

Monitoring sea-based oil pollution in the Black Sea: the MONRUK (Monitoring the marine

environment in Russia, Ukraine and Kazakhstan) **Project**

Guido Ferraro EC Joint Research Centre

Stein Sandven Nansen Environmental and Remote Sensing Center, Norway

STREP project funded by EU Framework Programme 6

Aeronautics and Space (2007 - 2009)

Web-site: http://monruk.nersc.no







- Overall objective is to develop and implement SAR monitoring of the marine environment in Black Sea, Caspian Sea and Barents/Kara seas
- Scientific objectives:
 - 1. Develop and test SAR retrieval algorithms for sea surface parameters
 - 2. Modelling of sea surface radar scattering
 - 3. Analysis of SAR images to characterize the sea surface conditions
 - 4. Dissemination using webmap services



SAR acquisition of the study areas





Region	Total*	Details
Barents	383	WSM: 131 APM: 12 IMM: 240
Kara	447	WSM: 276 APM: 3 IMM: 168
Black	182	WSM: 58 APM: 38 IMM: 86
Caspian	91	WSM: 38 APM: 1 IMM: 52

* Number of image obtained from ESA rolling archive from May to December 2007. In addition, archived data from earlier years are available for the studies.



Radar scattering modelling



MONRUK develops an improved model of radar scattering from a sea surface covered by oil and biogenic films to be used in detection and classification of surface film in SAR images



Flow diagram of the radar scatter model for simulation of a given surface condition



Field experiments at an offshore tower in the Black Sea Anemometer Ka-band radar Video-camera Stereo-camer Temperature Laser gauge Wave gauges

Optical system to measure short wave spectrum and surface mean slope

Video system to measure wave breaking



Oil spill experiments in October 2007

JRC

EUROPEAN COMMISSION

NERSC

Date, start time	Wind direction	Wind speed Z=4m	Wave Vector dir	Slick observations	
02.10.07 12:30	No wind 145º (SE)	0 m/s <0.5 m/s (14:07)	260º	VO (13:03) VO (14:15) OLO (15:07)	Artificial slicks: Veg.Oil, Olive oil, Dodecyl Alcohol, Diesel fuel.
02.10.07, 16:47	90º (E)	2.5m/s?	270°	Natural slick (17:12) DF (17:14)	Total: 16
03.10.07, 10:27	No wind 107º (11:43) 90º (12:28)	0 m/s 1-2 m/s 2 -3 m/s	270°	Natural slick (12:00) Natural slick (12:42) Natural slick (12:54) Natural slick (12:59) + VO Natural slick (13:13) OLO (13:43)	<u>Natural slicks</u> periodic and single bands Total number of slicks:
03.10.07, 15:46	110º	1-2 m/s	280°	Natural slick (15:50) Natural slick (16:03) OLO (16:09) Natural slick (16:14)	13
04.10.07, 10:34	120º	0-2 m/s	300º	Natural slick (12:37)	
04.10.07, 15:46	150º	1-3 m/s	330º	Natural slick (17:17)	
05.10.07, 10:28	0º - 5º	2-4 m/s?	270°	VO (12:22) Natural slick (12:30) OLO (12:44) DA (13:00) VO (13:39) VO (15:39) VO (15:50) DA (16:09) OLO (16:23) VO (16:23)	
06.10.07, 10:02	70°	2 - 4 m/s?	250º	OLO (11:55) Periodic Natural slicks	ASAR image



Improved slick observation using VV-HH ratio



Subset of ENVISAT ASAR AP image on 23 August 2003 off Novorossisk coast:

(a) VV-pol

(b) HH-pol

(c) Pol ratio (PR)

For clean seas PR is defined by contribution of bragg scattering and wave breaking, with typical value of 5 for this inc angle. In slicks bragg waves disappear and PR becomes close to 1



Distribution of oil spills in the Black Sea derived from SAR images



Analysis of about 150 ENVISAT images (May 2007 – January 2008) showing about 100 possible oil spill events.

Example from the Caspian Sea, use of SARTool





MONRUF



 The ASAR Wideswath image from 04 July 2007 covers most of the Caspian Sea (left figure). A subset of the image (above) was analyzed for the area off Baku (red circle) where a spill event could be detected. The SARTool provided by BOOST Technologies was used to detect and quantify the oil spill area.



NERSC

Oil spill event Kerch Strait 11 November 2007

C-band: RADARSAT
X-band: TerraSAR
L-band: ALOS PALSAR

Image: C-band: C-

Courtesy: Scanex

Courtesy: DLR

Images obtained 16 November - > case study for model comparison

ASAR 16 Nov. 2007







ASAR IM & Resurs DK1





 Many small oil patches are observed in the optical image, but not in the SAR image

Use of optical images







Interoperable Web Services



Many data providers - > one dissemination system

Layers

Multiple data sets in GIS layers: Example: SAR stripes & coastline

Map



Auxillary information







Example: Ocean colour + wind



NONRUT

Web Map Service : Summary



- Open Geospatial Consortium (OGC) WMS defines a protocol for Addated a protocol
- WMS is an established standard with a number of tools available, both public domain and commercial.
- Customers can access a WMS system through a web browser, no extract plug-ins needed.
- Maps from multiple providers can be overlaid, including a geographic grid, coastline/bathymetry and any other GIS data.
- A network of data providers' nodes can be set up to deliver different types of geographic data to the system, where
 - A user can obtain data from many providers.
 - A provider can distribute data to many users.





Thank-you for your attention

guido.ferraro@jrc.it