

# GlobCurrent — What's it all about?

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## User Requirements

### Pleasure boating

Knowledge of currents (as well as winds) help the planning of smooth or quick journeys.



### Aquaculture

Penned fish are susceptible to the advection of toxins, either from open ocean harmful algal blooms or from nutrient-rich river outflows



### Search & Rescue

The challenge of locating stricken vessels or people washed overboard is greatly aided by good near real-time current data



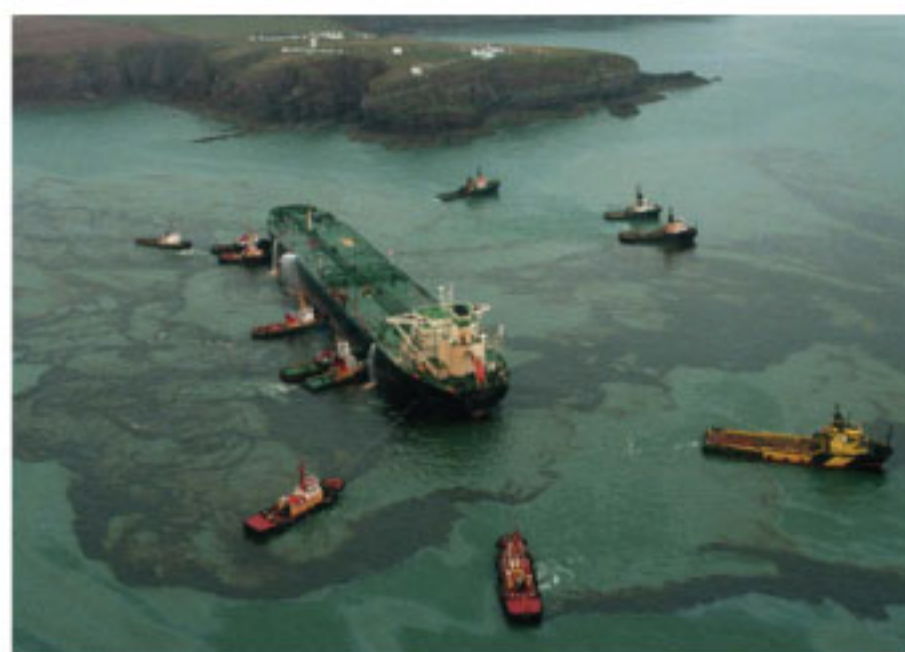
### Ocean Freight

Optimization of ship routes, through knowledge of recent currents, not only saves money on fuel, but can significantly reduce vessels' emissions.



