



# MEOS™ SAR Wind Estimation

## Value Added Product

The MEOS SAR (Synthetic Aperture Radar) Wind Estimation is used for environmental and marine surveillance.

### Wind Display

Ocean surface wind direction and speed are estimated from the SAR image. The results are displayed using MEOSView.

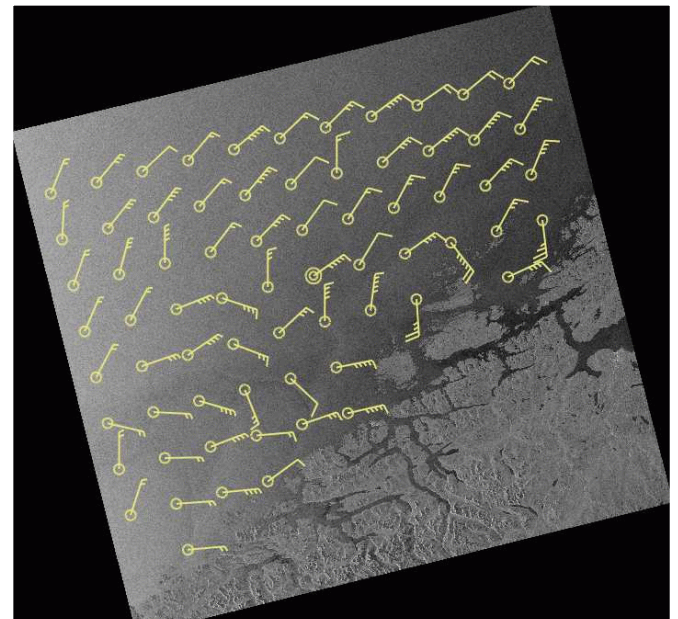
MEOSView is a visualisation tool specially designed to be used in an operational environment. The native input format is HDF5. MEOSView includes a thumbnail view of the product archive as well as a thumbnail view of pre-processed products and value added products if available.

Geographic information can be placed on images as overlays. If wind vectors are available they can be displayed as overlays on the image. Additionally MEOSView, can display Numerical Weather Predictions (NWP) model output as overlays on images.

### Key features

- Operational tested and in use in operational production
- Fast and effective automatic detection
- Wind estimation product available in different file formats: HDF5, JPEG, TIFF, GEOTIFF, XML and ASCII
- MEOSView visualisation tool<sup>1</sup>
  - Validation and verification
  - Generation of reports
  - Combination with Numerical Weather Predictions model Vectors and Ship detection positions
  - Combination of wind, oil, ship and overlaying graphics:
    - Coastlines and lakes
    - Rivers
    - Grid
    - Platforms
    - Pipelines

<sup>1</sup> Require HDF5 Format



### SAR Wind Estimation based on CMOD4 transfer function

The wind directions are extracted from wind-induced streaks, e.g. from atmospheric boundary layer rolls or wind shadowing, which are approximately in line with the mean wind direction near the ocean surface. The wind speeds are derived from the NRCS and image geometry of the calibrated images, together with the local wind direction retrieved from the image. Therefore the semi-empirical C-band model CMOD4, which describes the dependency of the NRCS on wind and image geometry, is used. The CMOD4 was originally developed for the scatterometer of the European remote sensing satellites ERS-1 and ERS-2 operating at C-band with vertical polarisation.

Consequently, the CMOD4 required modification for horizontal polarisation, which is performed by considering the polarisation ratio.

### SAR Wind Estimation consists of:

**Read SAR data**  
Subsets

**Land mask**  
Using GSHHS files

**Wind direction**  
Estimation through principal component analysis. Subsets that contain more than 10% land are discarded

**Wind speed estimation**  
Requires calibrated input products. Subsets that contain more than 10% land are discarded

**Wind report**  
Generated by MEOSView in Kongsberg Spacotec's ASCII format

The native SAR Wind Estimation format is HDF5.

The input SAR product is converted to HDF5, and the HDF 5 files are combined using MEOSView. The estimated wind directions and wind speeds may be edited using MEOSView.

Additional information may be overlaid such as model wind vectors and detected vessels.

### SAR Wind Estimation Performed on SAR Products:

- RADARSAT-1/2<sup>1</sup> Scan SAR (Narrow and Wide) and SGF (SAR Georeferenced Full-resolution) products
  - ENVISAT ASAR (Advanced Synthetic Aperture Radar) Wide Swath mode Medium resolution (WSM)
    - (ASA\_WSM\_1P), Image Mode Precision (IMP)
    - (ASA\_IMP\_1P), Image Mode Medium resolution (IMM)
    - (ASA\_IMM\_1P), Alternating Polarisation mode Precision
    - (APP) (ASA\_APP\_1P) and Alternating Polarisation mode Medium resolution (APM) (ASA\_APM\_1P) products
- ERS-1/2<sup>2</sup> PRI products

### Performance

Within 10 min. for ASA\_WSM\_1P or Scan SAR, less for other modes.

### Wind Direction

If no direction is estimated, the look direction and look direction plus 90 degrees are used as the proposed wind directions.

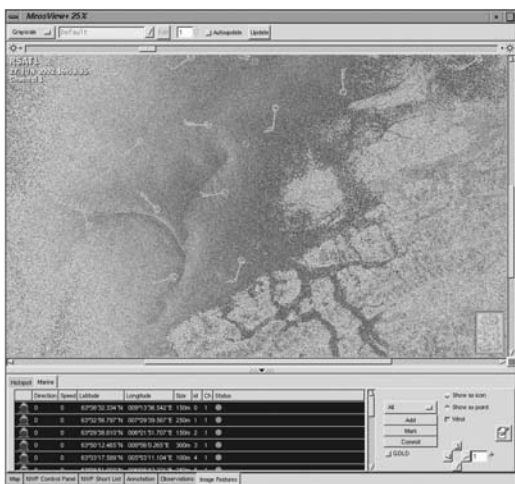
### Wind Speed

Requires calibrated input products. The valid range of wind speed values are within [2,35] m/s.

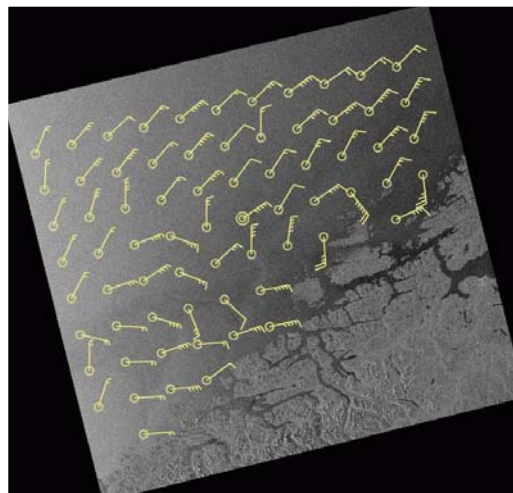
<sup>1</sup> Planned Upgraded

<sup>2</sup> To be confirmed

## Display Examples



SAR Ship Detection and SAR Wind Estimation combined using MEOS View



SAR Wind Estimation GEOTIFF image

**Note:**  
MEOS is a registered trademark of Kongsberg Spacotec AS. Specifications are subject to change without notice.

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