SYNERGISTIC INSTRUMENT DATA

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SatOC

AIRBUS
DEFENCE & SPACE

Ifremer

Starlab
Living Science

ASSUMPTIONS

WAVEMILL CONCEPT

- SAR ATI — Ku-band
- dual beam at $45°$ squint at the surface (physically or electronically)
- VV and HH polarisation at the surface
- Incidence angle $30°$
- one side $\sim$200km
- altitude: 500–600km
- sun-synchronous (6am or 6pm)

PRIMARY PRODUCTS

Simultaneously

- Ocean Surface Current (1–5km)
- Ocean Wind Vector (1–5km)
- Swell directional spectrum

Ancillary Data Need:

1. for Inversion
2. for Validation
3. for Scientific Exploitation

DO WE NEED PRECIPITATION?

- Impact on:

    σ_0 : Strong for low wind speeds and/or high rain rates
    PHASE : Probable for high rain rates

- Will affect:
    - Ability to estimate wind-wave artefact velocity and accurate current
- Need Precipitation Data to identify rain event
    - existing source too coarse?
    - new rain Flags for Wavemill

DO WE NEED SEA SURFACE HEIGHT?

- Impact error on:

PHASE : due to hybrid baseline
  - which depends on pitch and yaw accuracy
- Wavemill sensitivity?
  - $\delta h = 1$m $\Rightarrow \delta v_{surf} << 5$cm/s (PicoSAR study)
  - Is this confirmed for this Wavemill configuration?
- Sources of SSH error:
  - orbit height?
  - geoid (>100km)
  - tides (large scale)
  - SSH changes e.g. Gulf Stream (1m over 100km)

DATA FOR VALIDATION

- Altimetry (S-3, S-6/J-CS, (SWOT), (COMPIRA))
    - Geostrophic current
        - Global product at $\sim$1/4°, $\sim$7 days; finest scale resolve $\sim$100km.
        - SAR alt.: Along track, fine scale: 20km, decorr. time of $>$10 days
    - Wind Speed at $\sim$7km along track
    - Significant Wave: Swell + wind sea
- SAR imaging
    - Wind speed if wind direction information, 5km (S-1, 1km)
    - Total Current in quasi zonal direction
    - Swell directional spectrum
- scatterometry, radiometry, GNSS-R
    - wind at coarse resolution, 25km (12km)
- Maximum Cross-Correlation of SST, SSS, Ocean Color
    - Mean total current over few days at resolution $>$10km

Synergy with

- Fine scale altimetry
  - to relate geostrophic processes in mixed layer to surface ocean dynamics (S-3, S-6/J-CS, SWOT)
- SST
  - to estimate heat fluxes at submesoscale
  - to study air-sea interaction over ocean fronts and eddies [Small et al., 2008]
  - to compare SST derived vertical velocity with Wavemill derived estimates using Surface Quasi Geostrophy—SQG theory [Isern-Fontanet et al.]
- Ocean Color
  - to link upper ocean dynamics, vertical mixing and primary production [McGillicuddy et al.]

CONCLUSIONS

NEED FOR INVERSION
- Precipitation: useful but not critical for inversion. Will need careful flagging.
- SSH: not need for inversion?

NEED FOR VALIDATION
- Standard cross-over and validation methods

NEED FOR SCIENTIFIC EXPLOITATION
Significant added scientific value of synergy with high resolution (HR) altimetry, HR SST and ocean color

WAVEMILL
- 500–600km
- desc. node: 6am or 6pm

S-3 — ALT. + OPTIC
- 815km
- desc. node: 10am
- BUT large swath for optic