

# SAR EDDY MAPPING



## INTRODUCTION

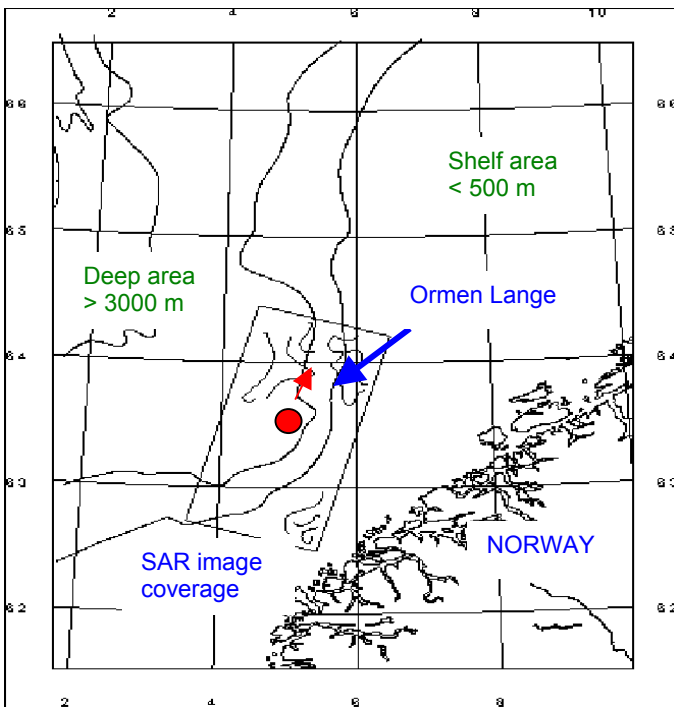
Synthetic Aperture Radar (SAR) monitoring of eddies and current features has been developed for the northeast Atlantic and the Norwegian Sea using satellite data available in near real time from Kongsberg Satellite Systems in Tromsø, Norway. There are two major categories of processes, which are observable in SAR images over ocean: (1) atmospheric boundary layer processes (wind, precipitation), and (2) ocean surface processes (surface waves, fronts, currents, sea ice). SAR can also provide information on specific features such as slicks, bathymetry and ships. For eddy mapping only ocean current features are retrieved from the image, which is feasible at wind speeds below  $10 \text{ ms}^{-1}$ . At higher wind speeds the surface wind signature dominates and tends to mask out current features. ERS SAR images have been available since 1992. From January 2003 ENVISAT ASAR images are available for eddy mapping and other ocean observations.

## EXAMPLE OF EDDY MAPS IN THE NORWEGIAN SEA

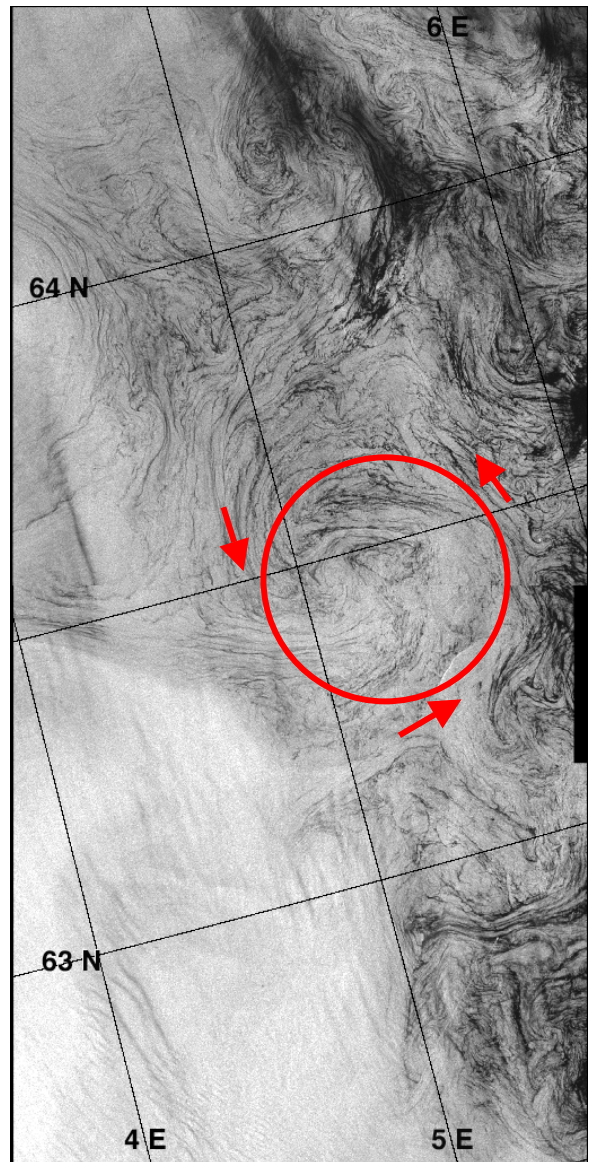
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ERS-2 SAR image covering the Ormen Lange field, obtained on 22 April 1998, showing intense eddy activity. One predominant cyclonic eddy of 30 km diameter is marked by the red circle. ©ESA/TSS, 1998.