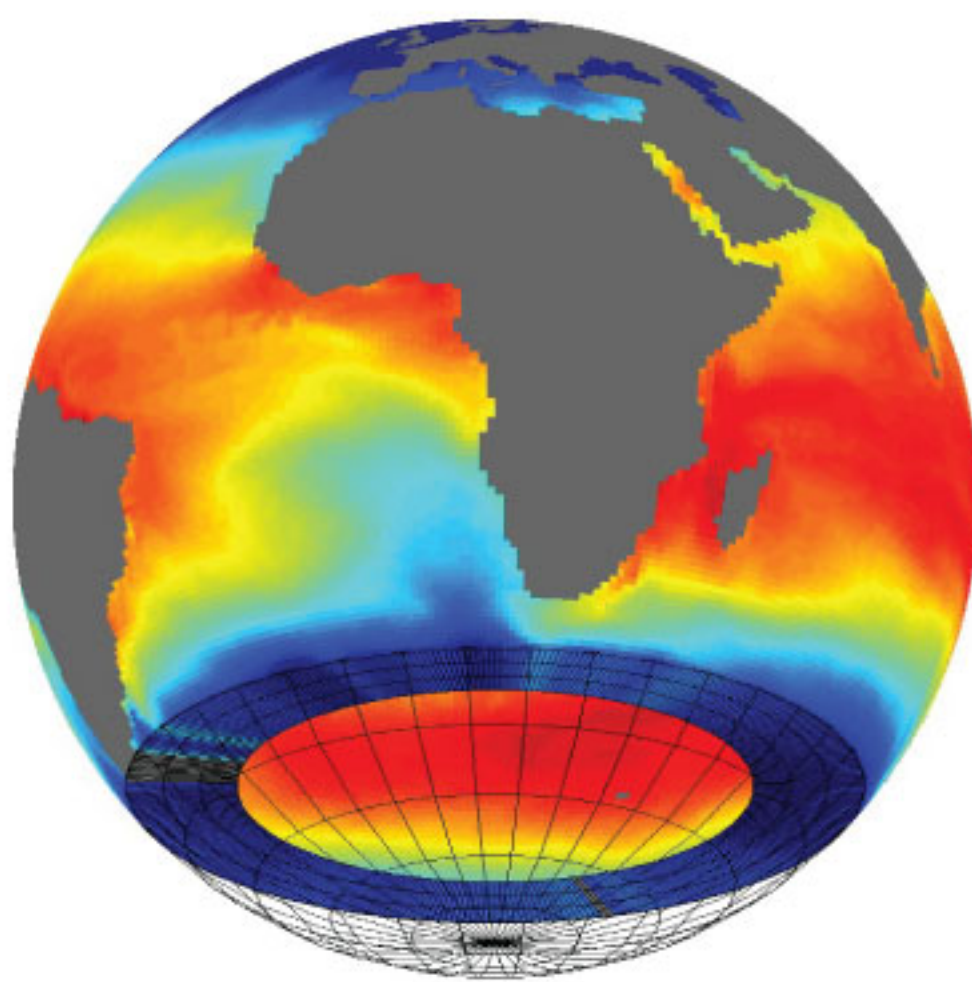
### Pollution Monitoring

Total currents (including wind and wave effects) lead to the dispersal of oil; improved knowledge will aid in deployment of protective booms and in clean-up operations.



### Climate Modelling

Good high-resolution real-world current records provide a key comparator for the assessment of ocean models.



### Transport of fish larvae

As well as heat and salt, ocean currents transport nutrients and free-floating larvae; improved current records can help understanding of the factors affecting life cycles and interannual variations in recruitment.



### Oil Industry

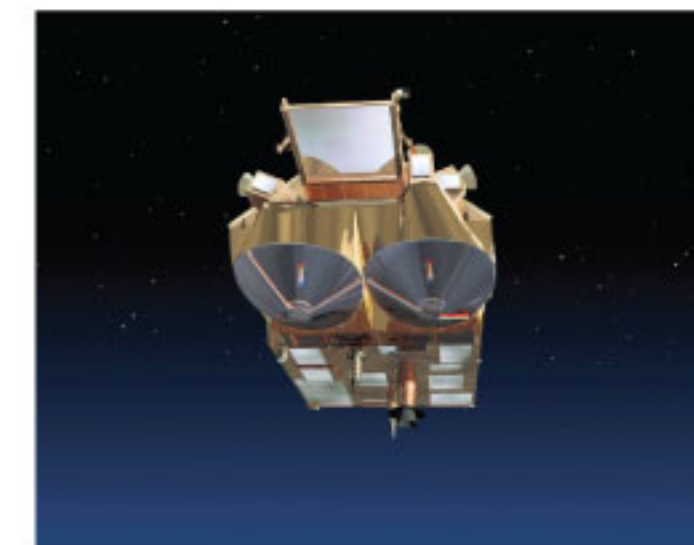
Knowledge of currents and their extremes is essential for selection of drilling sites, towing of rigs, and setting parameters for operations.



