Quantifying Errors and Uncertainties in Altimetry Data

- Climate / GMSL/ seasonal large scale errors:
  - Esselborn et al.
  - Ablain et al.
  - Cazenave et al.
  - Leuliette et al.
- Spatial/temporal error characterisation
  - Fu et al.
  - Ponte and Quinn
  - Philipps et al. (poster)
- Error estimation/specification for assimilation into ocean models:
  - Oke et al.
  - Remy et al.
  - Cosme et al. (poster)
- Coastal:
  - Birol et al. (poster)
- Reference Surfaces errors (Mean Dynamic Topography):
  - Horvath et al. (poster)
- Wind/waves:
  - Abdalla and Jansen

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- A very fruitful splinter session:
  - Different domains (wavelenghts/frequencies) covered: climate, mesoscale, wind/waves
  - Altimetry experts and oceanographers (users) in a same forum
  - Characterisation of the altimetry errors and…
  - Requirements from the way errors are prescribed

Quantifying Errors and Uncertainties in Altimetry Data - Summary

- **Climate scales:**
  - Henry et al. showed dicrepancies betweens MSL trend estimates from different groups (Univ. Colorado, Aviso):
    - Large differences in 2005-2011: 0.8 mm/yr (Key period for MSL closure budget)
    - JMR replacement correction on aviso reduces the differences
    - Processing differences (gridding, weighting, editing) explain as much as 0.3 mm/yr
  - Leuliette et al. showed:
    - Comparisons of all missions to tide gauges
    - Estimations of global and regional errors
    - Investigated the possible time tag bias depending on the yaw time between TOPEX and Jason-1 (centre of mass – centre of antenna)

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- **Climate scales:**
  - Ablain et al. provided a revisited estimation of the MSL budget error at climate scales, with a decomposition of the errors according to the different contributions (orbit, altimeter, etc):
    - GMSL error ~ 0.5 mm/yr
    - RMSL error ~ 3 mm/yr
  - Esselborn et al. investigated the orbit uncertainties by computing radial differences between several orbits. They also performed a sensitivity study for Time varying Gravity fields, as a current major source of errors in POD

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- **Spatial/temporal error characterisation:**
  - Fu et al. Described the SSH errors at wavelength < 100 km, using J1-J2 formation flight phase. They investigated the spectrum slope (after removing the white noise) and some implications in oceanography studies. New techniques (future missions) should improve the signal in the 10-100Km bandwidth
  - Ponte and Quinn showed altimetry errors estimates and geographical patterns of these errors using (J&-J2) differences. This kind of geographical distribution could be used in entry of assimilation.

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- **Altimetry wind/wave errors:**
  - Abdalla et al. showed how robust error estimates can be derived from triple colocations (several missions, buoys). The method provides wind/wave errors estimates of all altimetry missions, depending on wind/wave values, that should be introduced in the assimilation into the ECMWF model.

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- **Error estimation/specification for assimilation into ocean models :**
  - Oke et al. explained how errors are set up in the assimilation (Instrument error, Representation error, Age error). They discussed what might be missed (IB correction, MOG2D, Tidal, etc).
  - Remy et al. described the main challenges in taking into account a realistic error description in the assimilation (improving from a simple diagonal covariance matrix) and showed different metrics used to quantify the impact of observations

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- Additional inputs from the IP splinter: focus on noise level brought with SARM (i.e. instrument/processor specifications)
- End-users and particularly the Climate and Modeling community need more sophisticated end-to-end error assessment
- Larger datasets and independent assessments of SARM errors at all scales would be a desirable contribution to the error splinter

Quantifying Errors and Uncertainties in Altimetry Data - Recommendations

- MSL processing: benefits of using a a common set of algorithms and processing (e.g. gridding)
- TOPEX reprocessing is crucial for MSL estimation in the first decade: not only retracked parameters but also other sources of errors (time tag bias, CoG…)
- Need for altimetry/user communities to work together (forums… OSTST, GODAE) to better describe and use the altimetry errors
- New (and future) missions are likely to improve significantly the signal retrieval at wavelengths lower than 100 km: SAR (50 km), SWOT (10-20km)→ better error assessments are also needed
- It is crucial to maintain (on the long term) independent teams striving to improve the end-to-end error estimates in a precise and complete way.