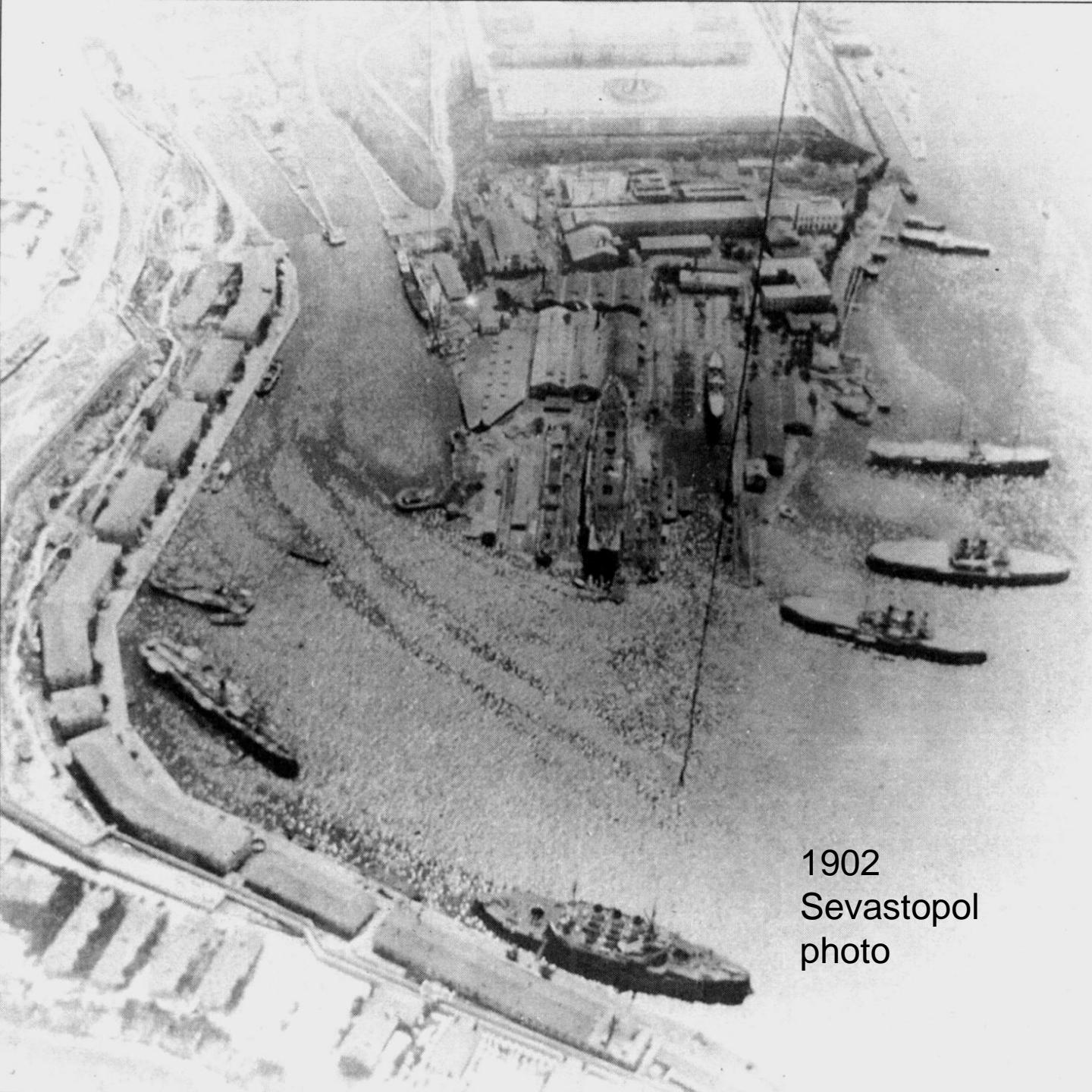
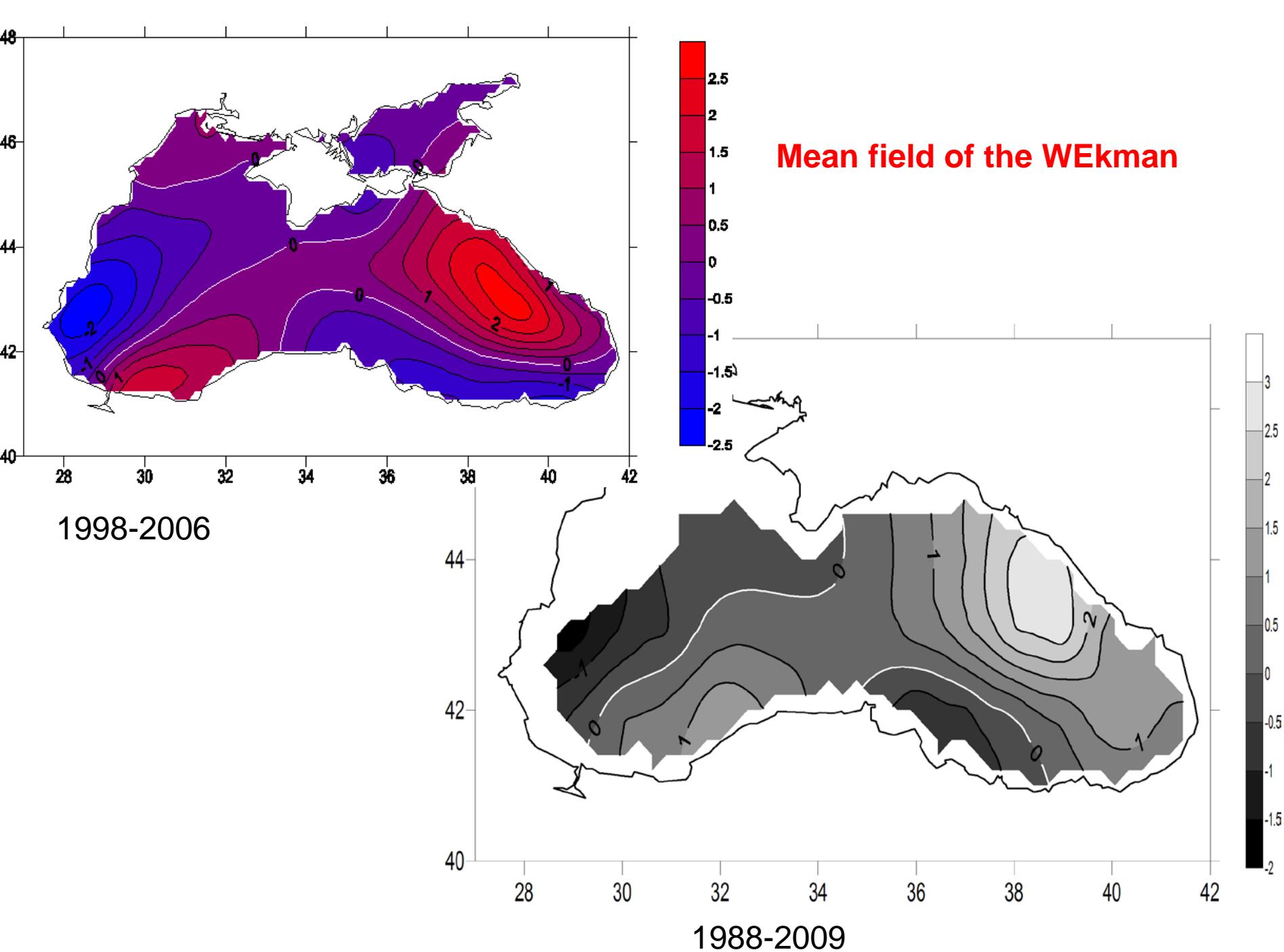


Multichannel, multiplatform approach for marine environment study

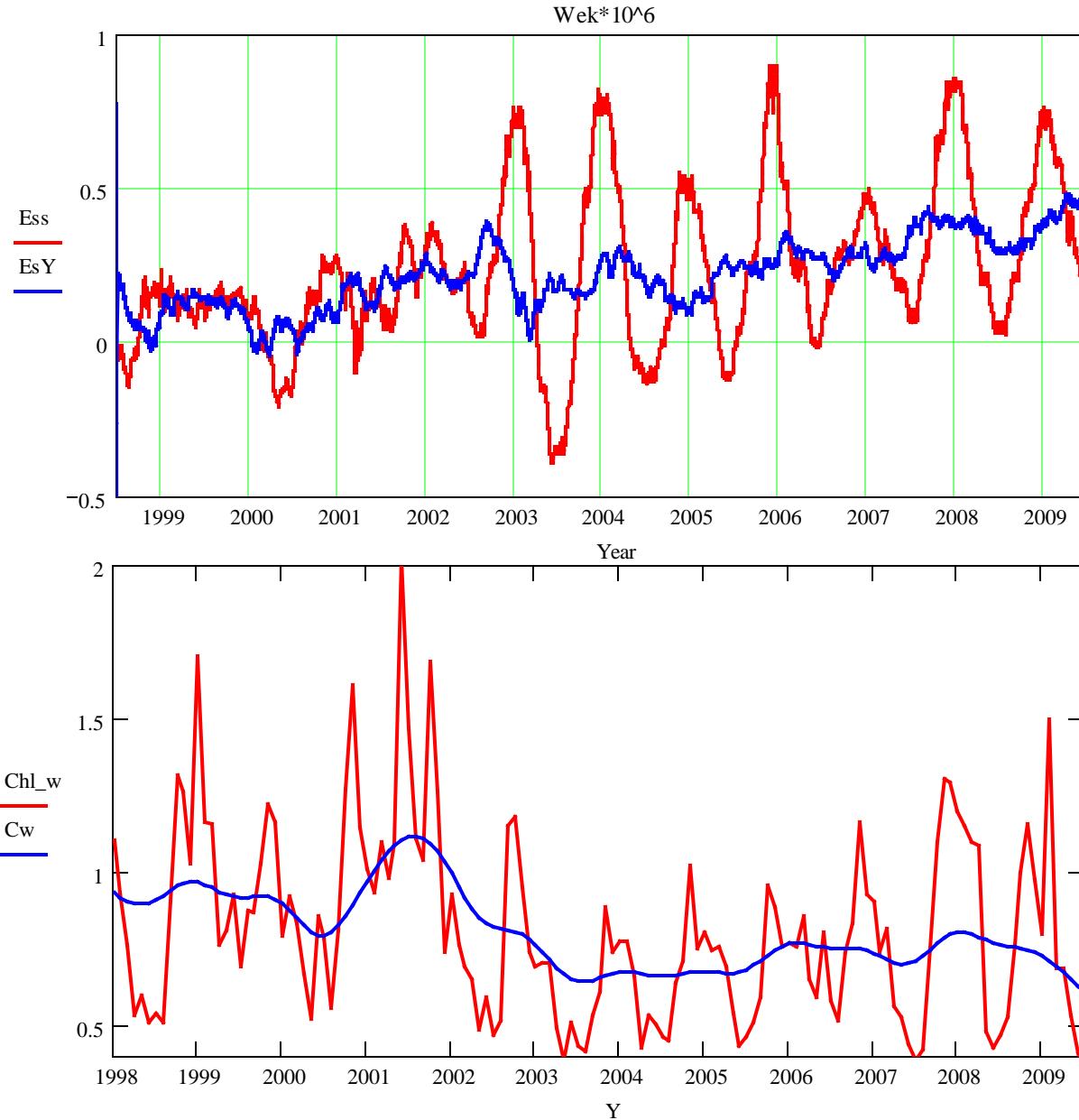
STANICHNY SERGEY
MHI, SEVASTOPOL

Oil spill detection by
remote sensing,
probably the first
Image with oil pollution
manifestation in optics