## New sensors; New data

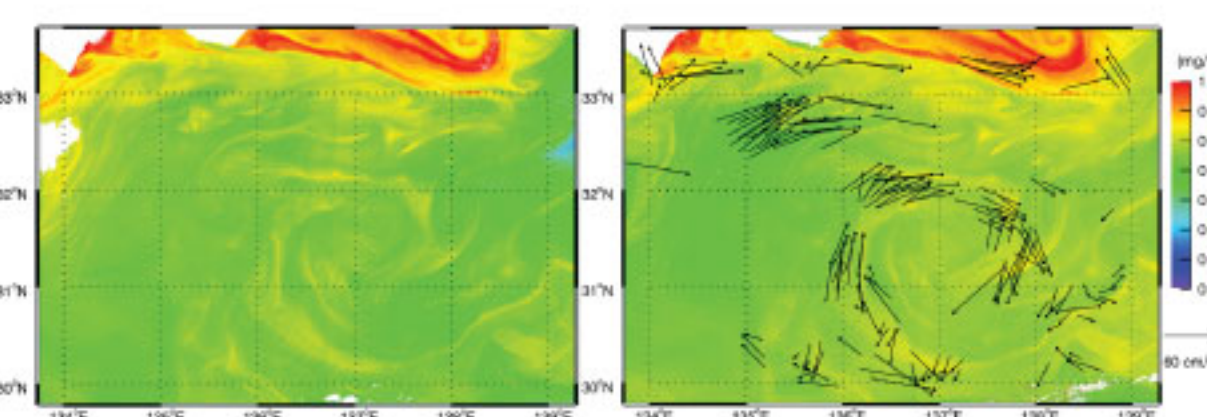
### Delay Doppler Altimetry

The new DDA technology on Cryosat-2 (and later on Sentinel-3) enables independent sea surface height retrieval at a finer along-track resolution than before, because of the much reduced instrument footprint.



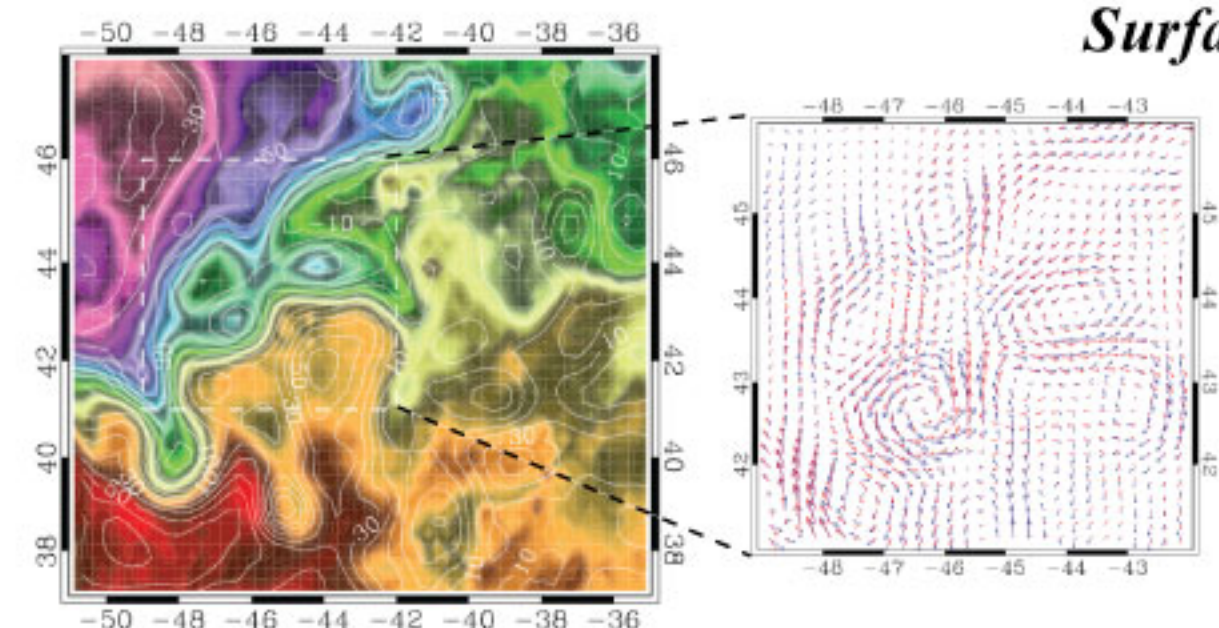
### Maximum Cross Correlation

MCC permits the inference of velocities from the derived translation of features in two consecutive images. The geostationary Korean satellite GOCE provides 500m resolution ocean colour images every hour during daytime.



