Abstract

The timeliness of satellite altimeter measurements has a significant impact on their value for operational oceanography. In this work, we use an OSE (observing system experiment) approach to assess the quality of near real time (NRT) altimeter products, a key issue for a correct monitoring and modeling of the ocean state.

In a nominal NRT situation, at least 3 altimeters are needed to get the observing capability of 2 altimeters in offline products (delayed time).

The analysis is extended with an assessment of the NRT error increase when altimeter flows are not delivered normally. After a few days of anomaly, is a three altimeter NRT observing system still able to meet the minimum requirement for mesoscale observability?

Comparison with in-situ data

The NRT and DT datasets are compared to assess the mesoscale signal missed by NRT processing. The information lost in a non-centered mapping is significant with 5 to 10 cm RMS (Fig. 5).

Both data sets are compared with in-situ data, either locally (individual measurements) or globally (statistical results).

Performance loss with late IGDR delivery

The analysis is extended with an assessment of the NRT error increase when altimeter flows cannot be delivered normally. Simulated NRT maps are computed as if the input IGDR were delayed (missing, platform anomaly...).

The quality of simulated NRT maps quickly deteriorates when altimeter data are delayed or missing. The comparison of "optimal" DT maps with degraded NRT maps (as a function of the number of days of delivery delay) shows a linear trend. Results are the same for all areas and only the base variance is different (Fig. 6).

The linear trend is used to define a NRT performance indicator. The RMS of the DT-NRT difference (additional NRT error) is normalized by the best and the poorest NRT results one could obtain in a nominal scenario (Fig. 8). This indicator shows how good the NRT configuration is, and how sensitive to data gaps and delays it can be.

The indicator shows similar results for all areas studied (Fig. 10). For a two satellite configuration, there is a 5% error increase per day of missing data, and only 4% for a three satellite configuration. Not only is a three satellite configuration better in a nominal case, but it is also more resilient to data gaps and delays.

As an illustration, after six days of missing data (stacked over all missions) a 3-satellite configuration becomes hardly more accurate (in NRT) than a 2-satellite configuration in nominal status. Similarly on a 2-satellite configuration, 50% of the improvement from the second altimeter is lost when 4 days of IGDR are missing or delayed.

Overview and objectives

There are three categories of altimeter products (1): The DT or GDR products benefit from the best accuracy, but the delay is not compatible with the requirements of operational oceanography. NRT products are used operationally but they involve additional sources of errors such as a less accurate orbit (MOE).

The NRT mapping process is not optimal due to the delay vs. precision tradeoff. To get the observing capability of SLA in near real time, one does not have access to altimeter measurement in the "map future" like in optimal DT mapping (Fig. 2). The objective of this work is to assess and to understand the additional NRT error, both in nominal and in degraded configuration.

In a first step, we generate a delayed time data set used as a reference. A near real time data set is then simulated using a realistic orbit error and consistent asymmetric time windows (Fig. 2).

Then we compare the accuracy of fast delivery products with respect to "optimal" delayed time data using tide gauge and drifter data.

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The linear trend is used to define a NRT performance indicator. The RMS of the DT-NRT difference (additional NRT error) is normalized by the best and the poorest NRT results one could obtain in a nominal scenario (Fig. 9). This indicator shows how good the NRT configuration is, and how sensitive to data gaps and delays it can be.

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