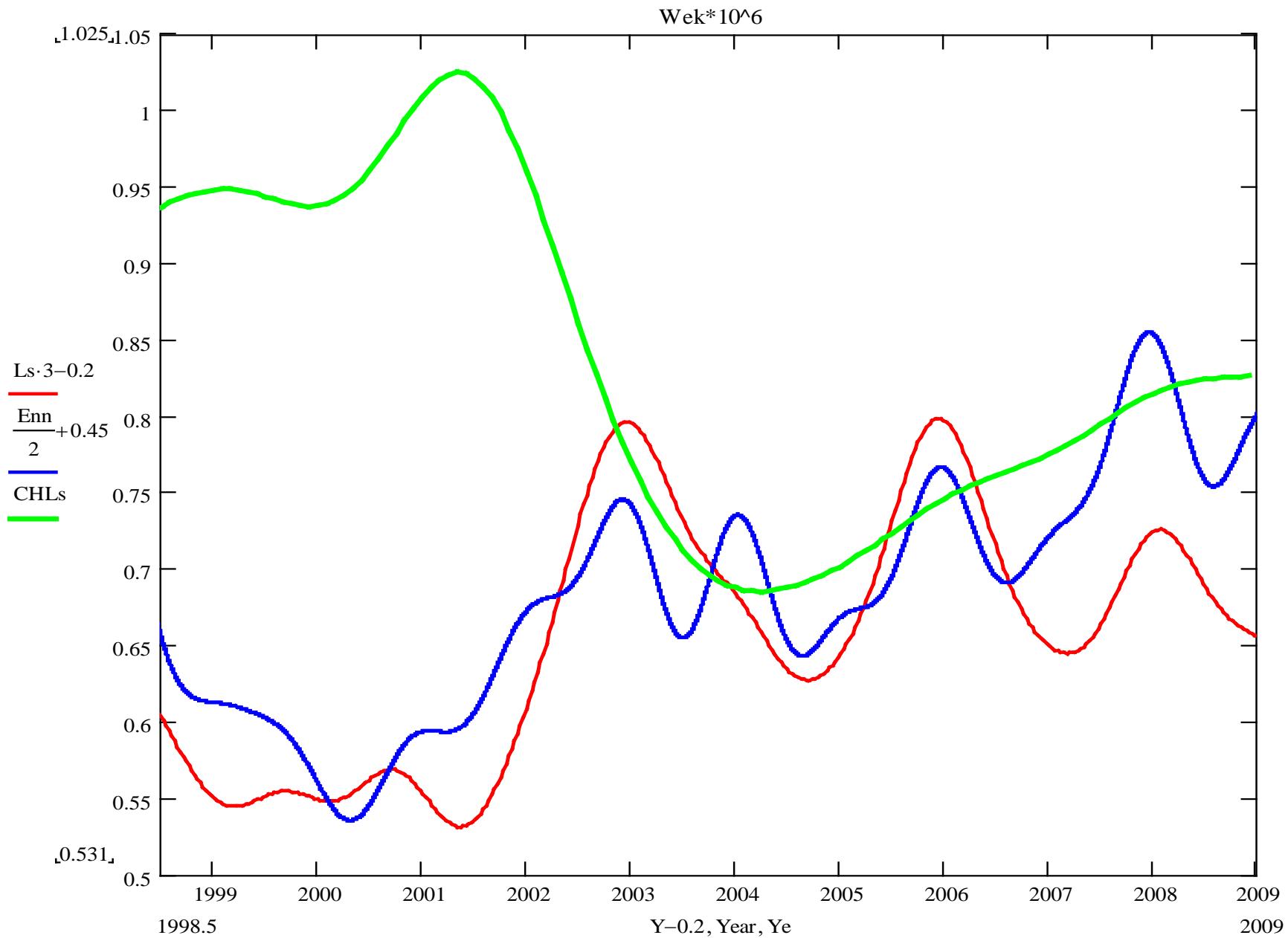




Wind stress curl NCEP and SeaWiFS chl_a concentration

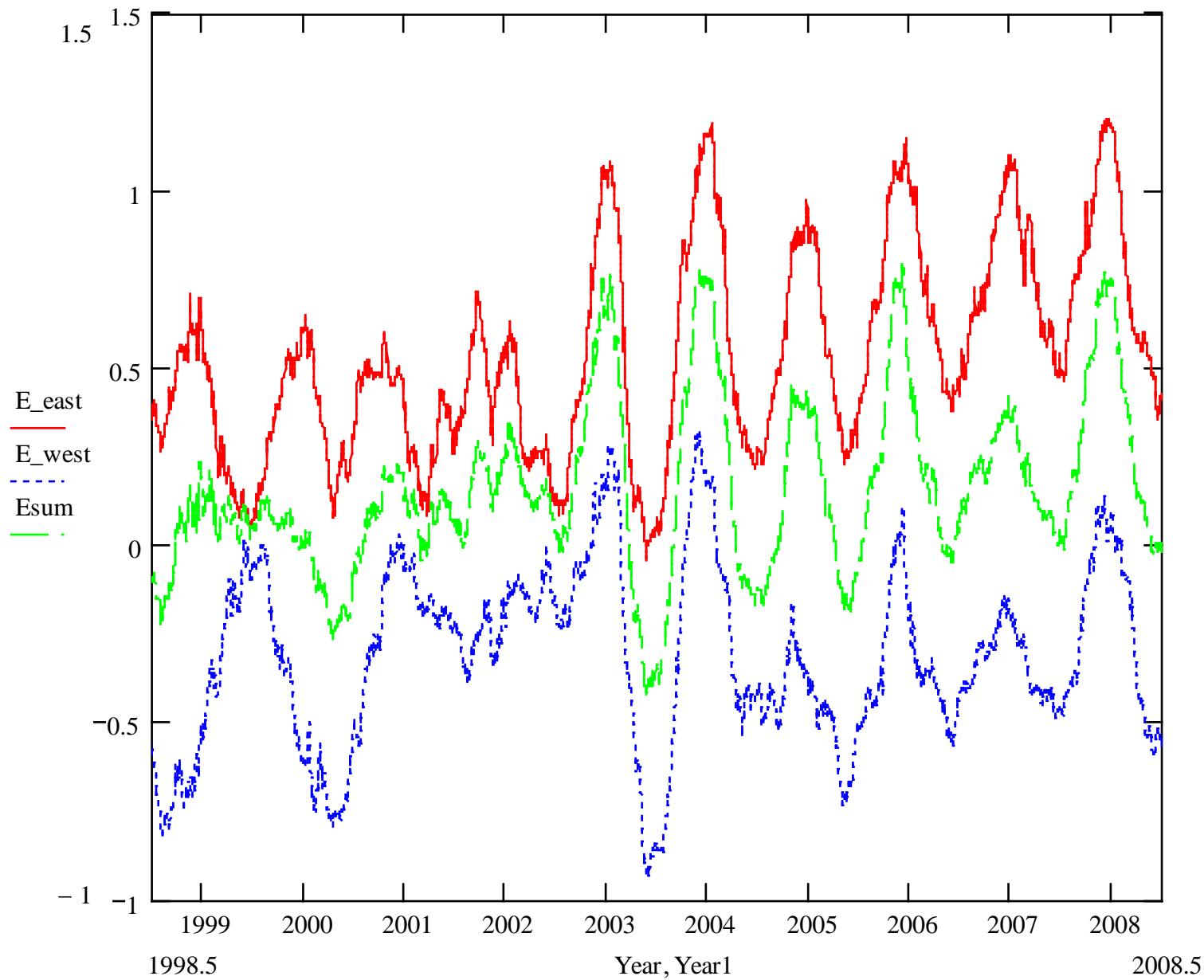


Altimetry derived kinetic energy E_V, Tau, Wekm

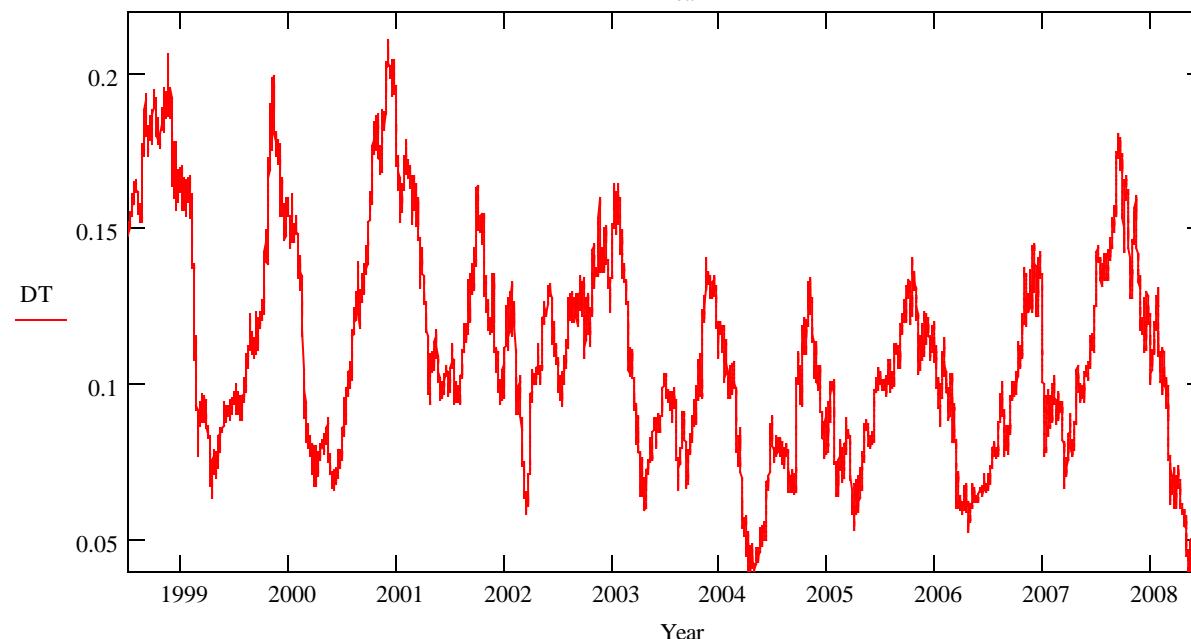
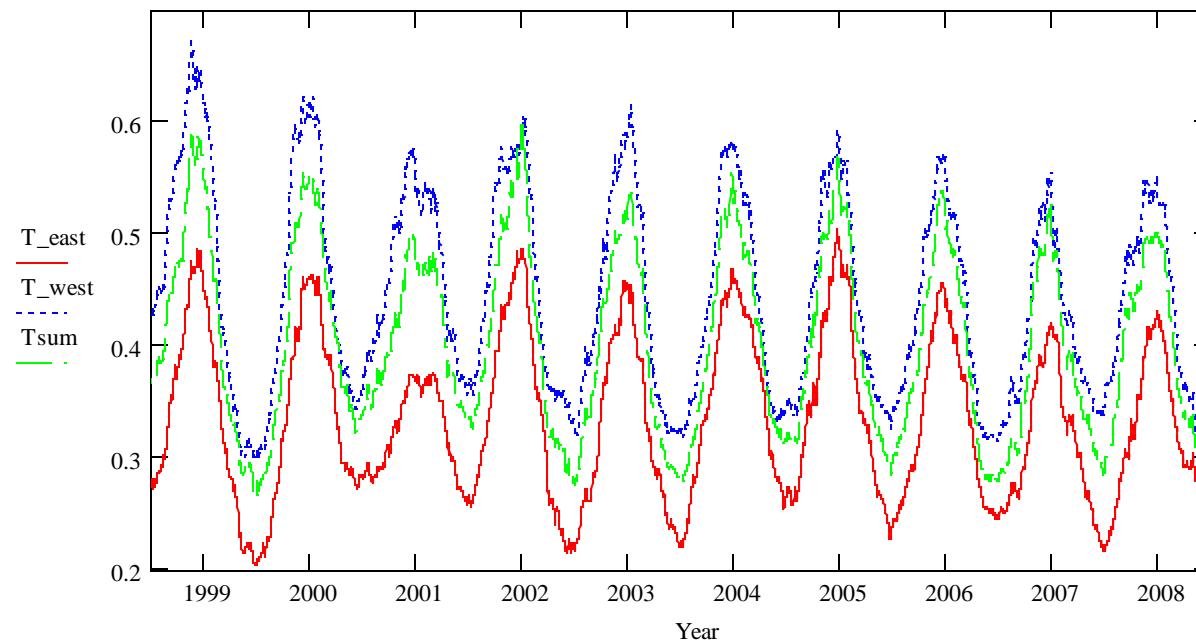


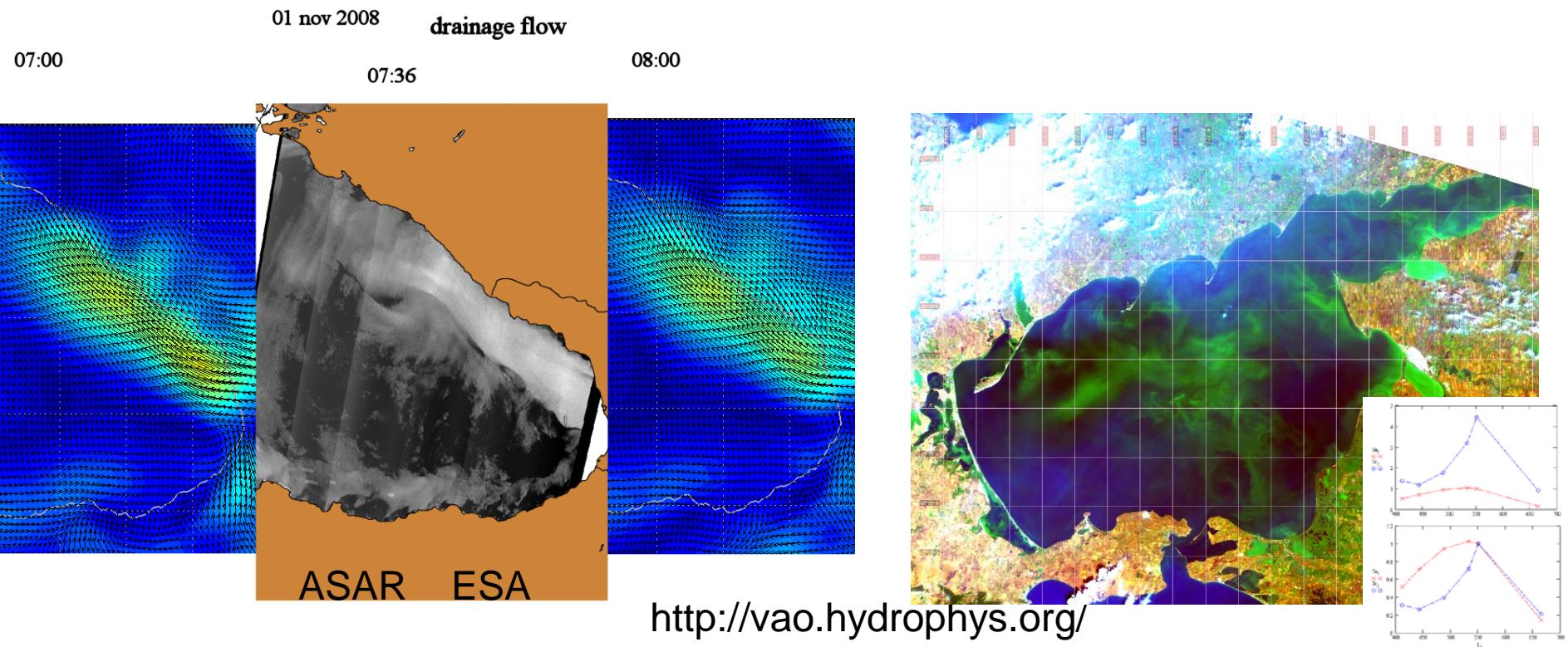
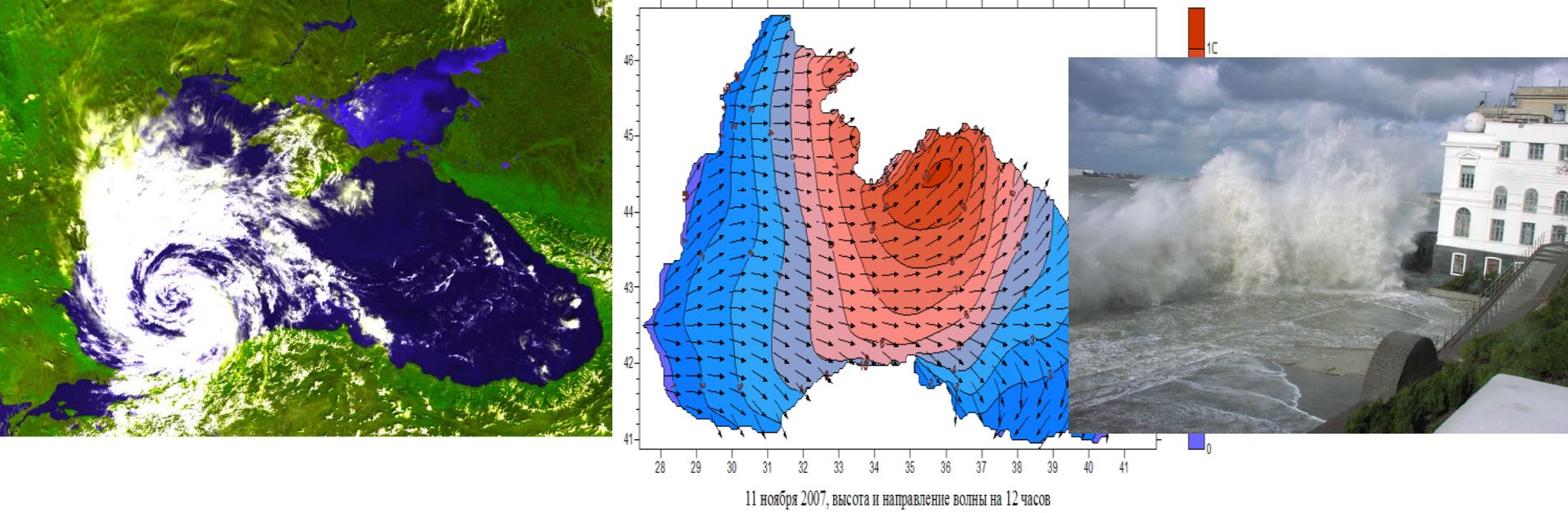
EAST – WEST parts 34E, Wekm

