Annex V-2 Website on Oil Spill Monitoring

(Prepared and Submitted by CEARAC Secretariat)

Satellite and aircraft image database general concept has been elaborated in detail including input data format, database file system and web site presentation layout. General procedure for other NOWPAP CEARAC countries to submit data into the database was worked out as well.

POI FEB RAS has systematically classified collected ERS-1, ERS-2 SAR and Envisat ASAR images with revealed oil pollution as well as with look-alike features of different origin. Other oceanic and atmospheric phenomena are marked and classified on the images (natural films, surface waves, oceanic internal waves and fronts, eddies, underwater bottom topography; atmospheric fronts, internal waves, convective rolls and cells, etc.) to improve reliability of oil spill identification.

For each image, a package of supplementary information (NOAA AVHRR image, depth maps, weather charts, wind and wave charts, SST charts) was compiled. Supplementary information also includes instrument characteristics (frequency, polarization, incidence angle, angles between wind direction and radar look direction), data, time, region of image origin and coordinates. It is supposed to add the interpretation schemes, enlarged fragments and estimates of polluted areas and volumes of oil for the most bright and illustrative examples.

Image preview/Location map

Image name	ERSC9709220200
Platform/Sensor	ERS-2/SAR
Flight altitude/speed	785 km/6.8 km/s
Image partition	Preview file is a strip of two frames
Wavelength(s)/Frequency(ies)/Band(s)	0.057/5.3/C
Polarization(s)	VV
Incidence angle(s)	23°
Calibration	Preview image: black is lowest NRCS, white is highest NRCS Full images: PRI format
Date/Time	22.09.97 / 02:00
Area	Northwestern Japan/East Sea
Coordinates	43.290°N, 131.260°E, 43.104°N, 132.447°E 41.499°N, 130.751°E, 41.315°N, 131.903°E
Surface geometry	2 frames 100x102 km = 100 x 204 km
Location map	Available
Other signatures seen in the image	Oceanic eddies, atmospheric convective cells, atmospheric front, rain events

