

Routine high resolution observation of selected major surface currents from space

SEASAR 200

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Doppler shift contributions

- Observed Doppler velocities = underlying current + background sea state + sea state perturbated by surface current.
- First order : only underlying current + background sea state
 - Hypothesis based on Doppler observation compared to HF radar except in area where tidal current is fast changing due to interaction with bathymetry :

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 Second order : sea state perturbated by surface current. Advanced models such as Doprim are needed to take into account modification of wave spectrum by surface current gradients.



CDOP geophysical model function

- First presented at ENVISAT Cal-Val review in 2002, published in JGR 2005 using wave mode at 23° incidence angle.
 - Modeled using tilt+breaking
 - largest influence from the largest steepness (typically in equilibrium with the wind stress)
 - First order : only wind dependance
 - empirical law only based on wind speed and direction relative to radar look



CDOP_23 = f(wind speed/direction)



CDOP geophysical model function

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 Now extended to all incidence angles using WSM Doppler grid.





Simple methodology to remove sea state effects

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Equatorial Pacific Zone monitoring





Equatorial Pacific Zone monitoring 2D comparisons









Equatorial Pacific Zone monitoring 1D comparisons





Equatorial Pacific Zone monitoring Monitoring the seasonal cycle













First Breakthrough

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• Help to the characterization of errors in existing ocean circulation models (MERCATOR) or ocean current derived using altimetry/scatterometry (OSCAR).





Supersites for systematic acquisition of ASAR Wide Swath scenes (400km width)

• Gulf stream (North Carolina)



Agulhas current



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NEW : Doppler Centroid Estimation now provided in all ASAR WSM and WSS products

Resolution 10km in azimuth and 5km in range







- Anomaly = measured predicted
- Compensated non-geophysical sources of anomaly :
 - Antenna misspointing (uniform shift)
 - Instrumental bias in the radial direction (radial discontinuities)
 - Doppler estimator bias caused by azimuthal variation fo backscatter (artificial correlation between doppler and sigma0).





CDOP correction



Residual velocities





15

Altimetry derived surface current : 3 days mean















































































Agulhas main stream velocity • From Sept 1 2007 to Jan 17 2008





Surface drifter velocity (float d378) from the Agulhas Current

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QuickTime[™] and a TIFF (Uncompressed) decompressor are needed to see this picture.



Conclusions

- Large scale surface current now routinely observed by SAR with quantitative estimations of surface current in the radar look direction. Surface current values validated at 100km scale.
- Need for high resolution validation dataset for full resolution validation (less than 10km). HF radar is an option but the range is to small even for SAR image mode.
- CDOP applicable to the C band ATI phase. Concept can possibly be extended to X and L bland.
- Thanks to ESA for now providing systematic wide swath Doppler grid over Agulhas and gulf stream since summer 2007 !