$E_{east} > E_{west}$

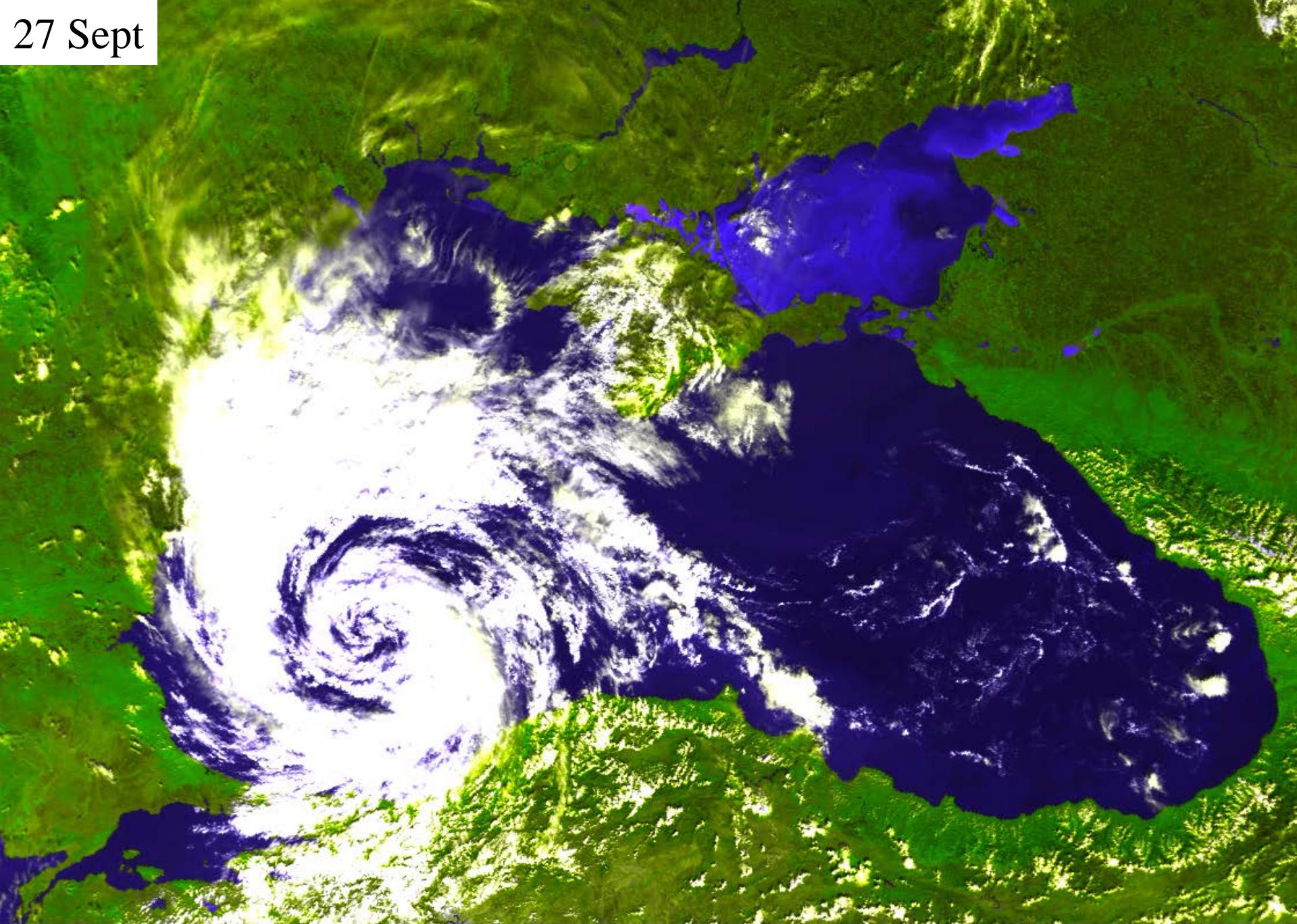


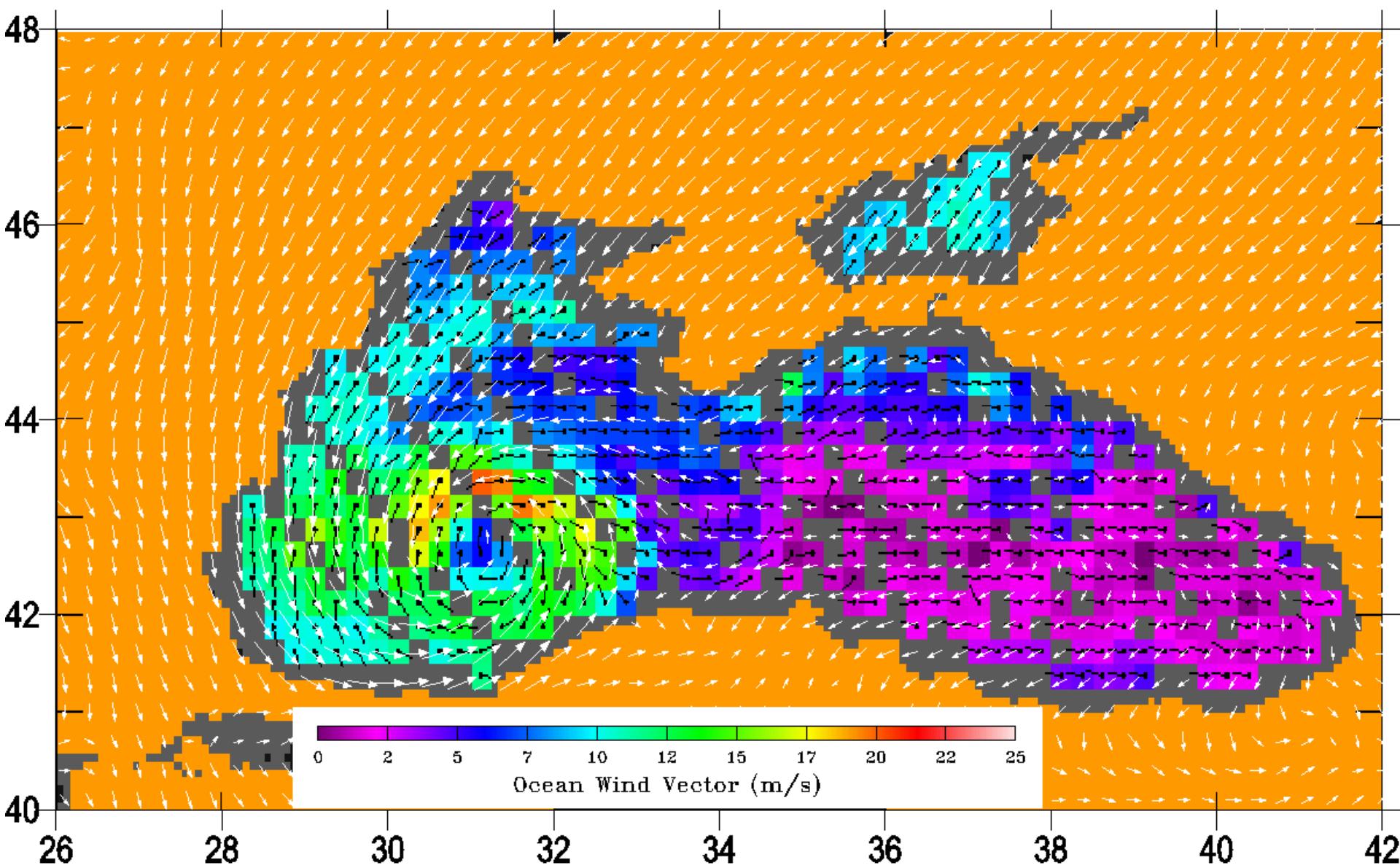
WIND STRESS - decreasing

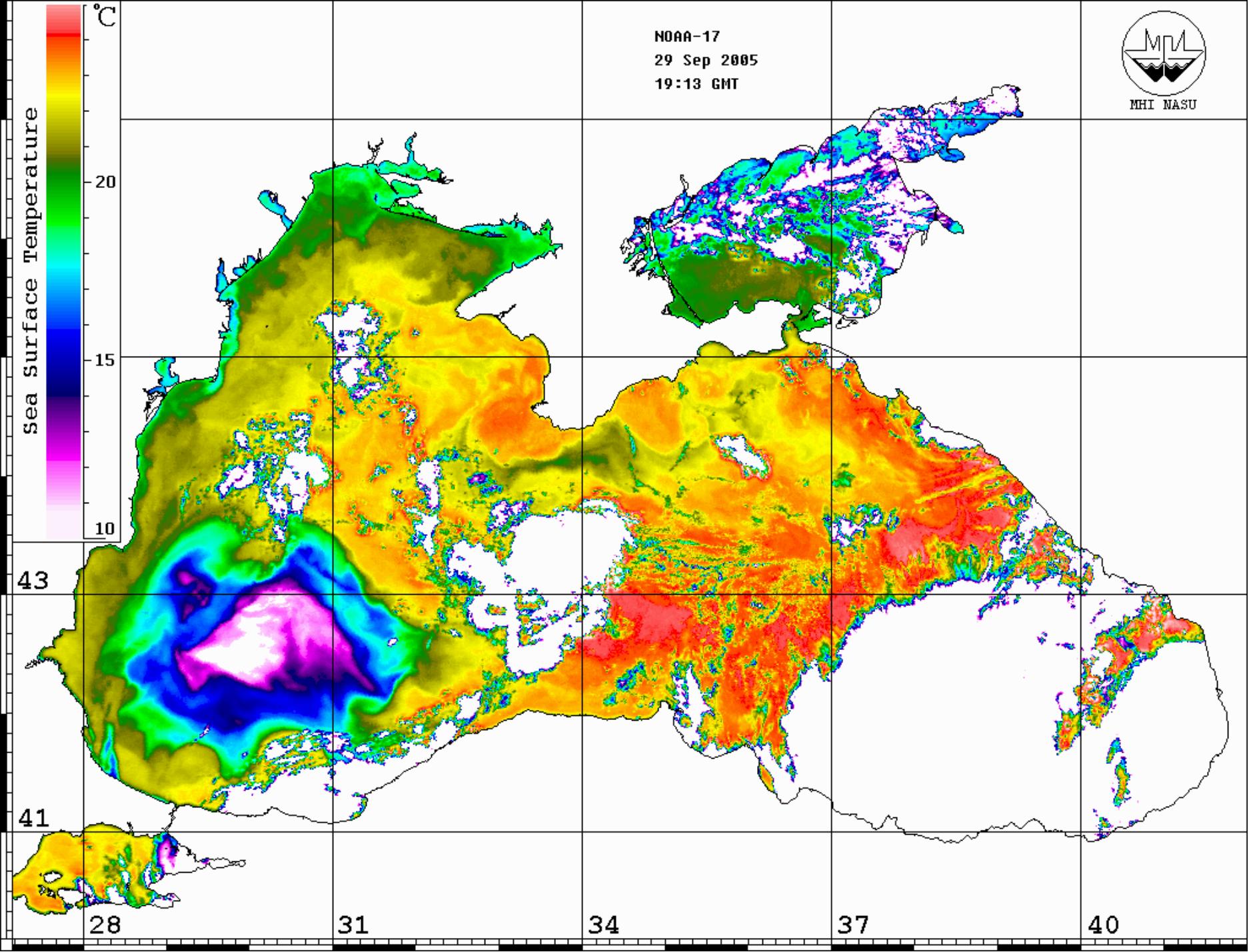
Tau_{east}<Tau_{west}

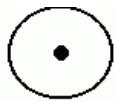


27 Sept





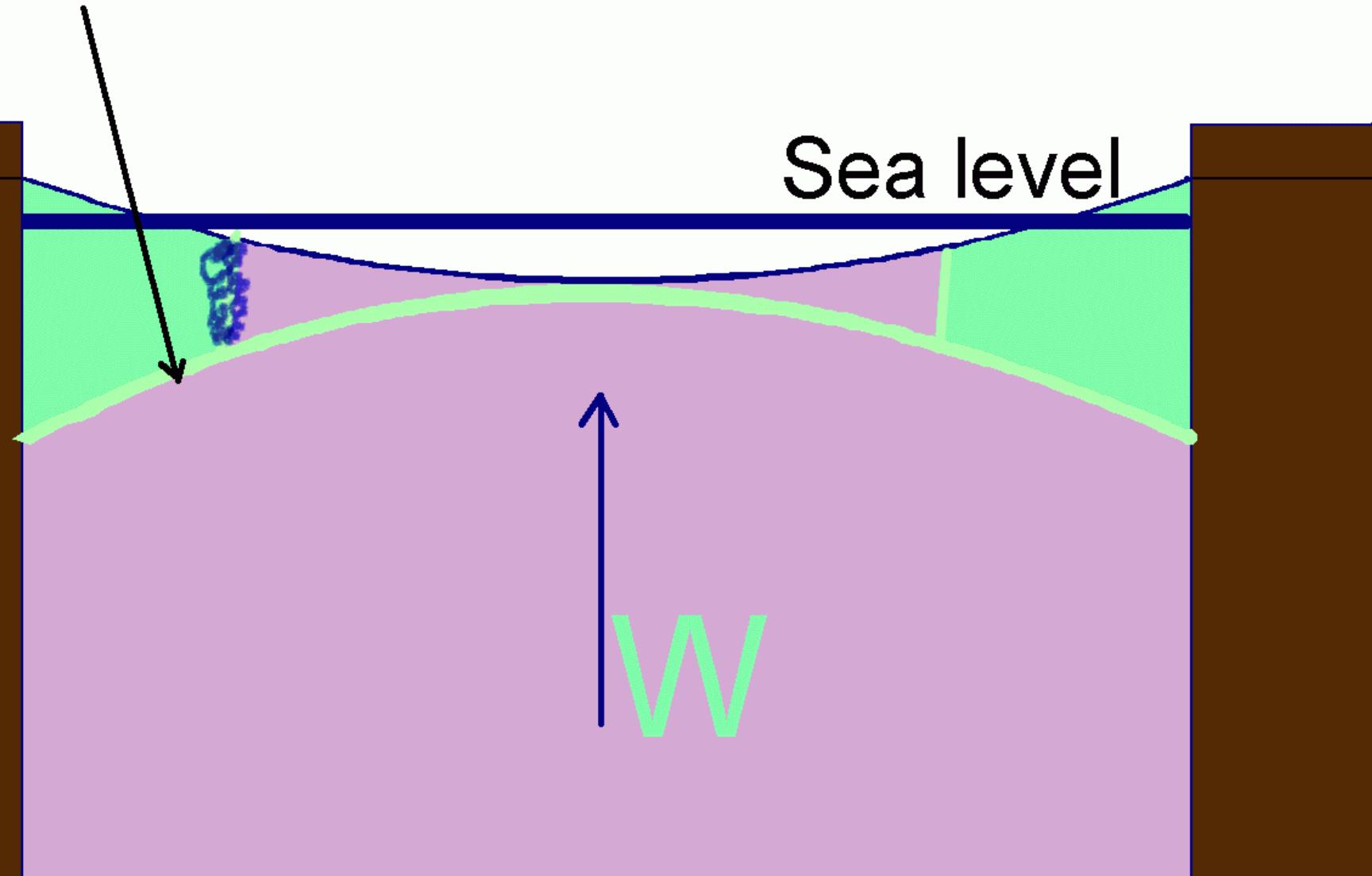