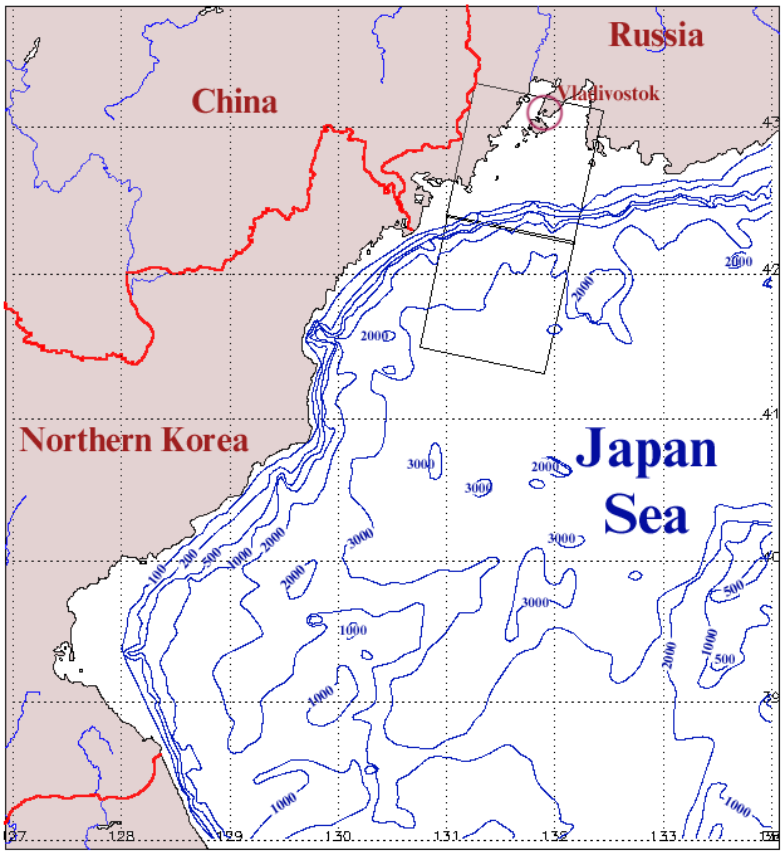
Supplementary information

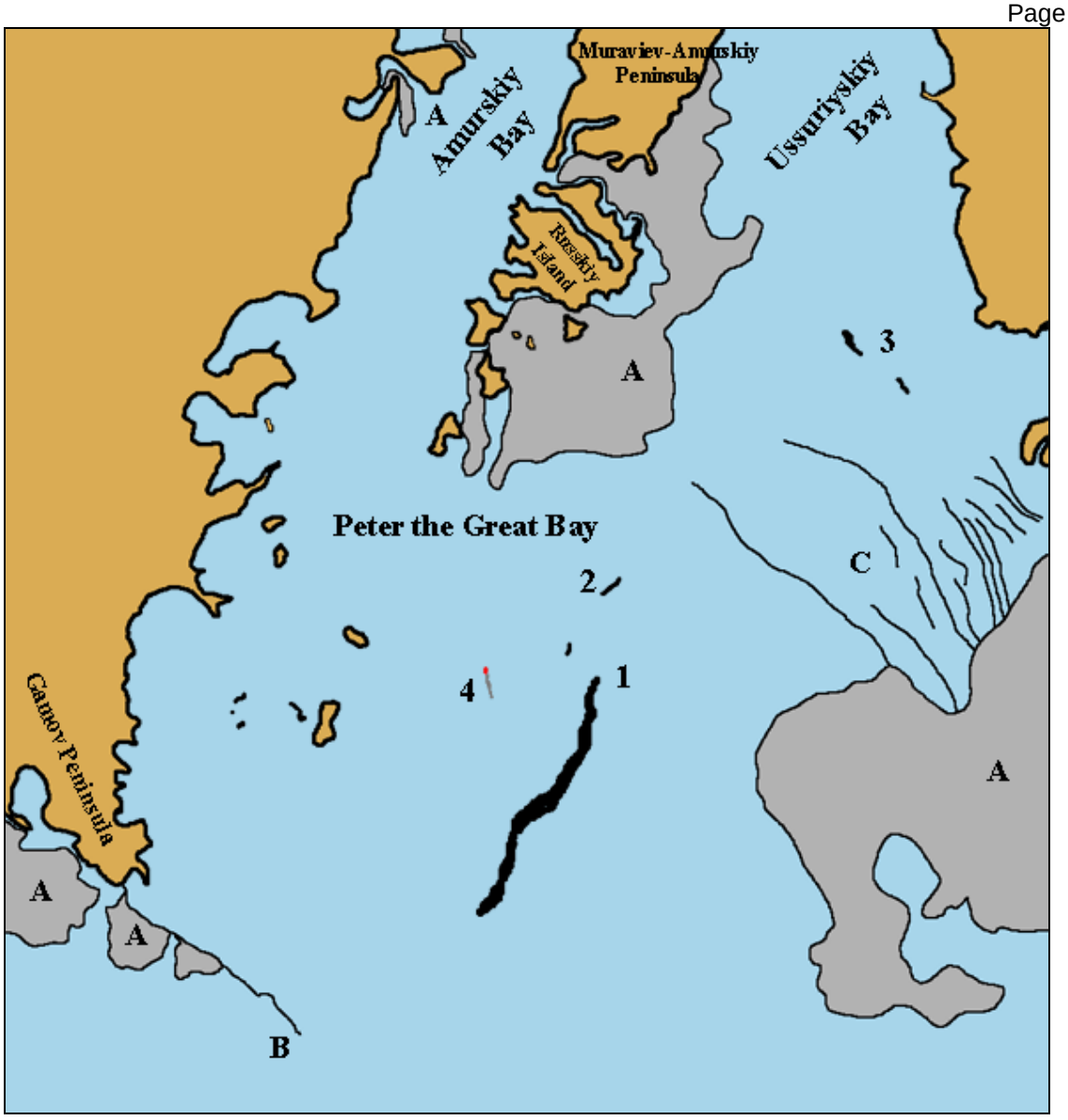
Source image : image size: 2*(8000*8200)=8000*16400; pixel = 16 bits; pixel size: 12.5 x 12.5; file size: 2*128 Mb = 256 Mb