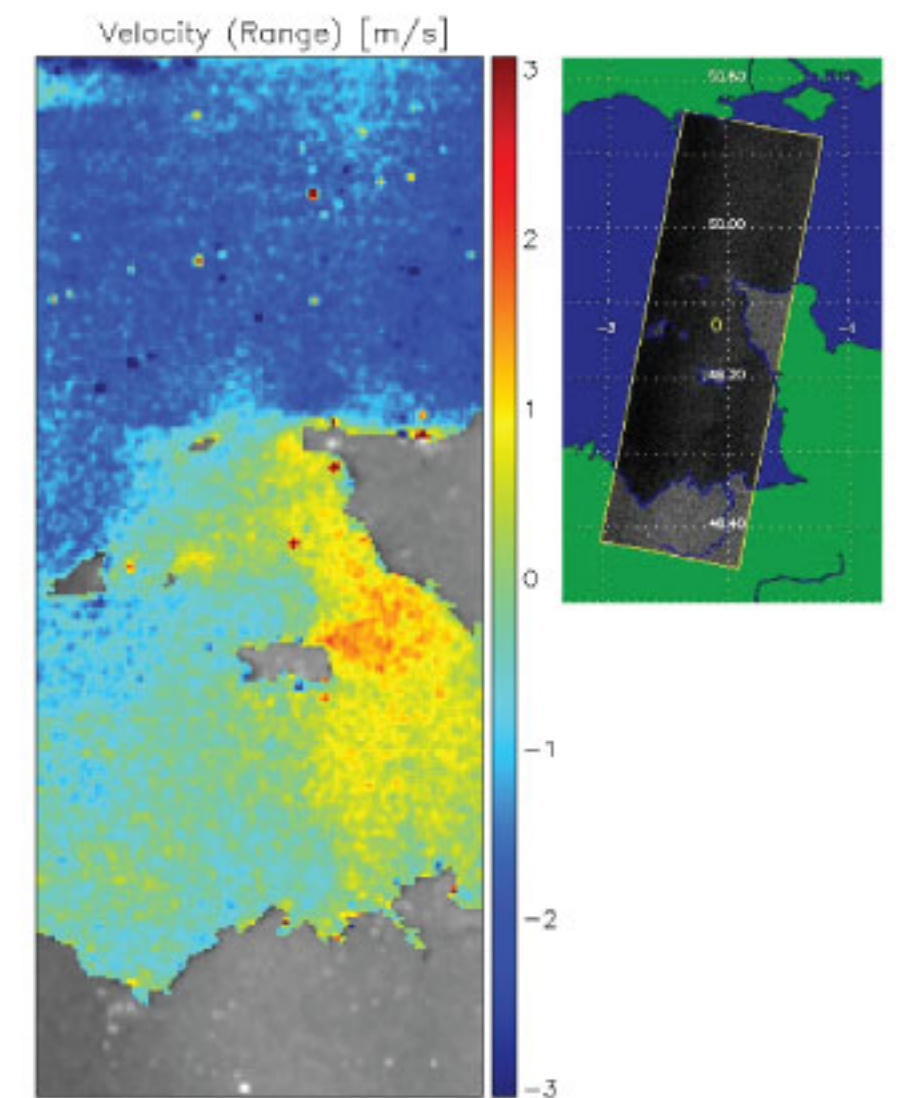
### Surface Quasi-Geostrophy

Microwave radiometers, such as AMSR-E provide nearly complete spatial coverage of SST (left); the SQG approximation allows current to be inferred. The right-hand panel shows the good agreement of SQG-derived velocities (in red) and altimetric ones (blue). [From Isern-Fontanet et al., 2006].