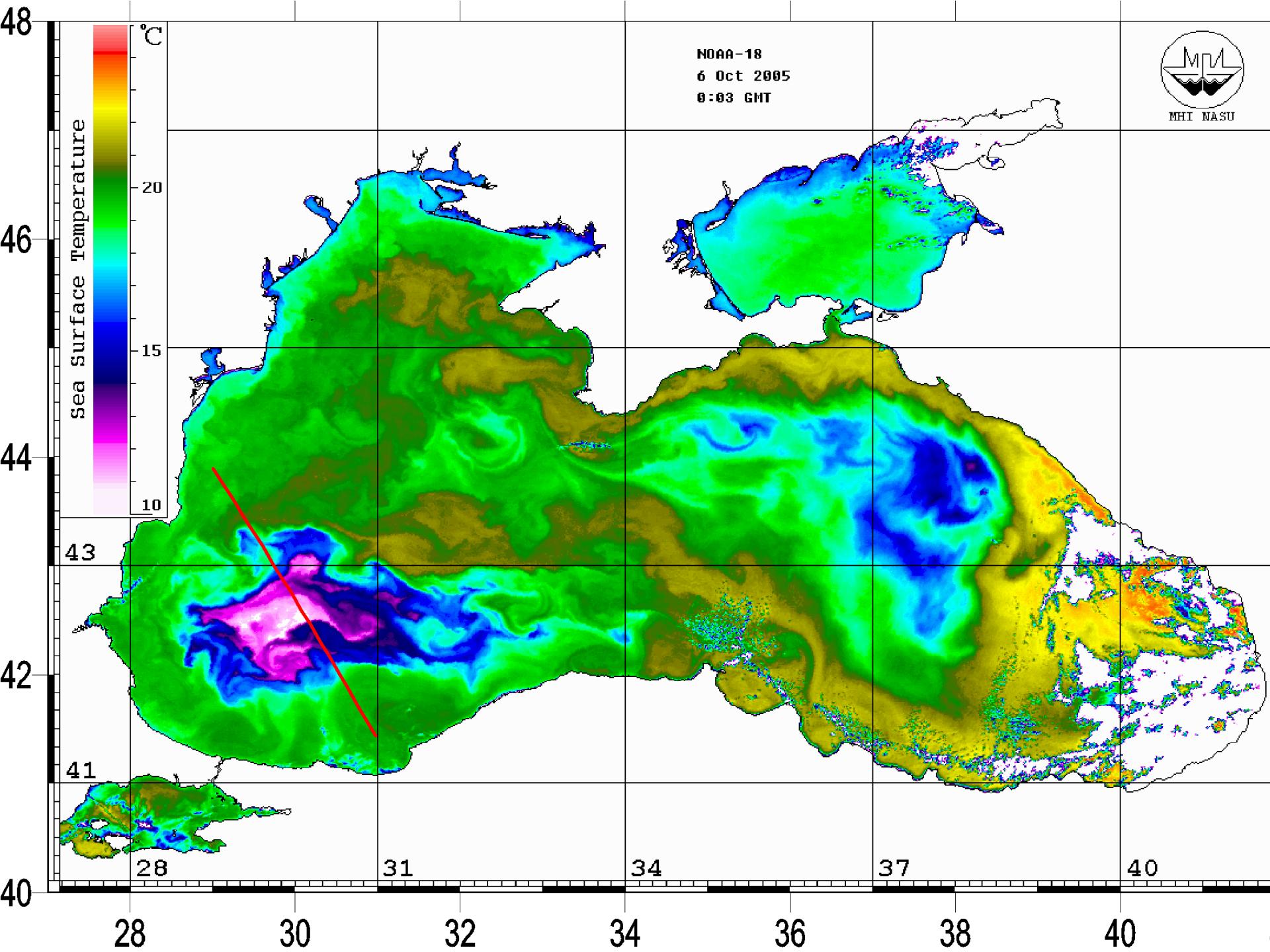


ветер



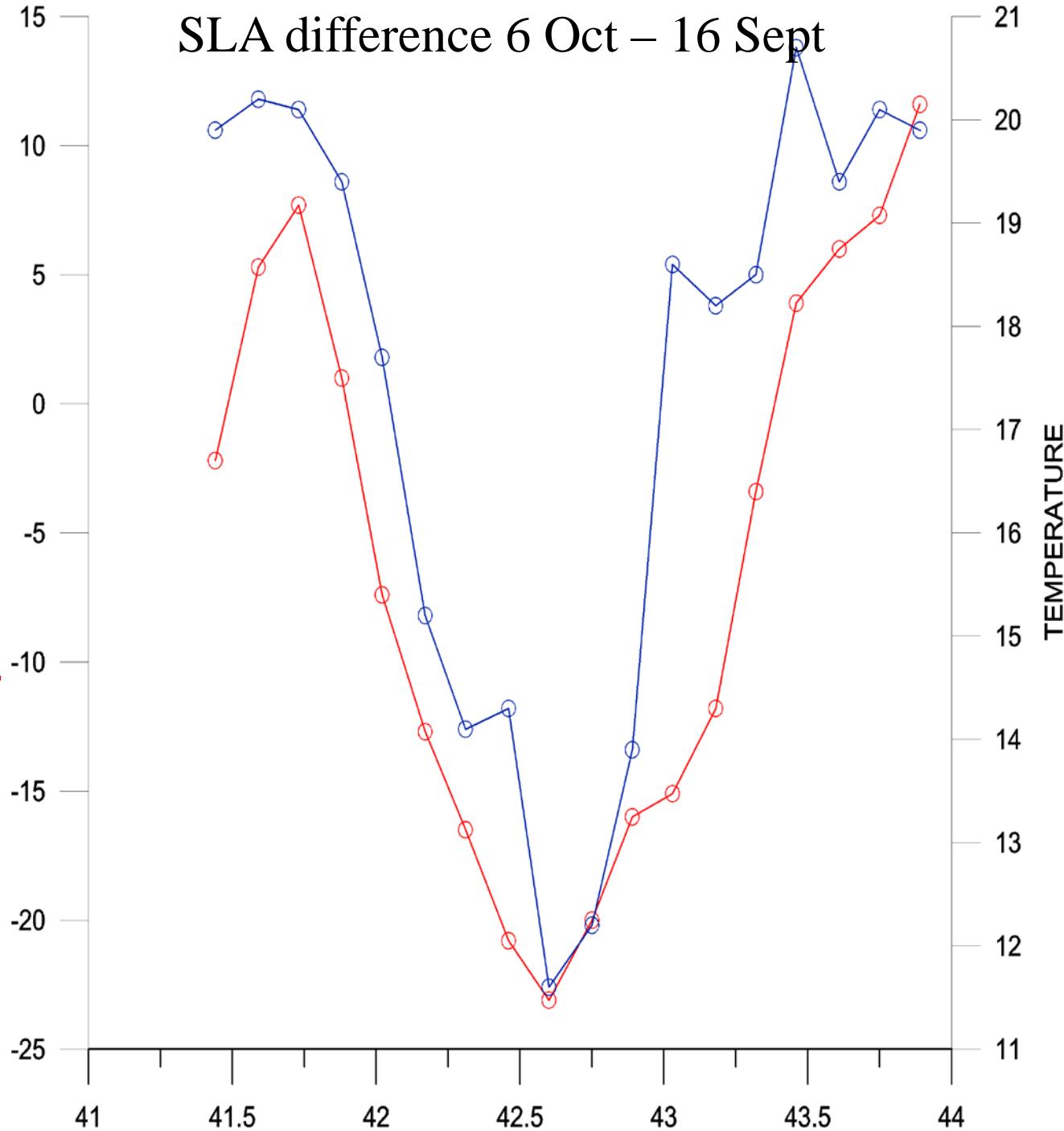
ПИКНОКЛИН

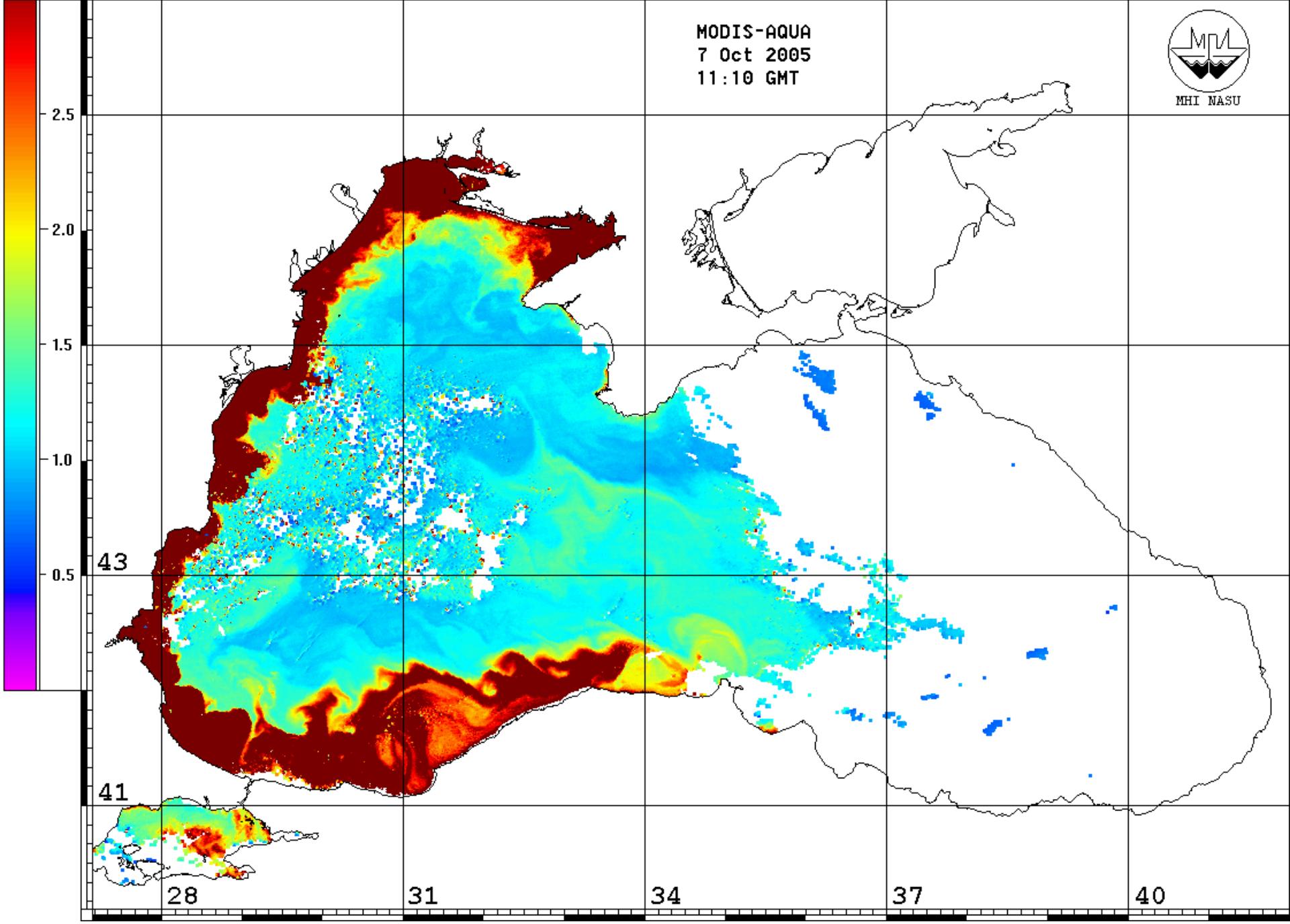




SLA difference 6 Oct – 16 Sept

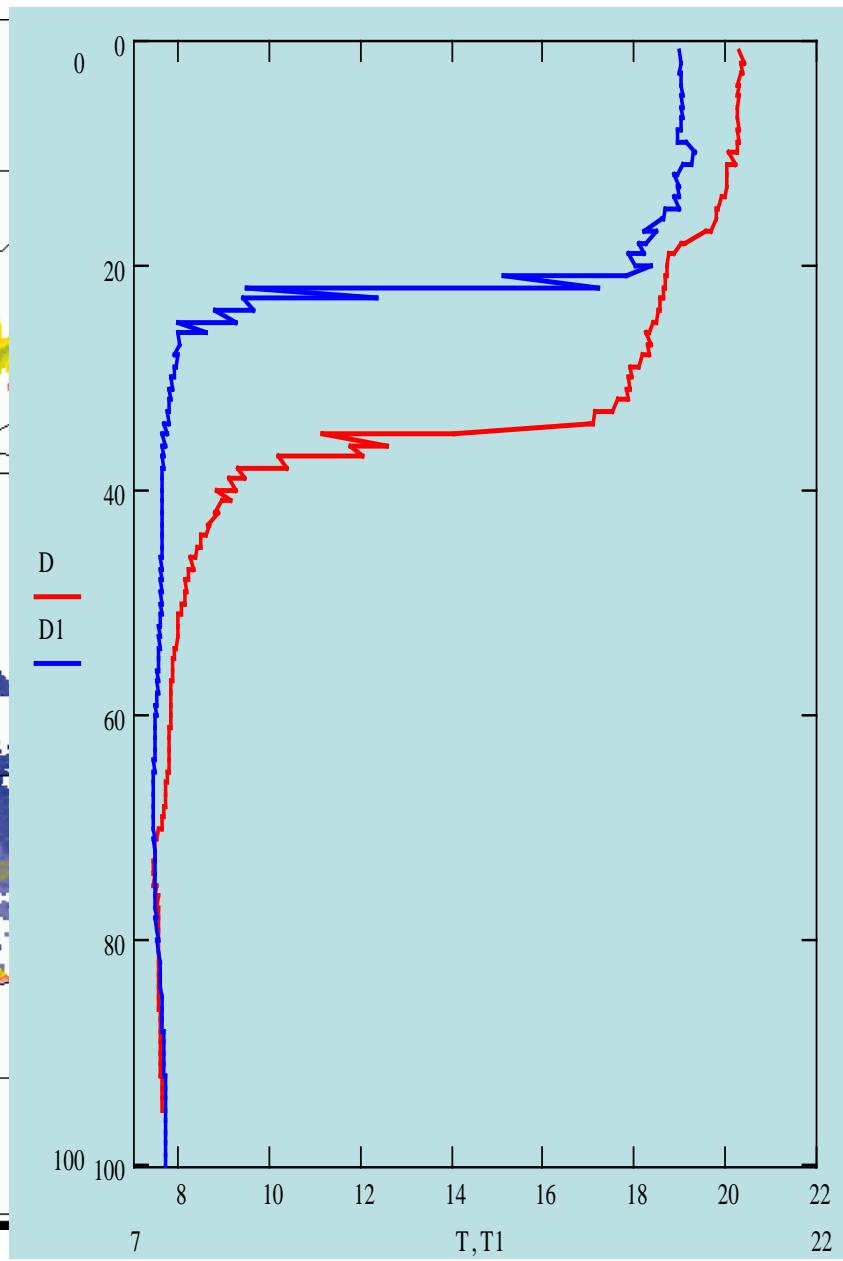
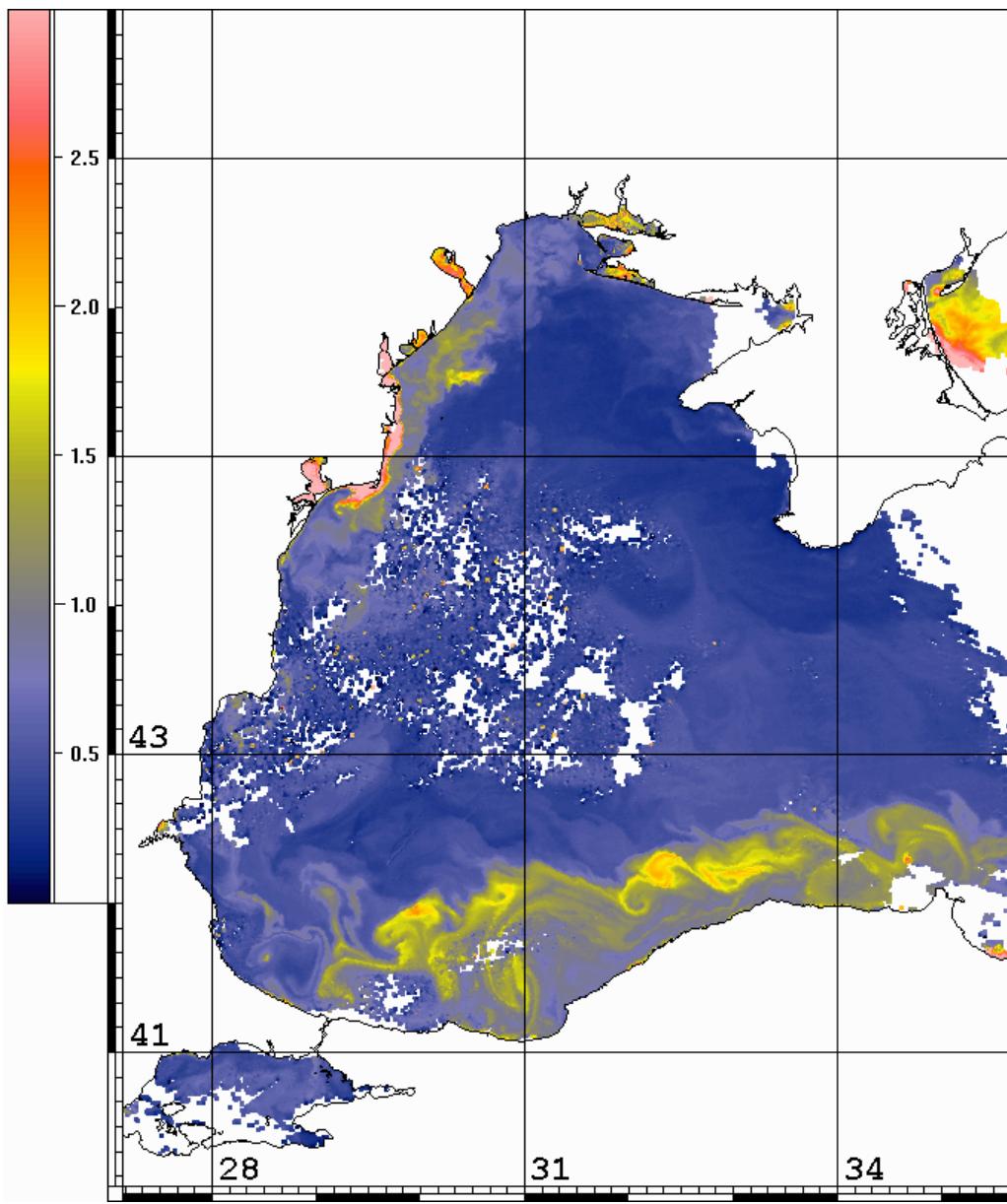
**Sea level
Difference,
cm**

