waves (coherent and incoherent)
- Assessment of the possible corrections for internal waves on SWOT data

- Processes for the generation and propagation of internal tides
- vertical structure of internal waves

- Interaction between internal waves and regional circulation / eddies
- Impact of these internal waves on mixing and biological processes

- Analysis of the (sub)meso-scale processes (once interal waves are filtered out)

Strong potential for an in situ experiment in New Caledonia with a special focus on the observation and dynamics of internal waves

- **2018-2021 actions in preparation for the in situ experiment**
  - analysis of mesoscale, submesoscale and internal waves from most recent conventional altimetry (AltiKa, Sentinel-3)
  - how to link informations from different observations (SSH, SADCP, TSG, gliders) ?
  - analysis of high-resolution simulations including internal tides (extraction of MIT-GCM global simulation / regional simulation)

- **Definition of a strategy for in situ observations during *fast sampling* SWOT phase**
  - need to test various designs from HR simulations
  - to be adjusted to possible minimalistic design for a Xover experiment
  - possible design
    - u-CTD + S-ADCP + TSG during a dedicated cruise
    - 1 currentmeter + CTD mooring (vertical structure and energetics of internal waves)
    - 1 or 2 gliders around mooring for the propagation properties of internal waves
    - HF radar?
  - fundings ?