Contact: Laboratory of Satellite Oceanography, POI FEB RAS

Image preview

Location map





Interpretation scheme of the ERS/2 SAR image of the northwestern part of Japan/East Sea

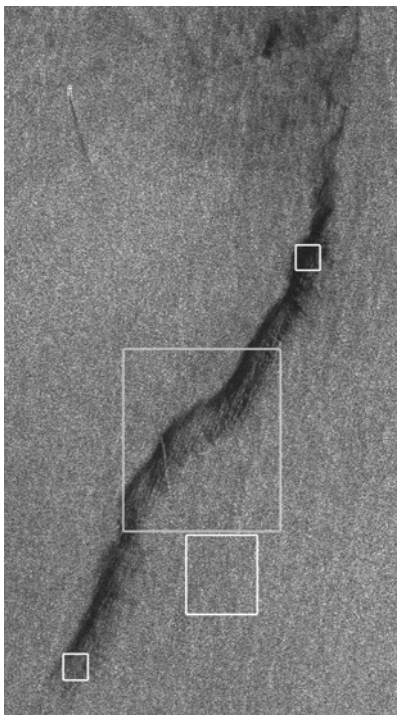
The ERS-2 SAR image of the coastal zone of the northwestern Japan/East Sea acquired on 22 September 1997 at 02:00. The SAR image covers a region of about 100 x 100 km. The spatial resolution of the SAR image is 100m x 100m.

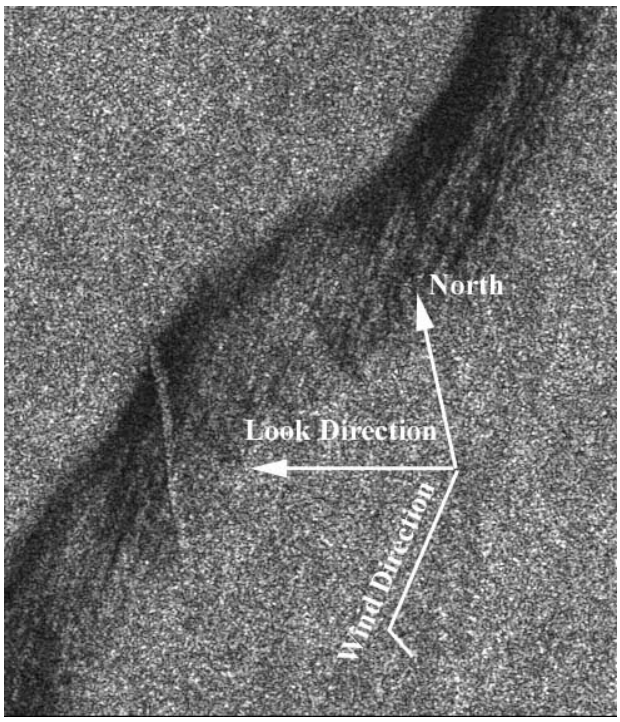
There are several dark features in a central part of the Peter the Great Bay (1, 2, and 4) and in the Ussuriyskiy Bay (3). The slicks were classified as illegal oil spills from the ships. A ship can be seen as a light point west of large oil spill (4). Ship wake appears as a dark narrow band behind the ship.

The dark patches east of the Muraviev-Amurskiy Peninsula, east of the Russkiy Island, southwest of the Gamov Peninsula **(A, B)** were likely due to weak winds although effect of surface films must not be ruled out. The thin dark lines **(C)** are an example of natural biogenic slicks resulting from enhanced biological activity.