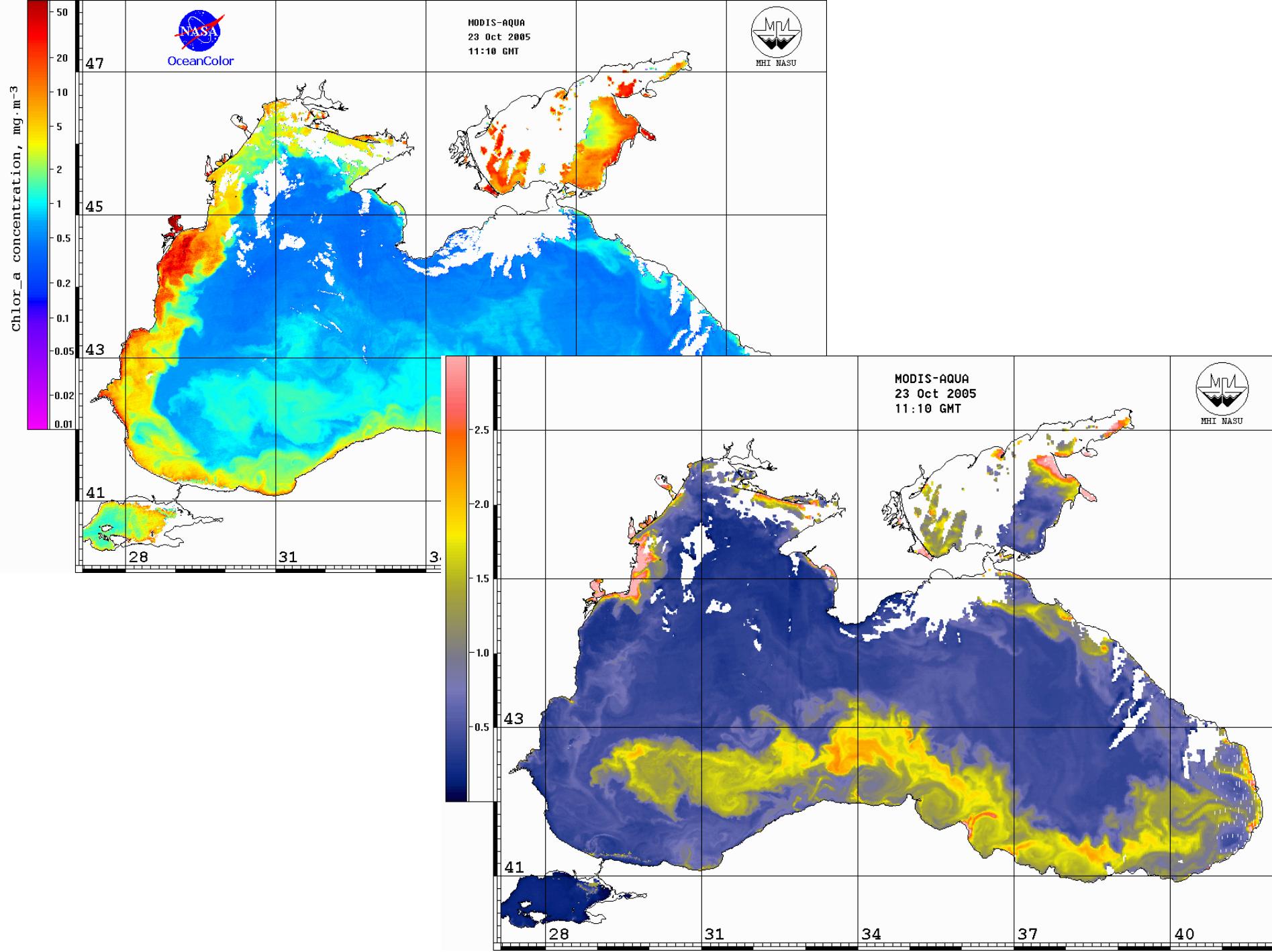




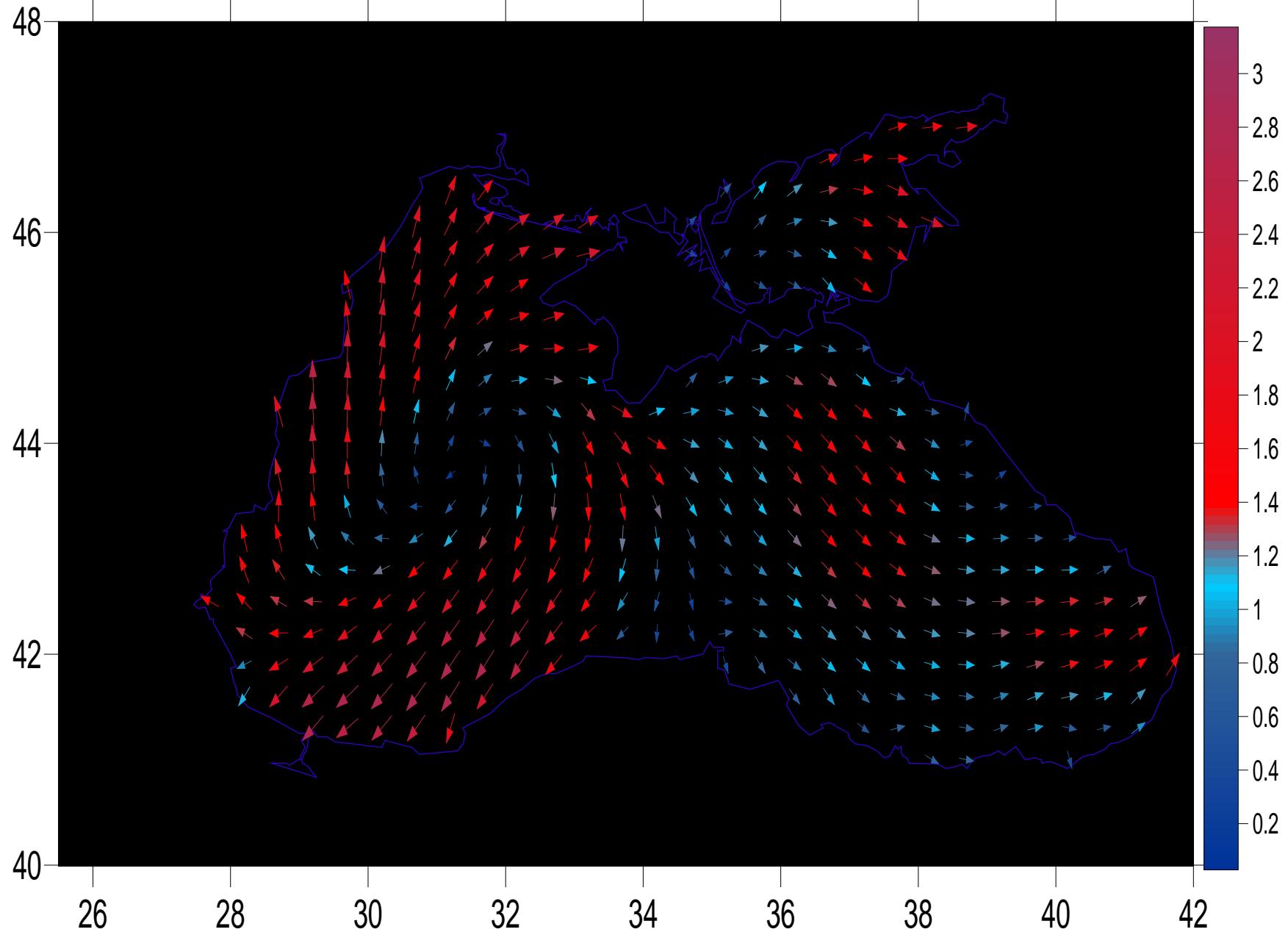
MODIS-AQUA
7 Oct 2005
11:10 GMT

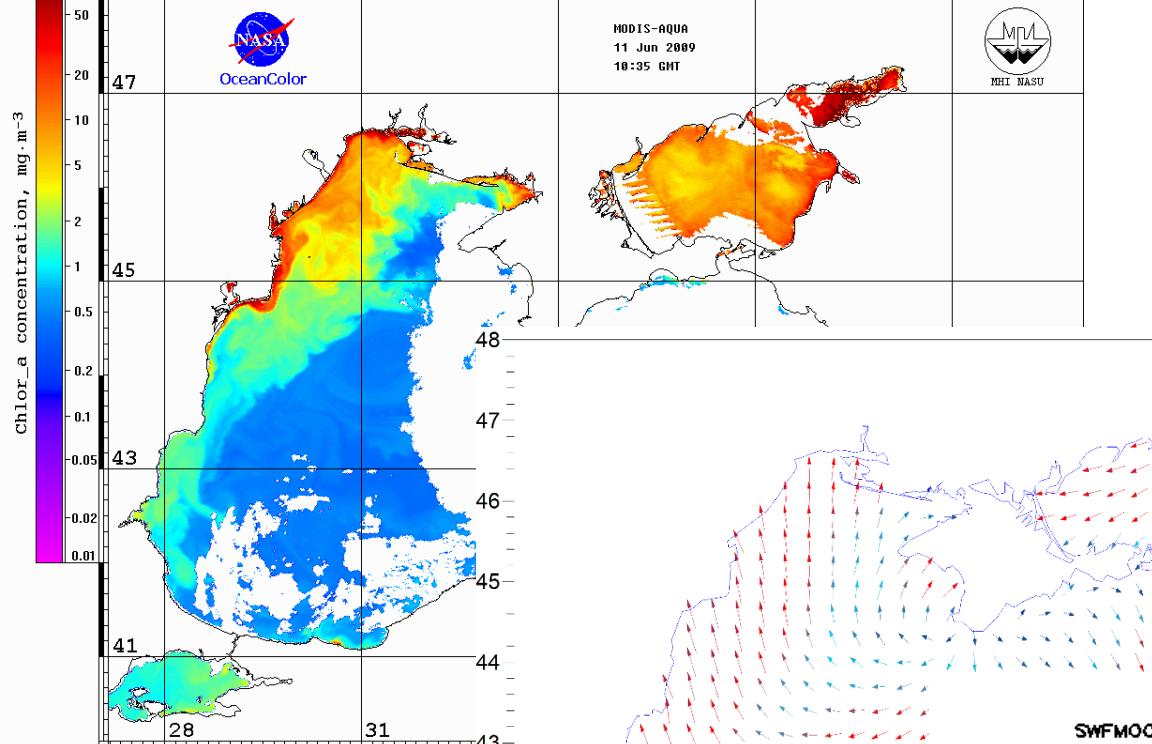




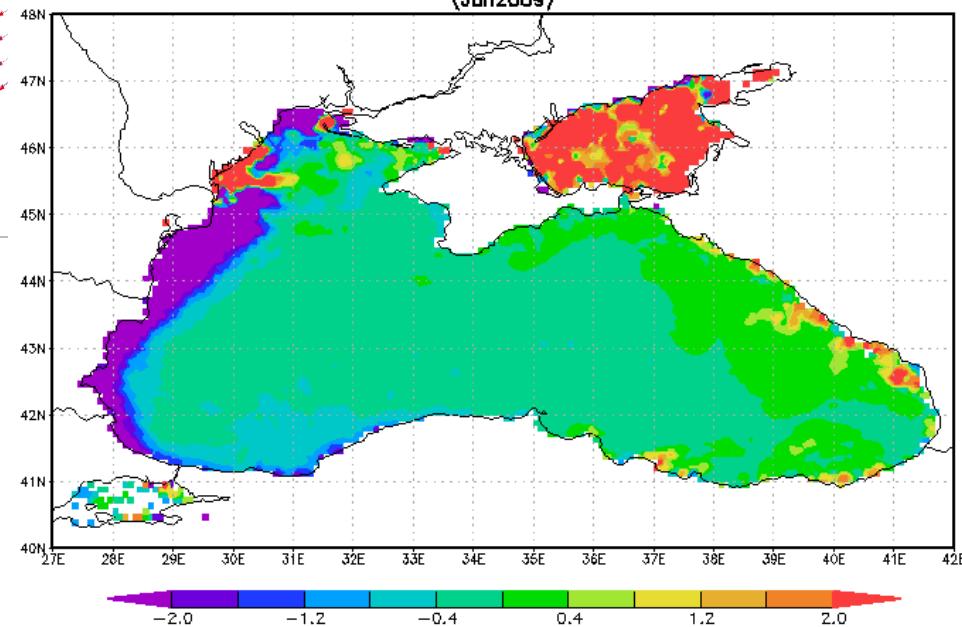
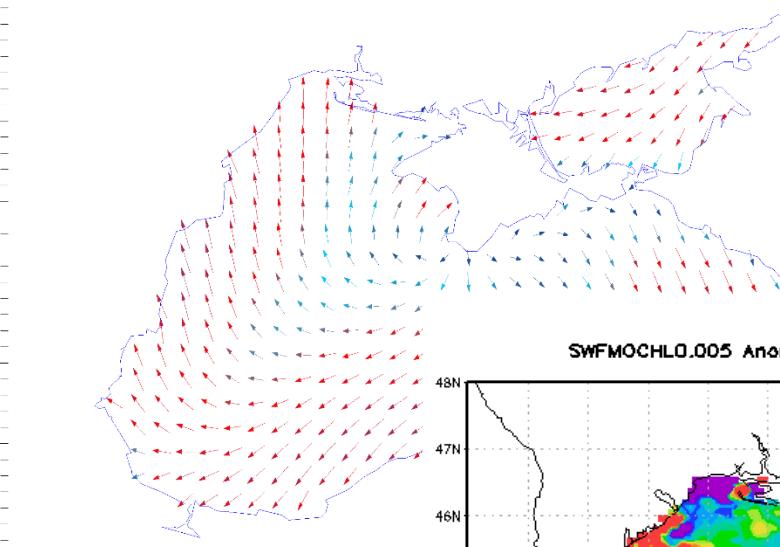