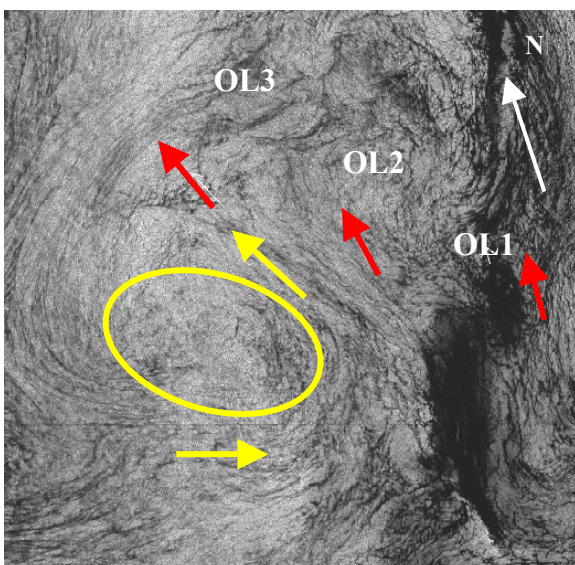
The met-ocean conditions (wind, waves, currents) of the Norwegian Sea can be extreme because of the exposure to the Atlantic Ocean and the Norwegian Sea. SAR observations of surface current patterns has been used as one of several methods to obtain knowledge about current conditions required for design and operation of floating structures in this region.



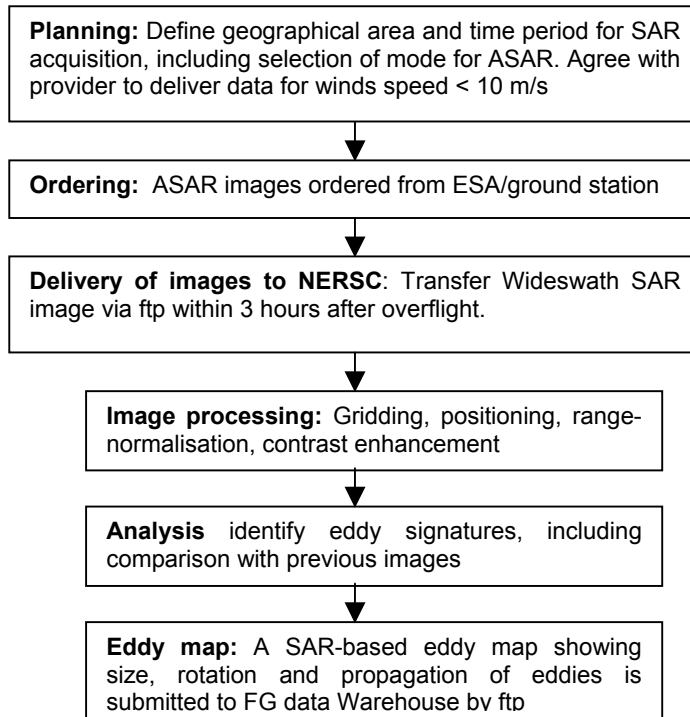
Map of the eddy position and propagation observed in the deep sea drilling area off mid-Norway.



#### VALIDATION OF SAR OBSERVED EDDIES WITH CURRENT METER DATA



Example of eddy detection with SAR from ERS-2 on 11 June 1997 at the Ormen Lange field west of Mid-Norway. A well-defined cyclonic eddy is seen southwest of the three Ormen Lange current meter moorings (OL1, OL2 and OL3). Current measurements at 100 m depth were used to compare with the surface signature in the SAR image : OL1 measured 15 cm/s in direction 0°, OL2 measured 40 cm/s in direction 350°, and OL3 measured 40 cm/s in direction 330° (indicated by red arrows). These directions are all in good agreement with the line features defining the eddy (yellow circle and arrows).



## ENVISAT ASAR FEATURES

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- Observations every two days at 70 N and every 3 days at 60 N;
- Selection of incidence angle from 15 to 45 degrees for optimal detection of eddy features
- Simultaneous observations with MERIS and partly AATSR for improved detection
- In cloudless areas, MERIS and AATSR can be used alone to detect eddies,
- On-board storage of data allowing full global data acquisition

## CONTACT POINTS

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