A wind speed W was estimated by the using of CMOD4 model. W = 3 m/s over the area of the large oil spill (1). Wind direction was taken the same as orientation of dark stripes

within the oil band (1). Oil begins to spread as soon as it is spilled but it does not spread uniformly. Any shear in the surface current will cause stretching and even a slight wind will cause a thickening of the slick in the downwind direction. Windward side looks like dark stripes that stretch on wind direction. Estimated wind direction was about 220° over the area of the large oil spill. The sea surface temperature was 14-15°C over the whole image. It was estimated from NOAA AVHRR data.





The area of the largest oil spill (1) is $32.3 \times 10^6 m^2$; volume of the spilled oil is 6.5 m^3 provided that oil film thickness is 0.2 mkm. The areas of others oil spills were less than that of the first one but they are well-defined on radar image.

Method of interactive adaptive slicing of the clusters is used for the determination of the oil spill area. This method consists of two stages. The first stage based on expert analysis of a radar image to identify and distinguish oil pollution on the ocean surface by the using of visual estimating of shape, geographical location, etc. taking into account instrument characteristics, sensing geometry as well as the climatic and regional features. The major challenge is to separate the oil slicks from the look alikes. If this object is an oil spill then the second stage of the method will be used.

The second stage implies that a threshold range for the selection of the oil spill is defined by the local histogram analyzing. An accuracy of this method is about 1-3% from the oil space.

I. Raw-database record format:

Platform	Sensor	Orbit	Track	Frame	Product Type	Start Date	Start Time

NW Lat	NW Lon	NE Lat	NE Lon	SE Lat	SE Lon	SW Lat	SW Lon

Pixel Spacing	Data Lines	Pixels per Line	Bits per Pixel	Geography	Features	Ancillary Data	File name	Partici-pant

Data format - ASCII.
Record length – not fixed.
Fields length free,
Fields separate with <;>.

Fields definition:

1. Platform – ERS1, ERS2…
2. Sensor - SAR.
6. Product type – PRI, tif, gif …
7. Start date format – DD.MM.YYYY.
8. Start time format – HH:MM:SS
9-16. Corners coordinates:

Define corners from NW clockwise.
NW – northwestern corner, NE – northeastern corner,
SE – southeastern corner, SW – southwestern corner.
Latitude format: SDD.TTT
S – sign *'-' for South Latitude*;
DD - degrees;
TTT - thousand parts of degree
Longitude format: SDDD.TTT
S – sign *'-' for West Longitude*;
DDD - degrees;

TTT - thousand parts of degree

17. Pixel Spacing:
for SAR PRI - 12.5A, 12.5R (A – azimuth, R – range).

22. Features:
- OS – oil spill.
- NF – natural films,
- SC - sea currents,
- IW - sea internal waves,
- SF - sea front,
- AE - sea anticyclonic eddy,
- CE - sea cyclonic eddy,
- BT - bottom topography,
- AC – atmospheric cells,
- AR – atmospheric rolls,
- AF - atmospheric front,
- RC - rain cells,
- AW – atmospheric waves,

23. Ancillary Data:

- CTD - in situ T,S data,
- ADCP- in situ current data,
- WM - weather map,
- BM - bathymetry map,
- SST - sea surface temperature,
- AT - air temperature,
- WSD - wind speed and direction,
- AS - aerological sounding,

24. File name format:
SSOOOOOFFFF
SS- platform (E1, E2, …)
OOOOO – orbit,
FFFF – frame
Example:
E1001020060 -> according to satellite ERS-1, orbit 102, frame 60.

25. Participant:
Number of Participant (1 - Russia, 2 - Japan and etc.)

Record Example:

ERS1; SAR; 702; 3; 2745; 04.09.1991; 1:58:48; 42.739; 132.056; 43.281; 131.602; 43.098;132.776; 42.376; 131.344; 42.194; 132.5; 192.746; 12.5A, 12.5R; 8225; 7805; 16; Northwestern Japan Sea; AC, AE; CTD, WM, BM; E1001020060

II. Images preview.

Image preview format – pixel spacing 200 x 200 km. Standard baseline JPEG compression with quality 6.

III. Software for calibration, derivation of σ_0, and subimage processing.

The ERS SAR Toolbox (http://earth.esa.int/STBX/).