SKIRON





Июнь 2009,

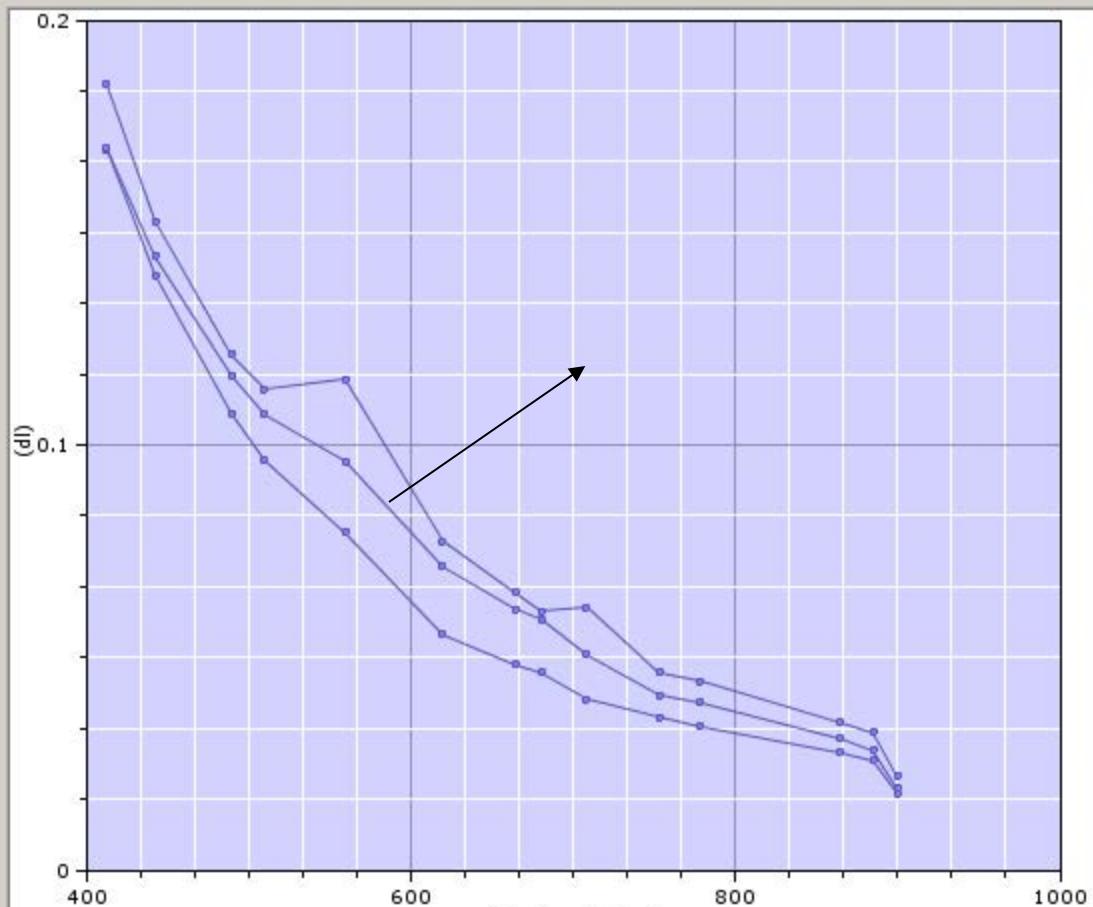


25 июля 2009 Цветение сине-зеленых водорослей





Spectrum View



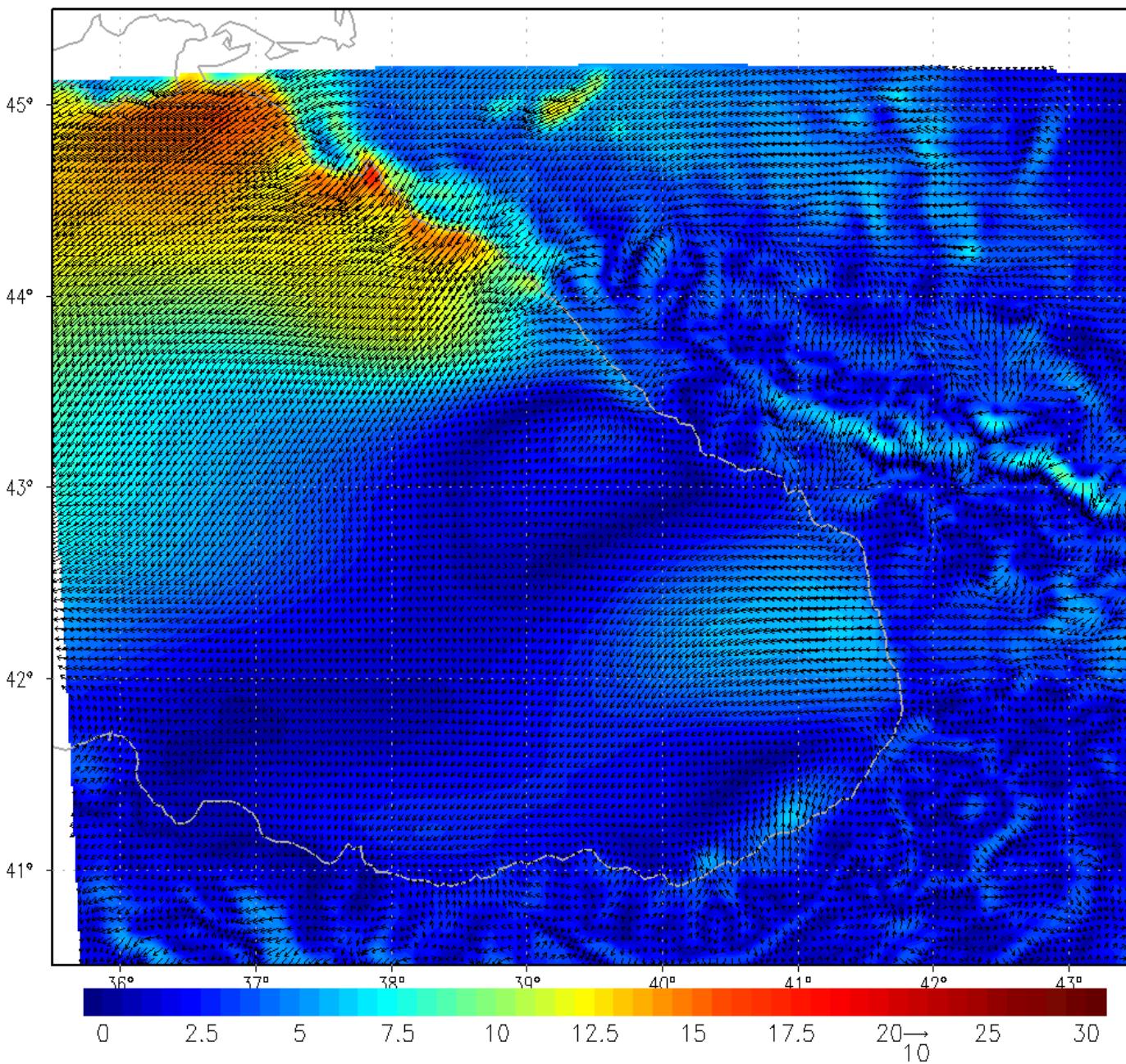
Pin 1

Pin 2

Pin 3



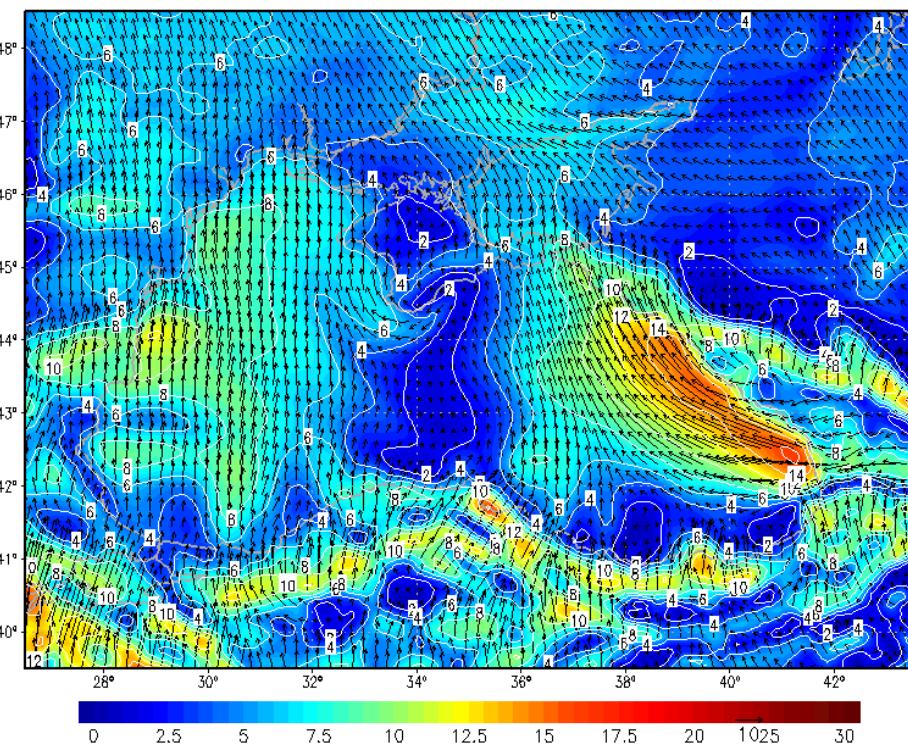
01Z09NOV2008



00Z10JAN2010

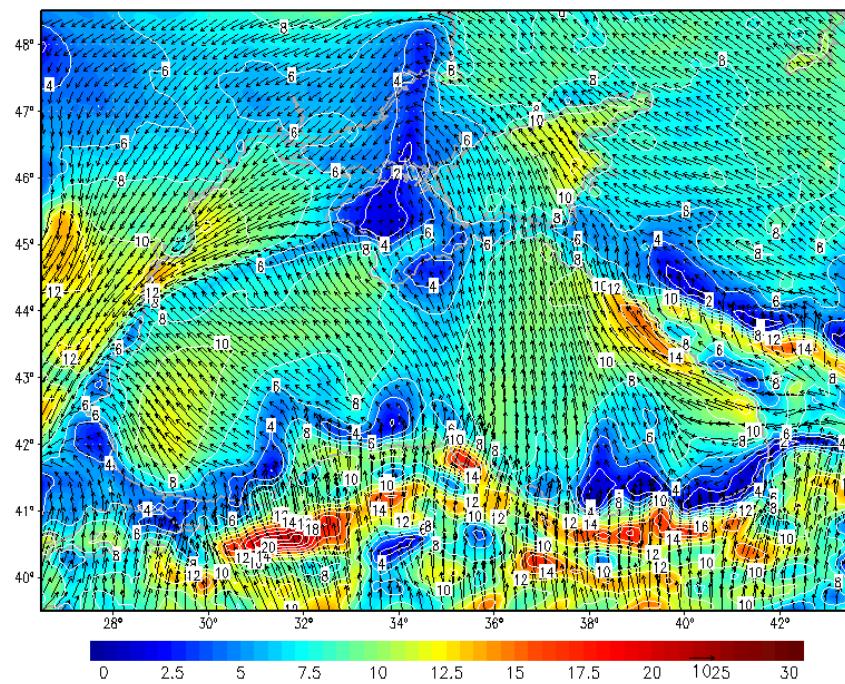
10m wind, m/s

vao.hydrophys.org

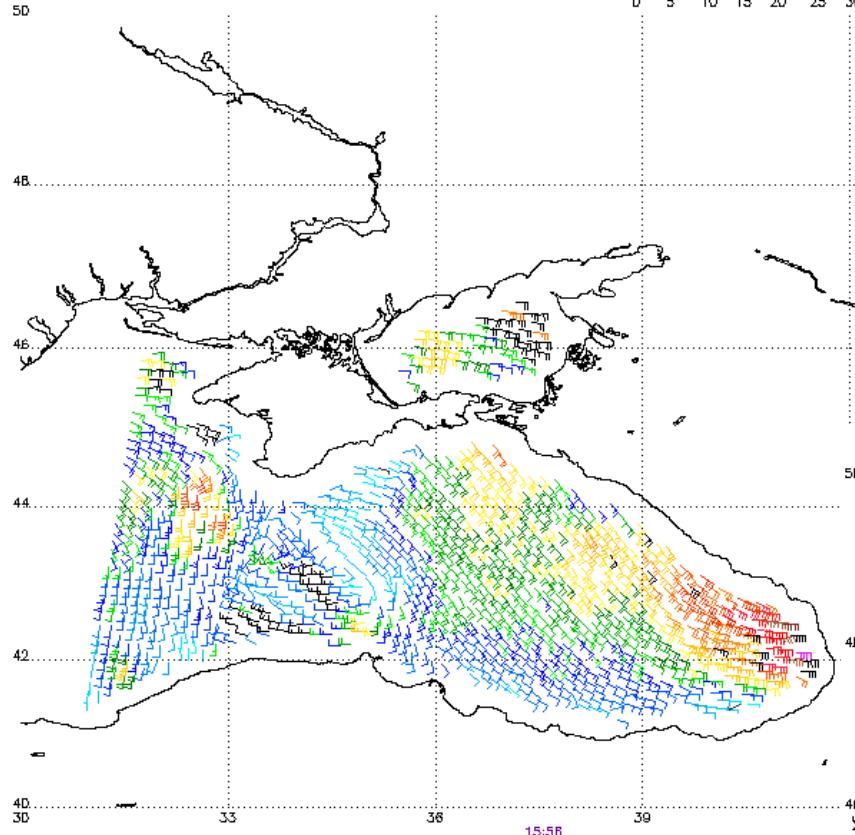
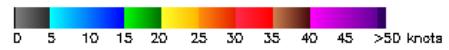


06Z08FEB2010

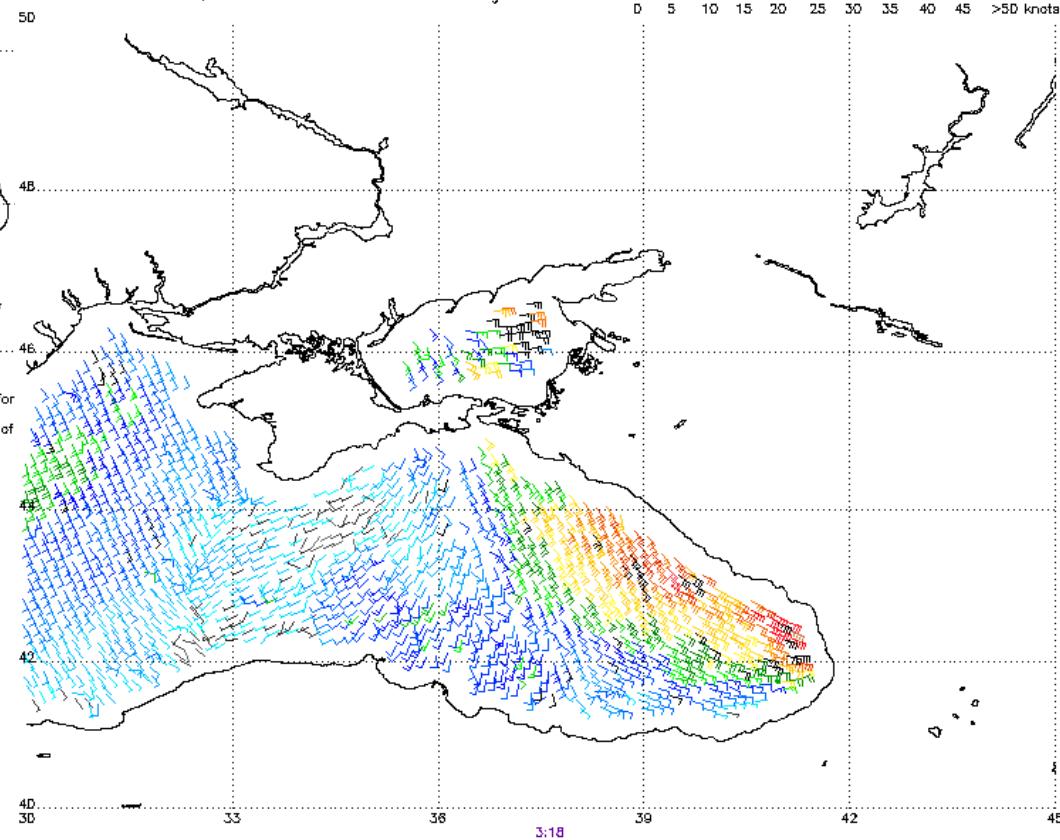
10m wind, m/s



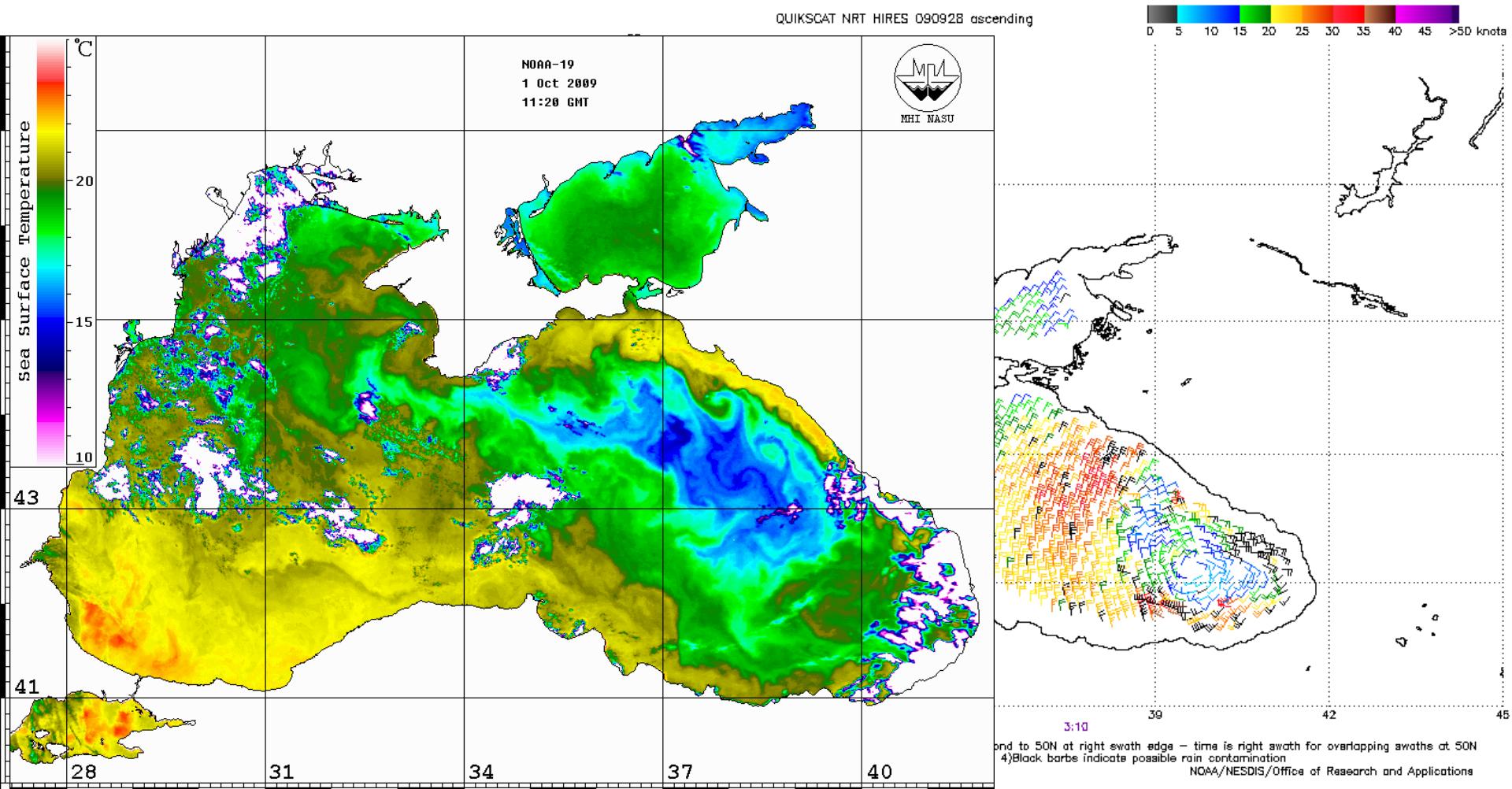
QUIKSCAT NRT HIRES 090123 descending



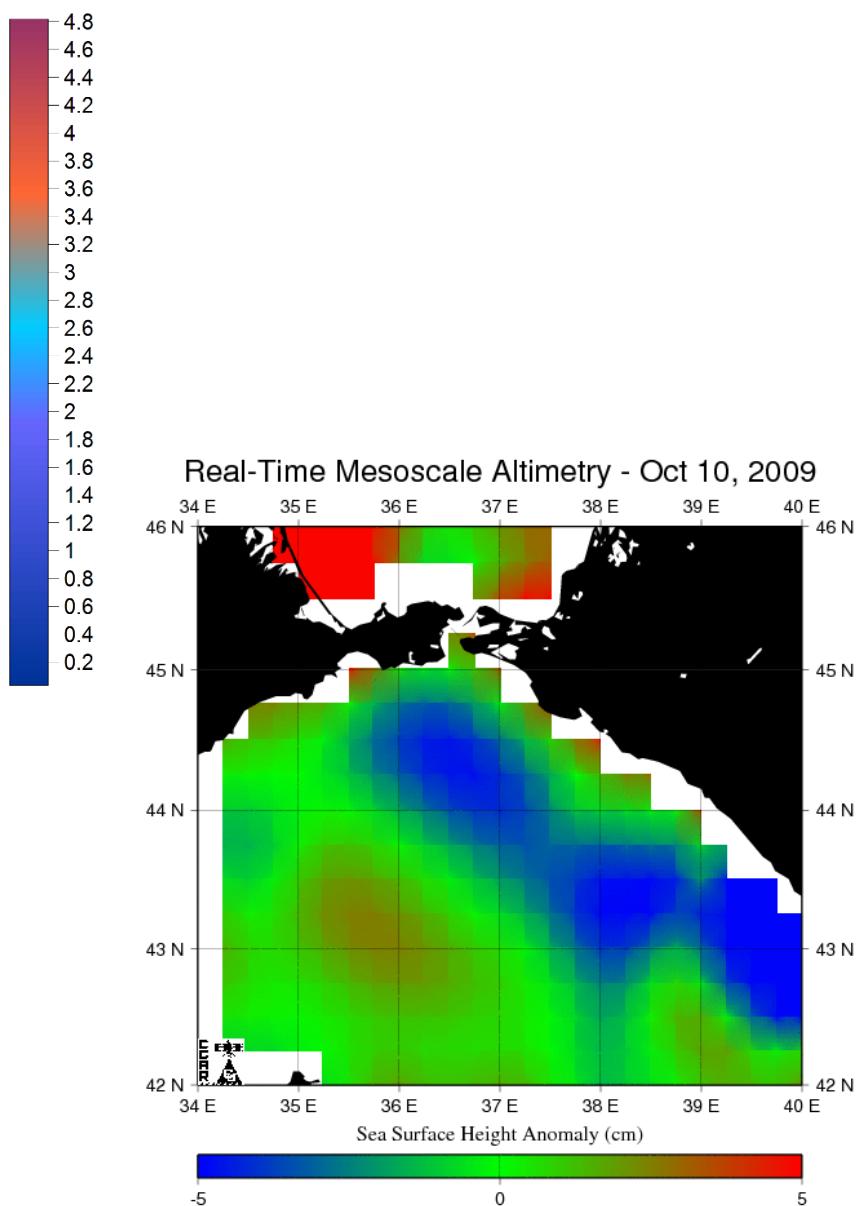
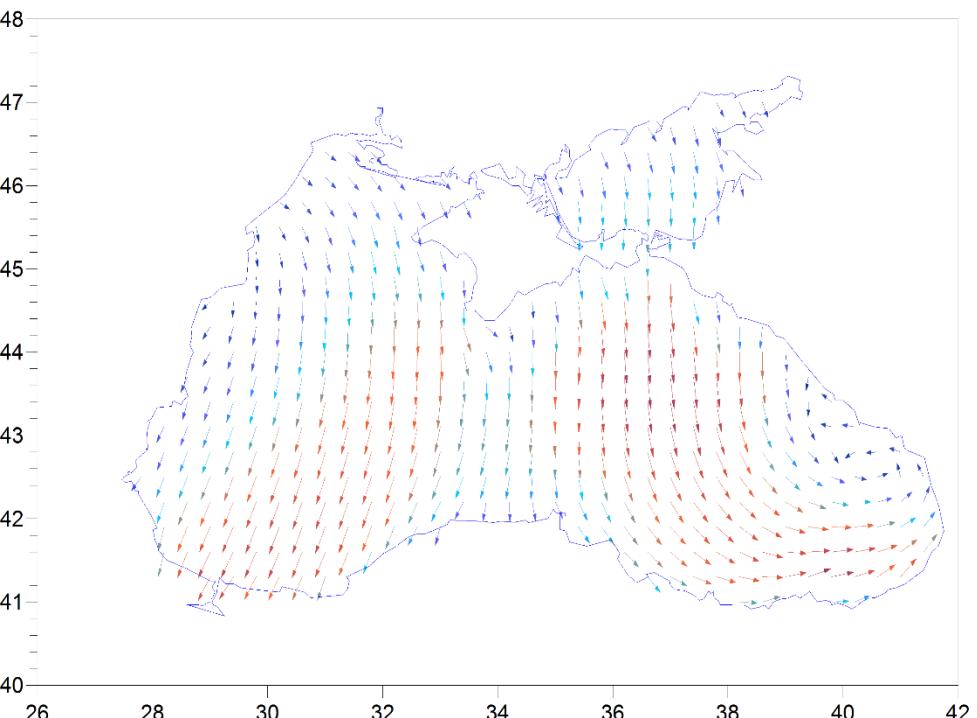
QUIKSCAT NRT HIRES 090124 ascending