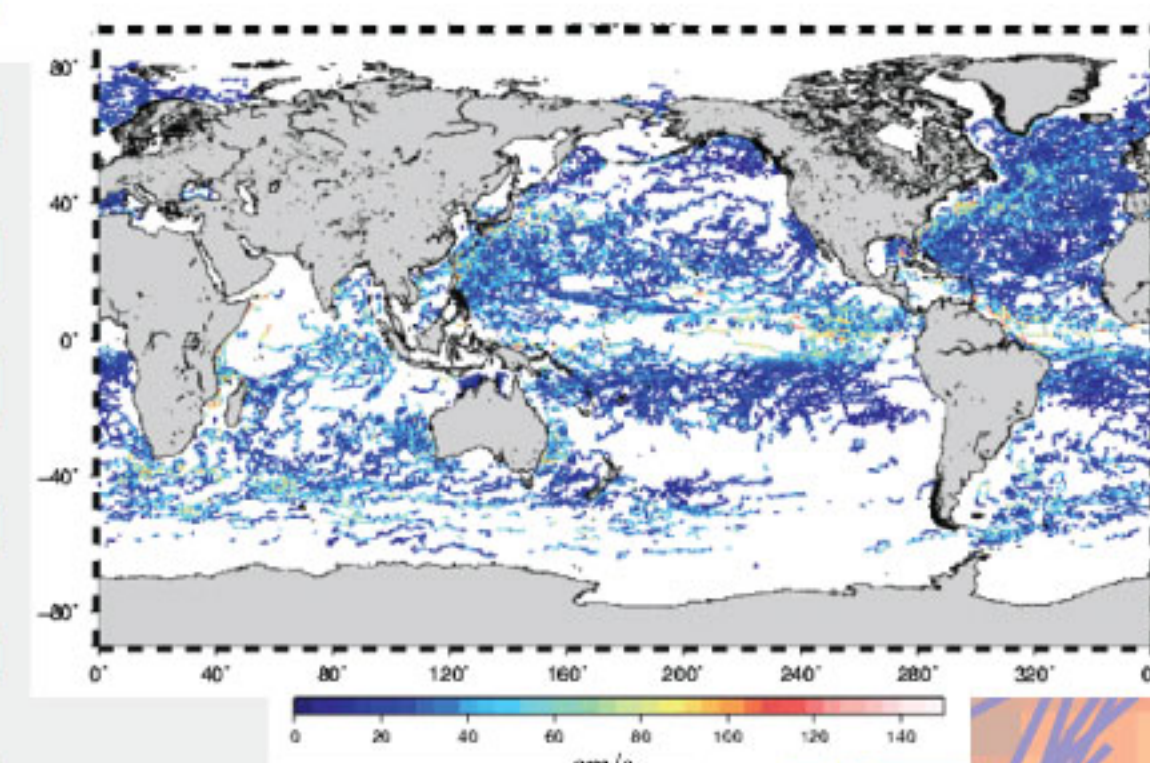
### SAR Doppler

The centroid frequency of SAR return signals is Doppler shifted by the line-of-sight motion caused by short wind waves, circular motion and breaking of larger waves, and surface currents. Johannesson et al. (2008) showed how the surface current component could be extracted. Illustration shows radial velocity field retrieved from ASAR data over the English Channel.



### Drifters

The global armada of drifters provide an important check on all the satellite-derived data, with their response to total currents. Illustration shows the coverage of all records received by Coriolis in real time during Sept 2012-Sept 2013.