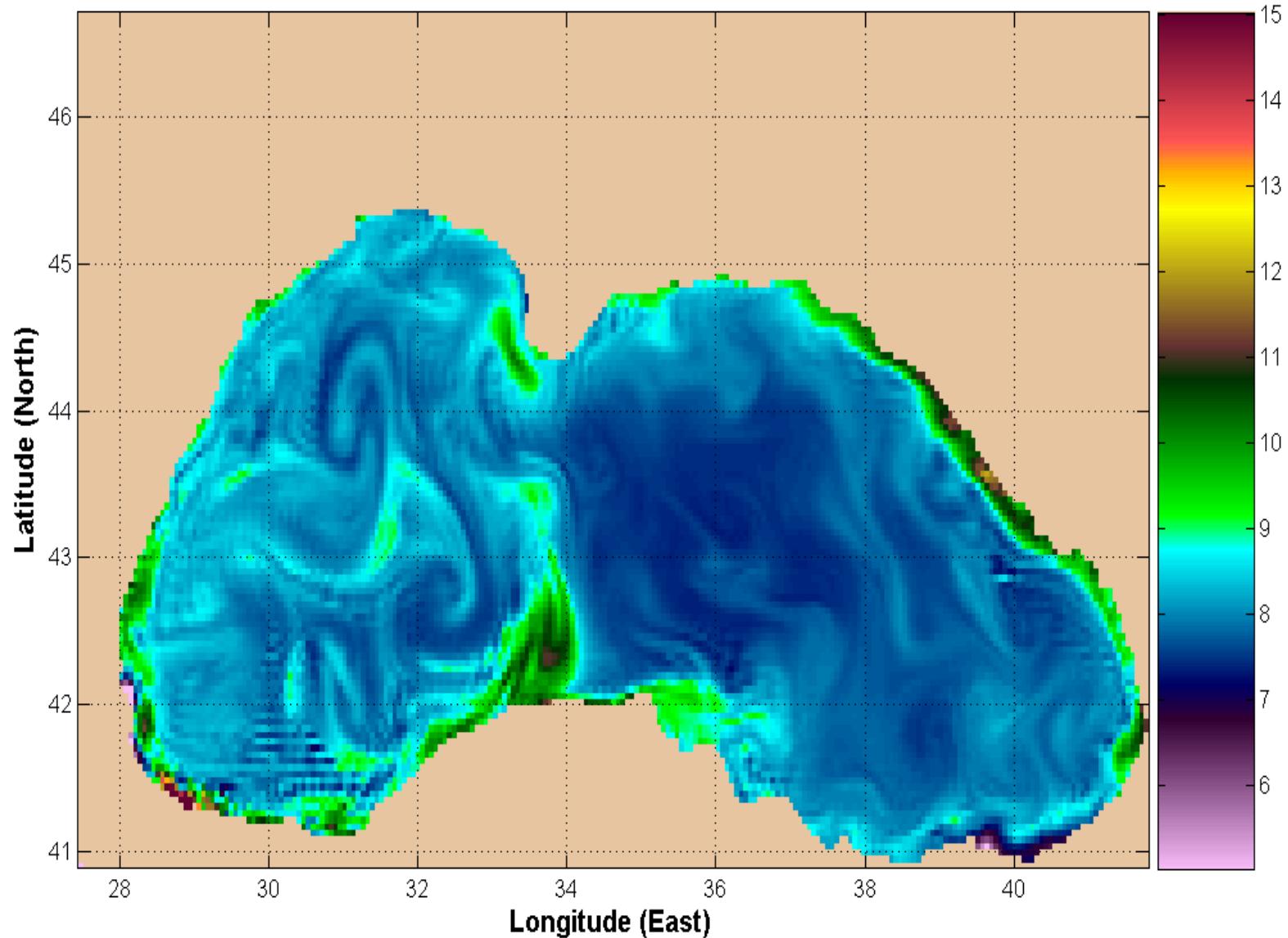
2009 September



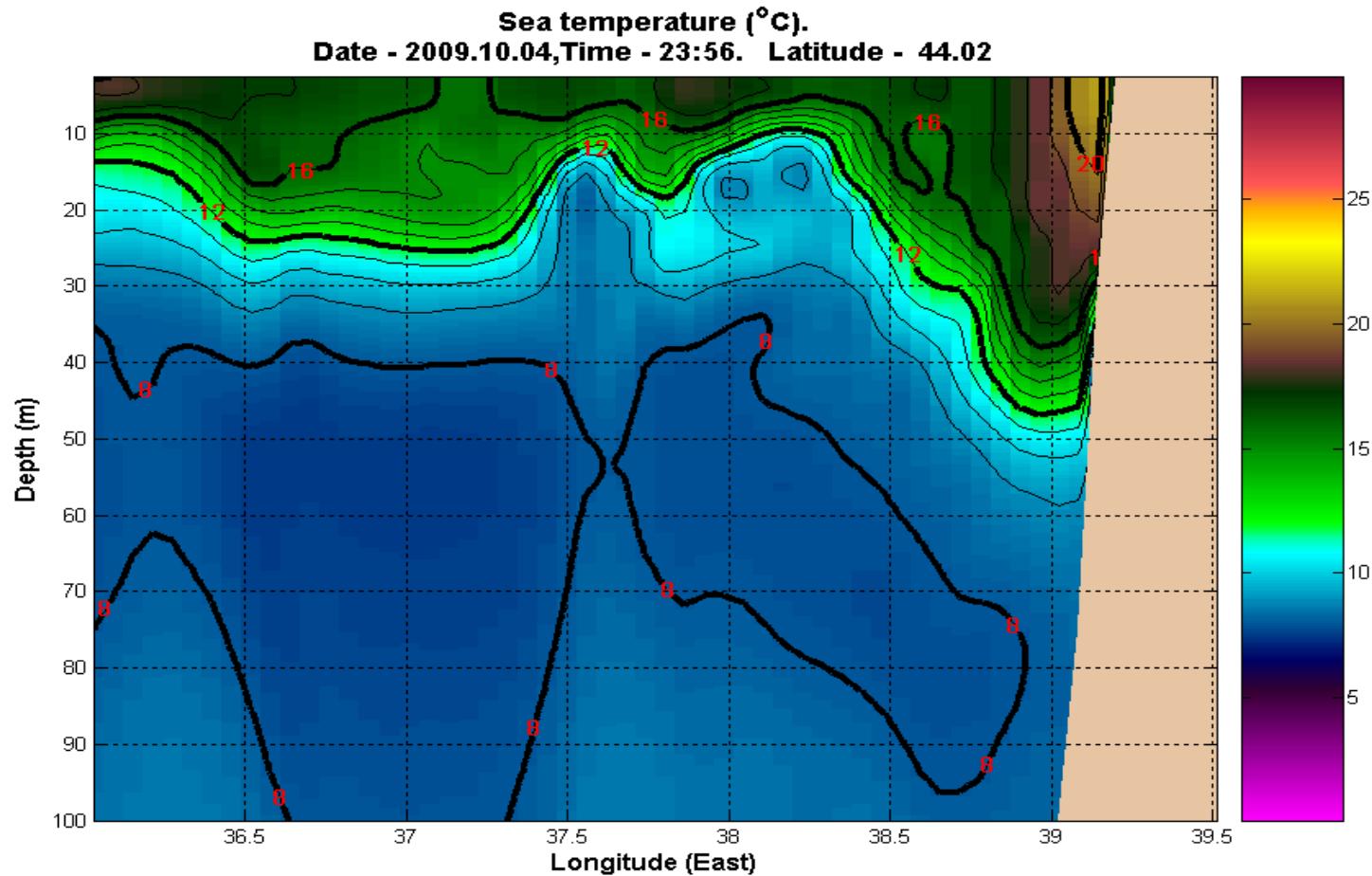
Средний ветер 15-30 сентября



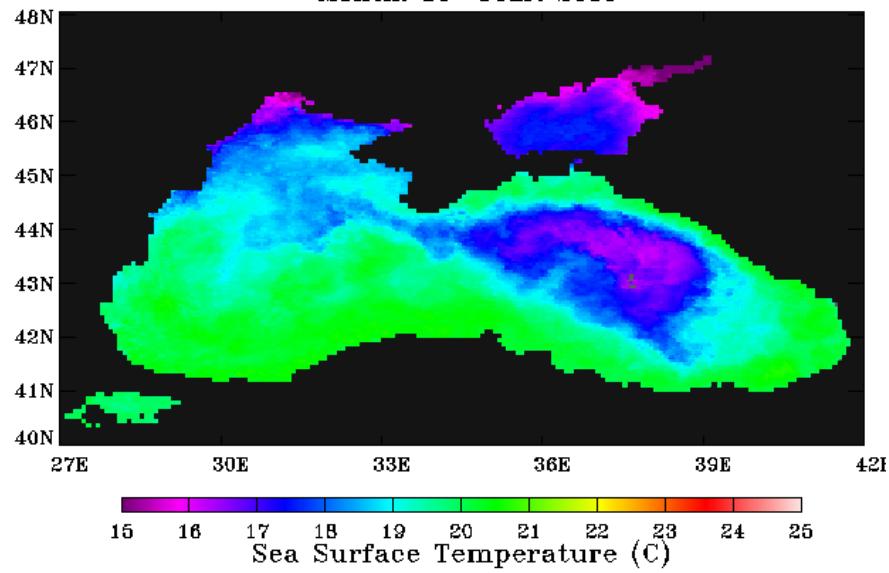
Sea temperature ($^{\circ}\text{C}$). Depth= 50.0 (m). Date 2009.10.04. Time 00(h):00(m)



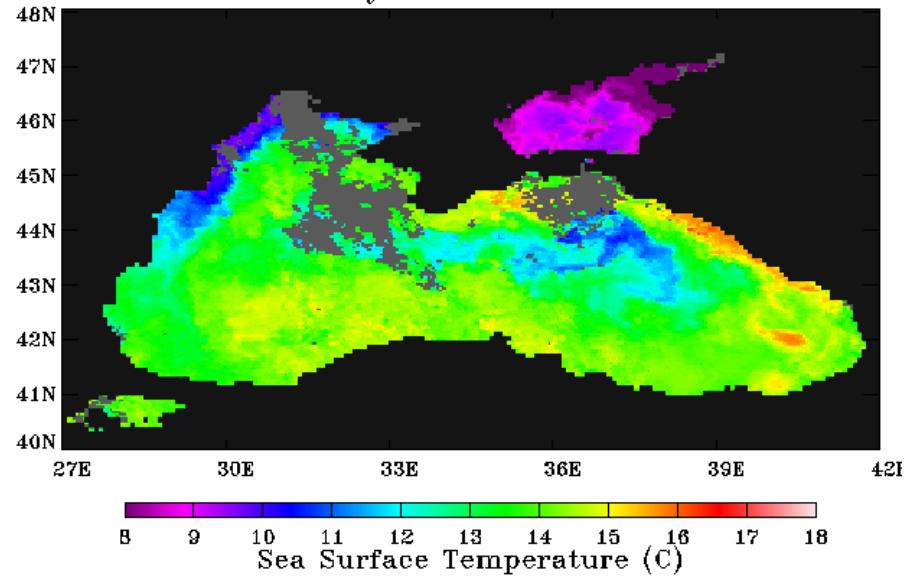
Temperature cross section 44N, MODEL MHI



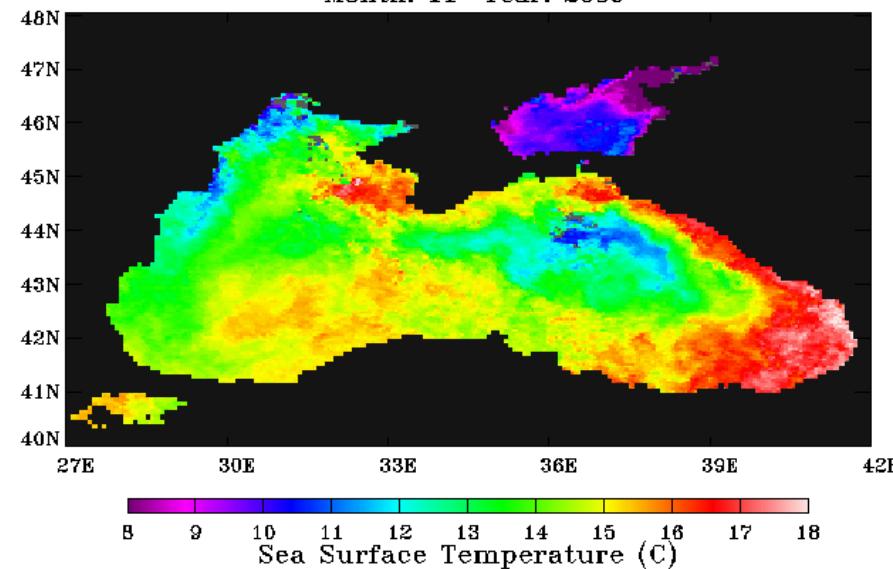
Month: 10 Year: 2009



Day: 329 Year: 2009



Month: 11 Year: 2009



Jan 24 2010

post.jpl.nasa.gov

Jan 24 2010

post.jpl.nasa.gov

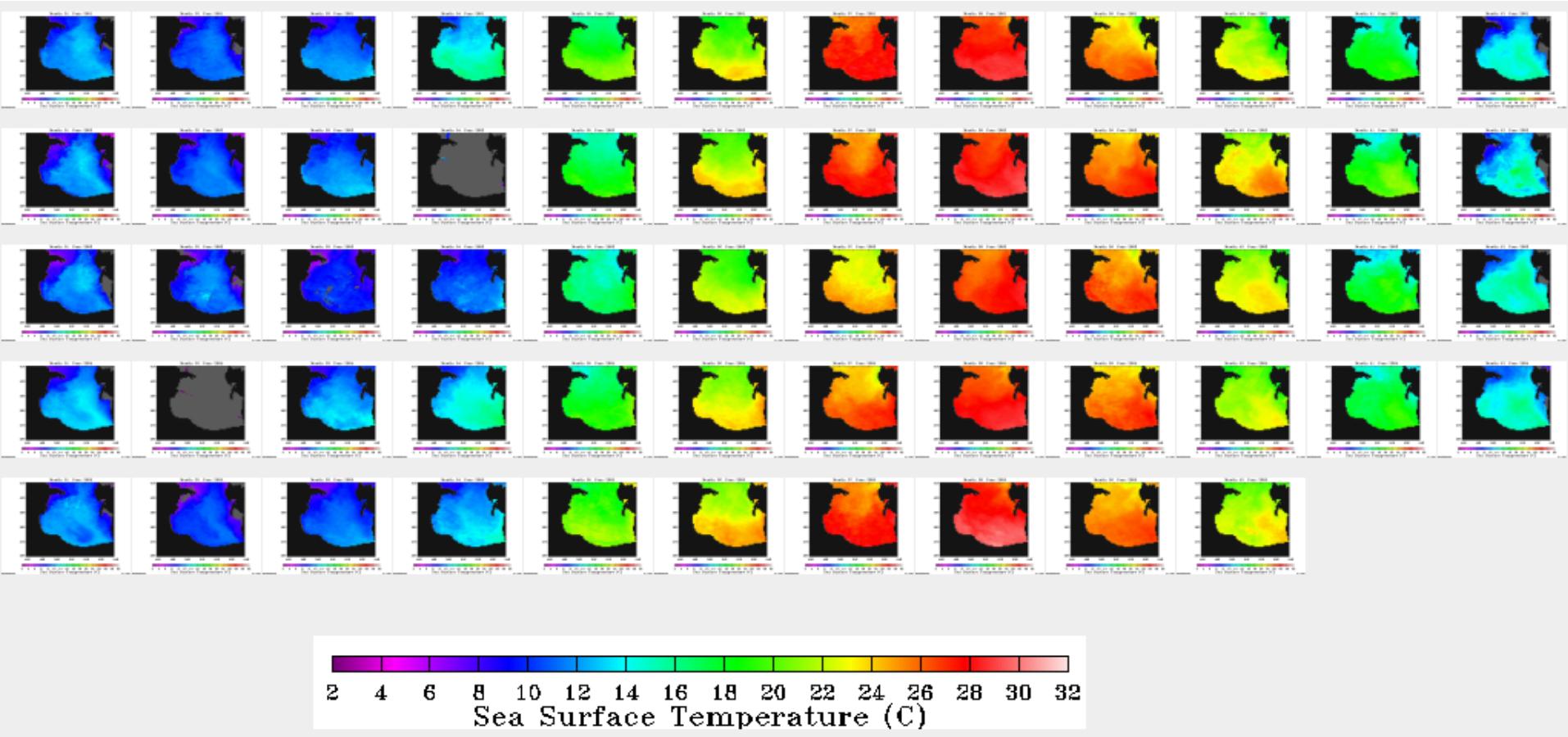
- Optical satellite data allow to detect and investigate blooms of the some specific types of the phytoplankton:
- Blue – green (cyanobacteria)
- Coccolithophorids

Blue-green algae bloom

Nodularia spumigena floating poison
containing species

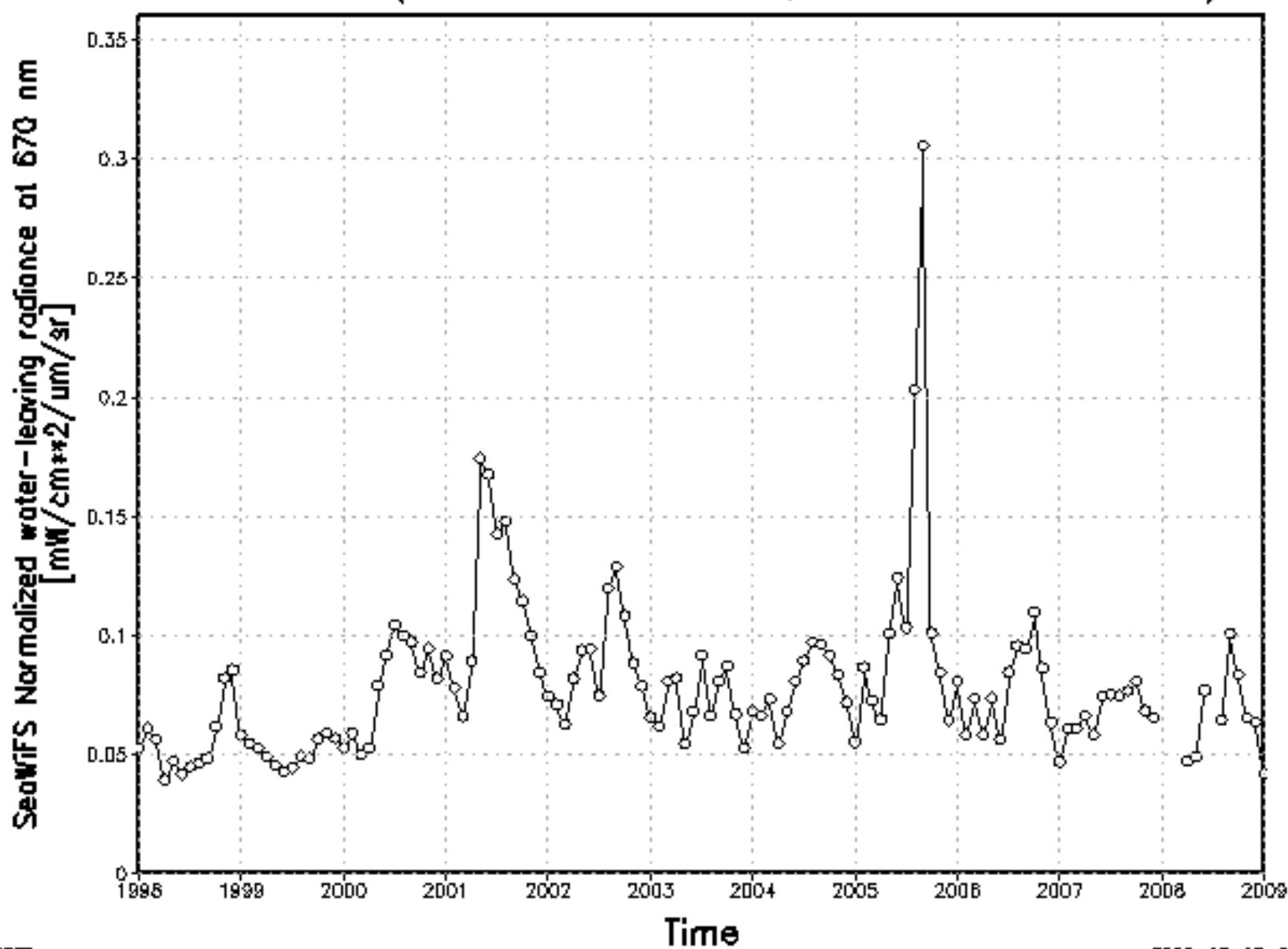
Nodularia spumigena

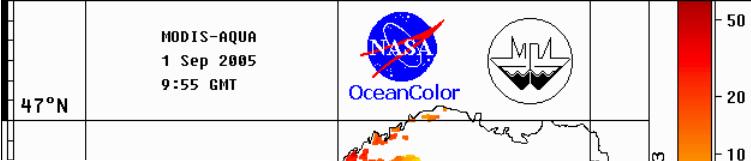
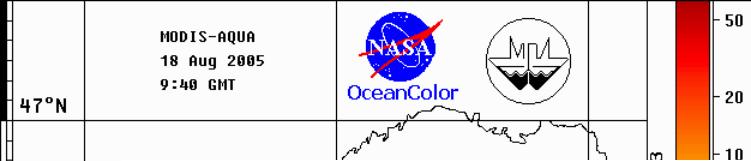