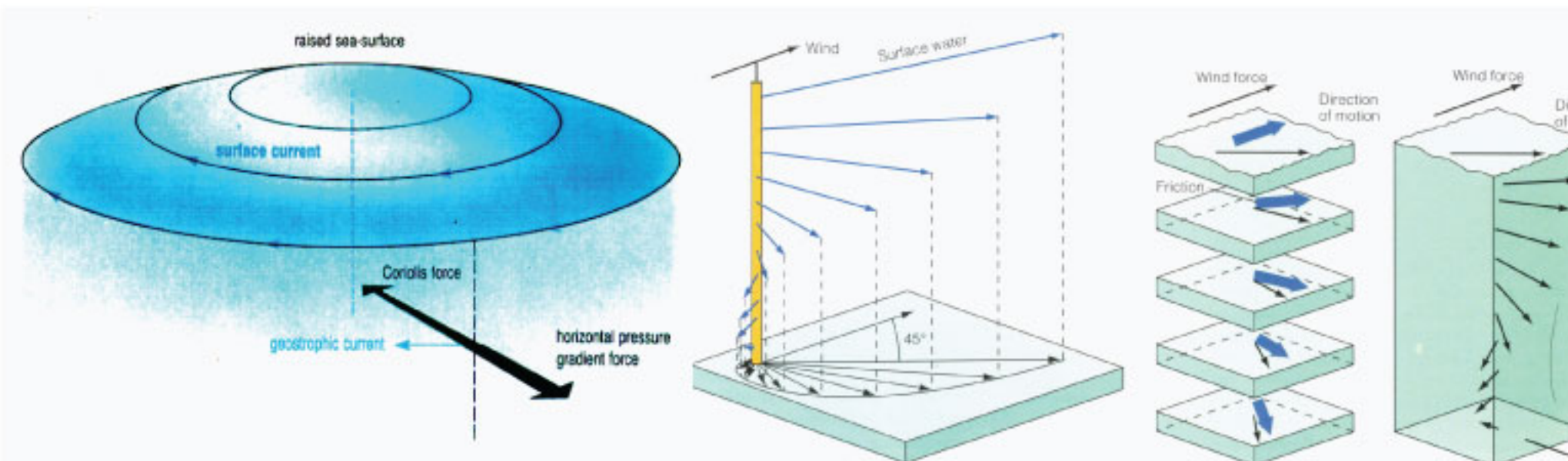
### References

- Ardhuin, F. et al., 2009. Observation and estimation of Lagrangian, Stokes, and Eulerian currents induced by wind and waves at the sea surface. JPO, 39, 2820–2838.
- Isern-Fontanet, J. et al., 2006. Potential use of microwave sea surface temperatures for the estimation of ocean currents. GRL, 33, art. no. L24608.
- Johannesson, J.A. et al., 2008. Direct ocean surface velocity measurements from space: Improved quantitative interpretation of Envisat ASAR observations. GRL, 35, art. no. L22608.
- Rio, M.-H. et al., 2014. Beyond GOCE data for the ocean circulation estimate through the synergistic use of altimetry, gravimetry, Argo floats and drifting buoy. GRL (accepted)

## Summary

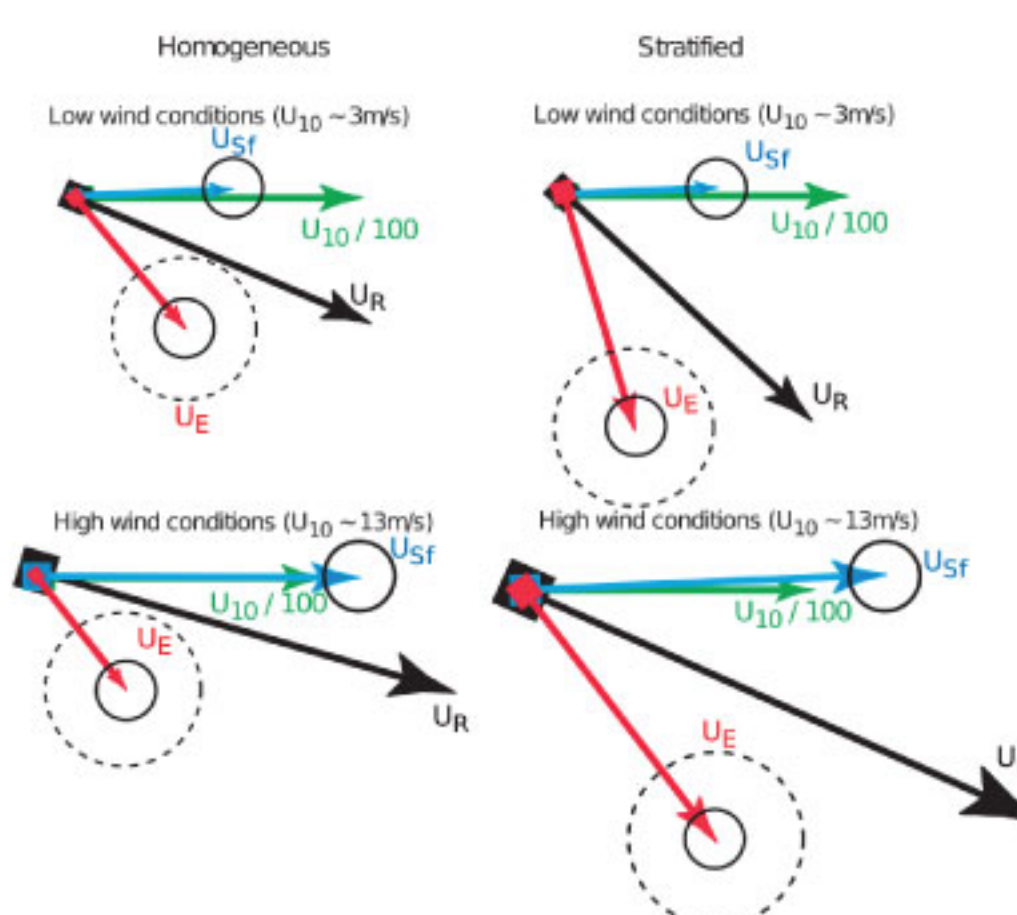
GlobCurrent is an ESA-funded initiative to provide Ocean Surface Currents that match the users' needs -- skin flow or averaged over 10m draught; geostrophy and/or Ekman and/or tides ... Of course it can not provide kilometre resolution all the time everywhere (as users ideally want). However it aims to meld intermittent high-resolution current retrievals (MCC, SAR Doppler ...) based on a backbone of altimetry with modelled Ekman currents, Stokes drift and tidal components, with drifters, HF radar sites and instrumented moorings providing the essential independent validation data.

## Defining / Calculating a Total Current



The geostrophic component of the current is, of course, calculated from sea surface height, and this affects the whole of the surface layer. Ekman currents spiral with depth, with the very surface flow often thought of as at 45° to the wind direction. We will use the fields calculated by Rio et al. (2014).

However, if the top few metres are highly stratified, the Ekman flow will be larger and at a greater angle (Ardhuin et al., 2009). The Stokes drift is in the direction of the largest and steepest waves, and decays rapidly with depth. Thus the overall resultant flow will depend upon the depth of interest and the stratification.



To match the different needs of users, GlobCurrent will deliver estimates of the current at four near-surface depths, with the individual components (geostrophic, Ekman, Stokes, tides) being available as well as the total current. The aim is to produce a 0.25° resolution product every 3 hours, with a finer resolution in the coastal zone. An initial sample of one month (Sept. 2012) is available now, with the period 2010-2012 to be available for evaluation by the end of the year.

This initial release is based on altimetry and models for wind, wave and tides. Research is ongoing to assess the current retrievals from MCC, and incorporate those and SAR Doppler currents in a later version.

URL: [www.globcurrent.org](http://www.globcurrent.org)

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