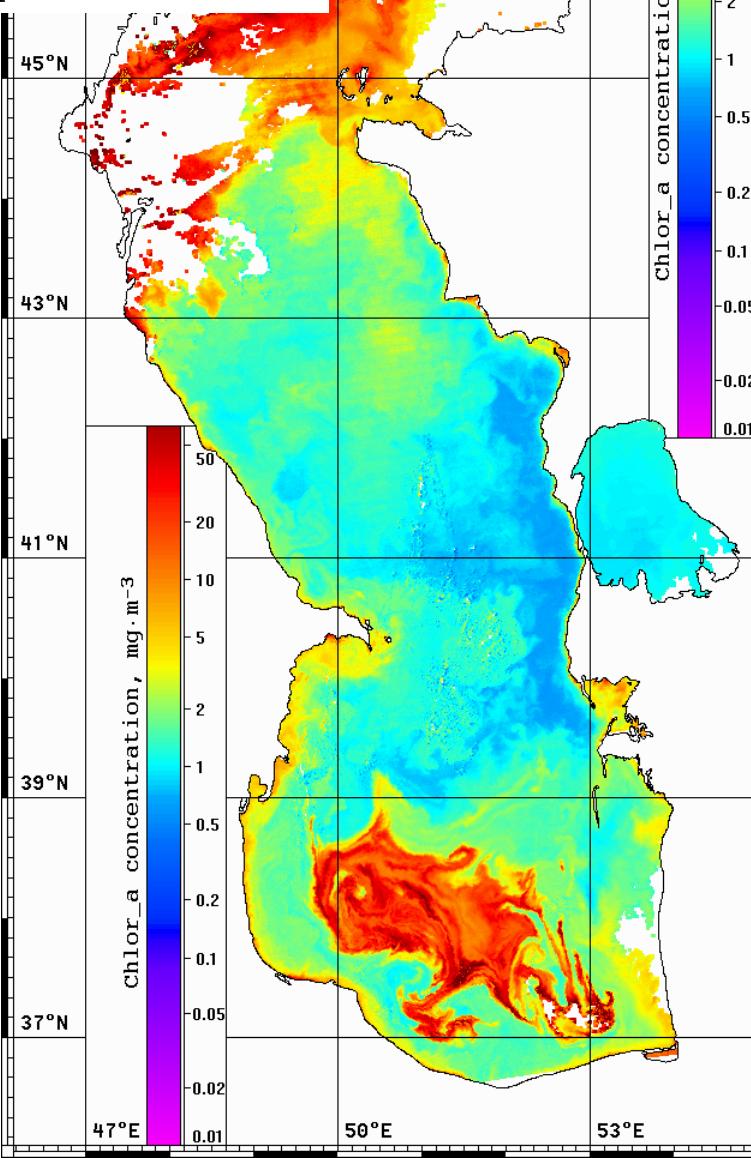
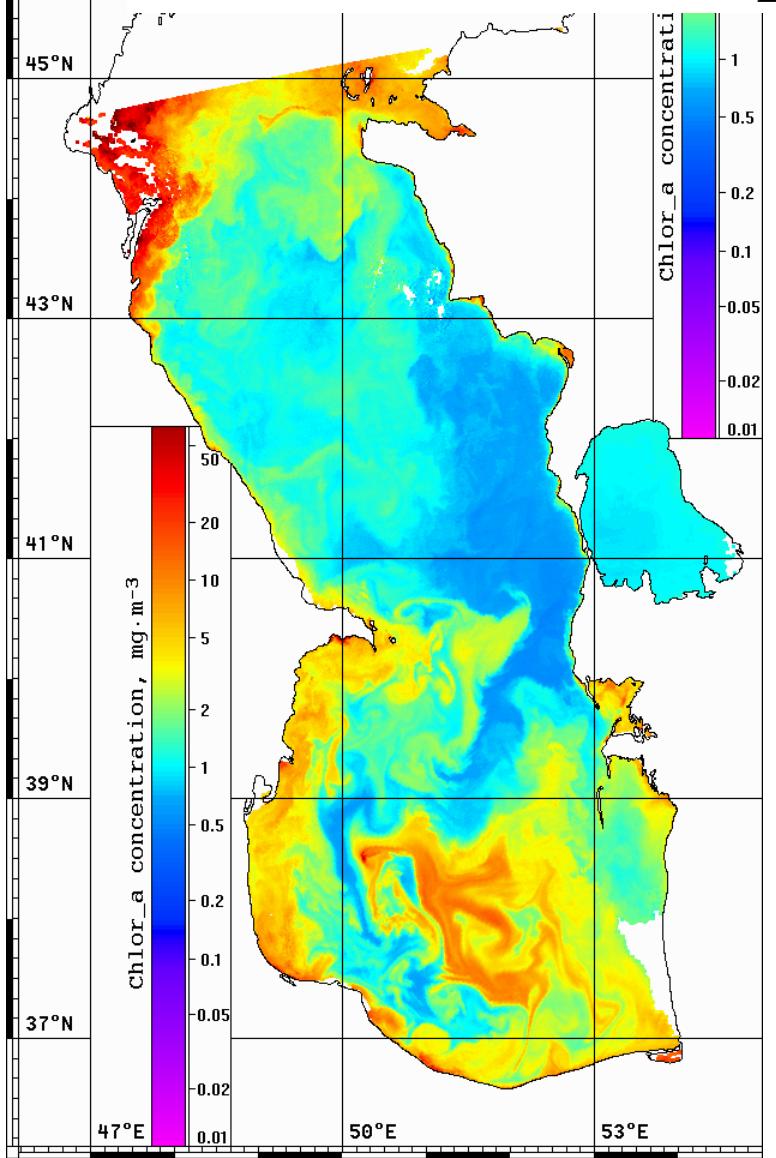
MONTHLY MEAN DAYTIME MODIS SST FROM PODAAC JPL
COLUMNS – MONTHS JANUARY – DECEMBER
ROWS - YEARS 2001-2005

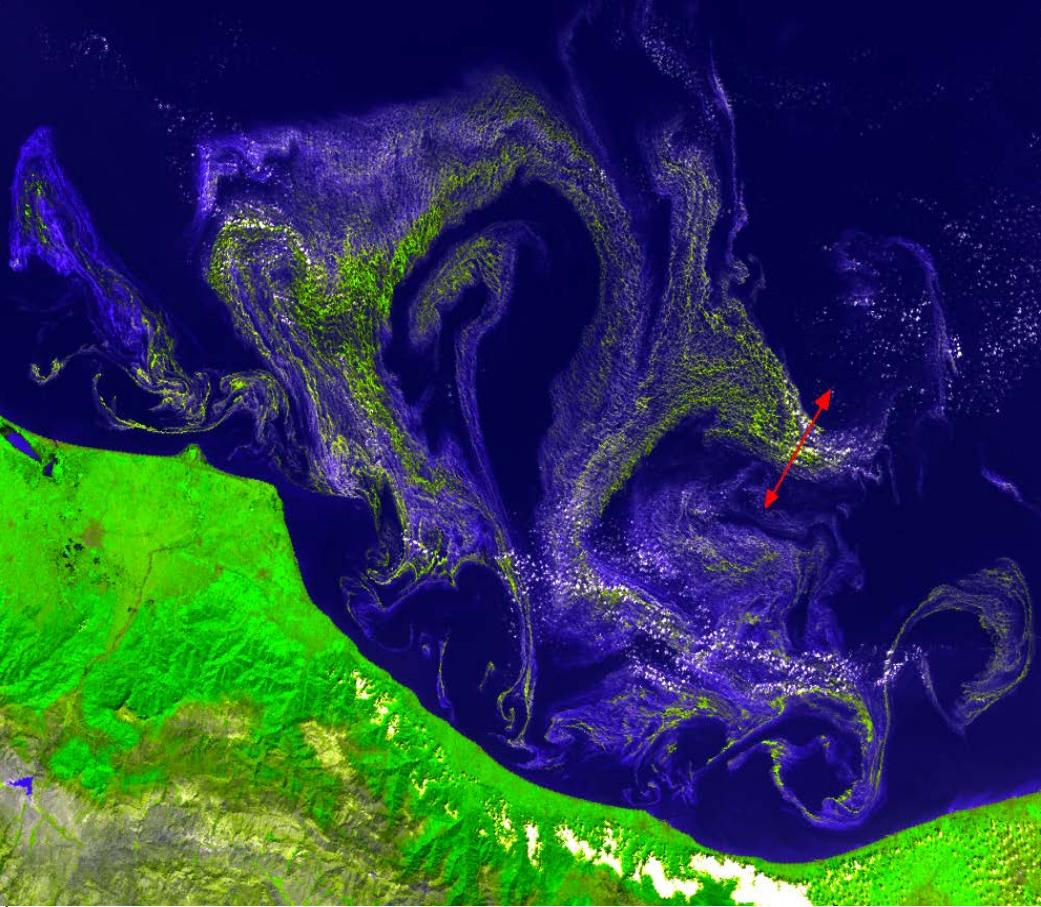
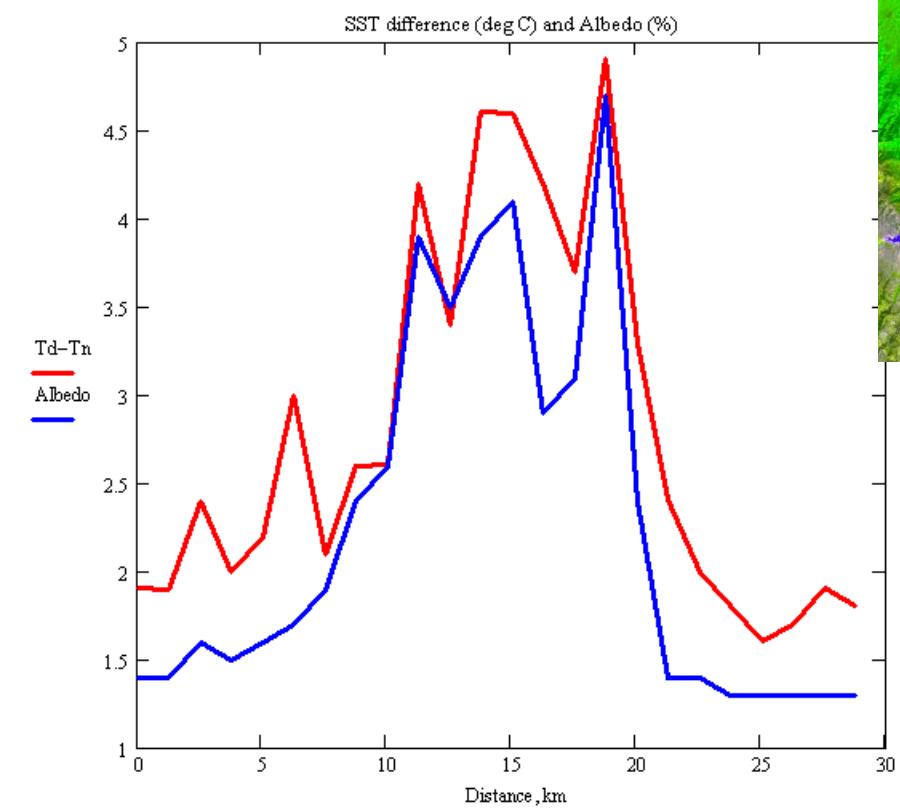
For area (Lat: 37.0N–38.0N, Lon: 51.0E–52.0E)





HAB in the Caspian Sea





25 июля 2009 Цветение сине-зеленых водорослей

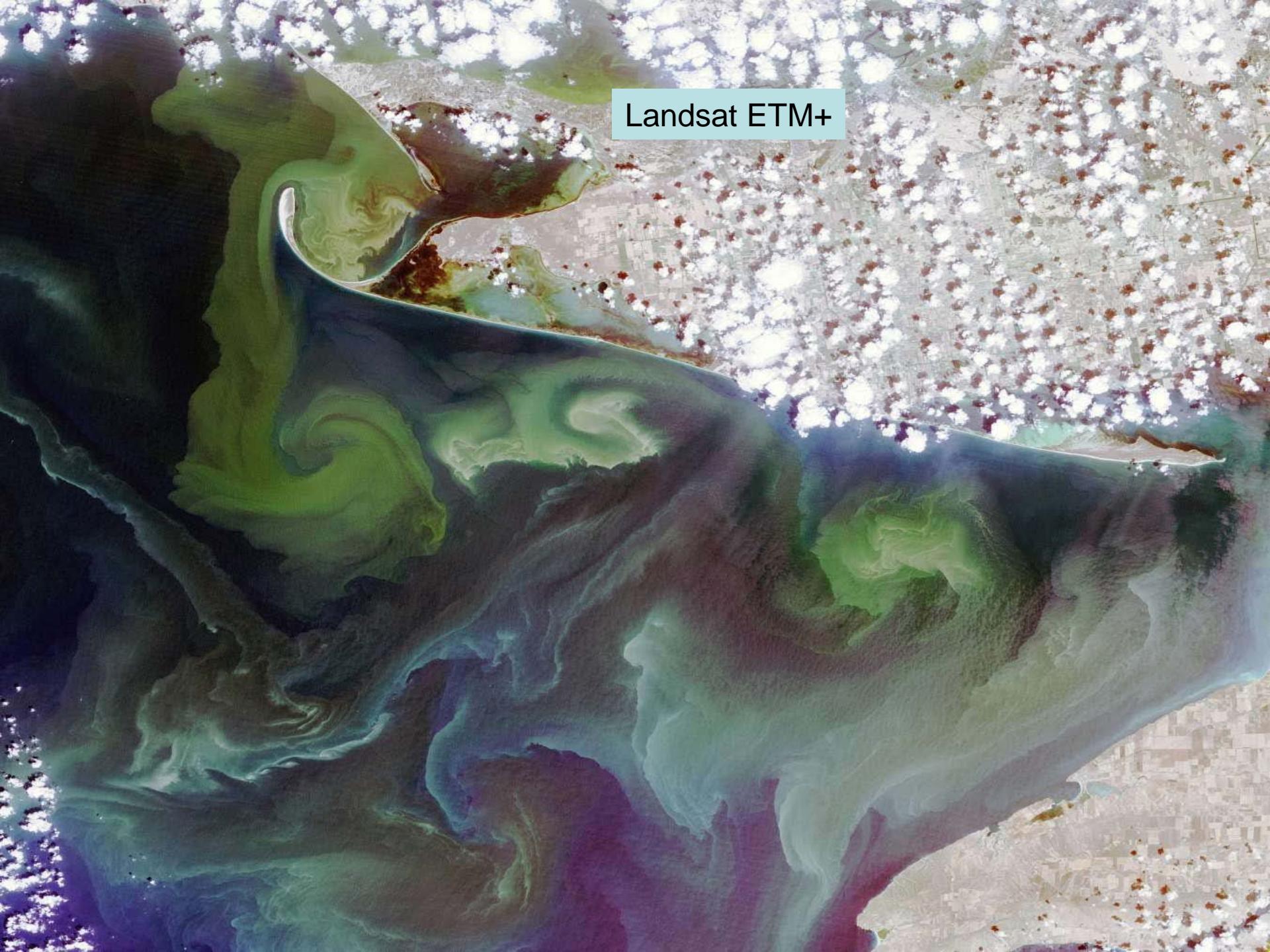


- Last years Blue-green blooms observed in the Black Sea and Sea of Azov.
- Origin of the bloom – river mouth
- Propagation up to 150 km
- Max concentration in divergence zones

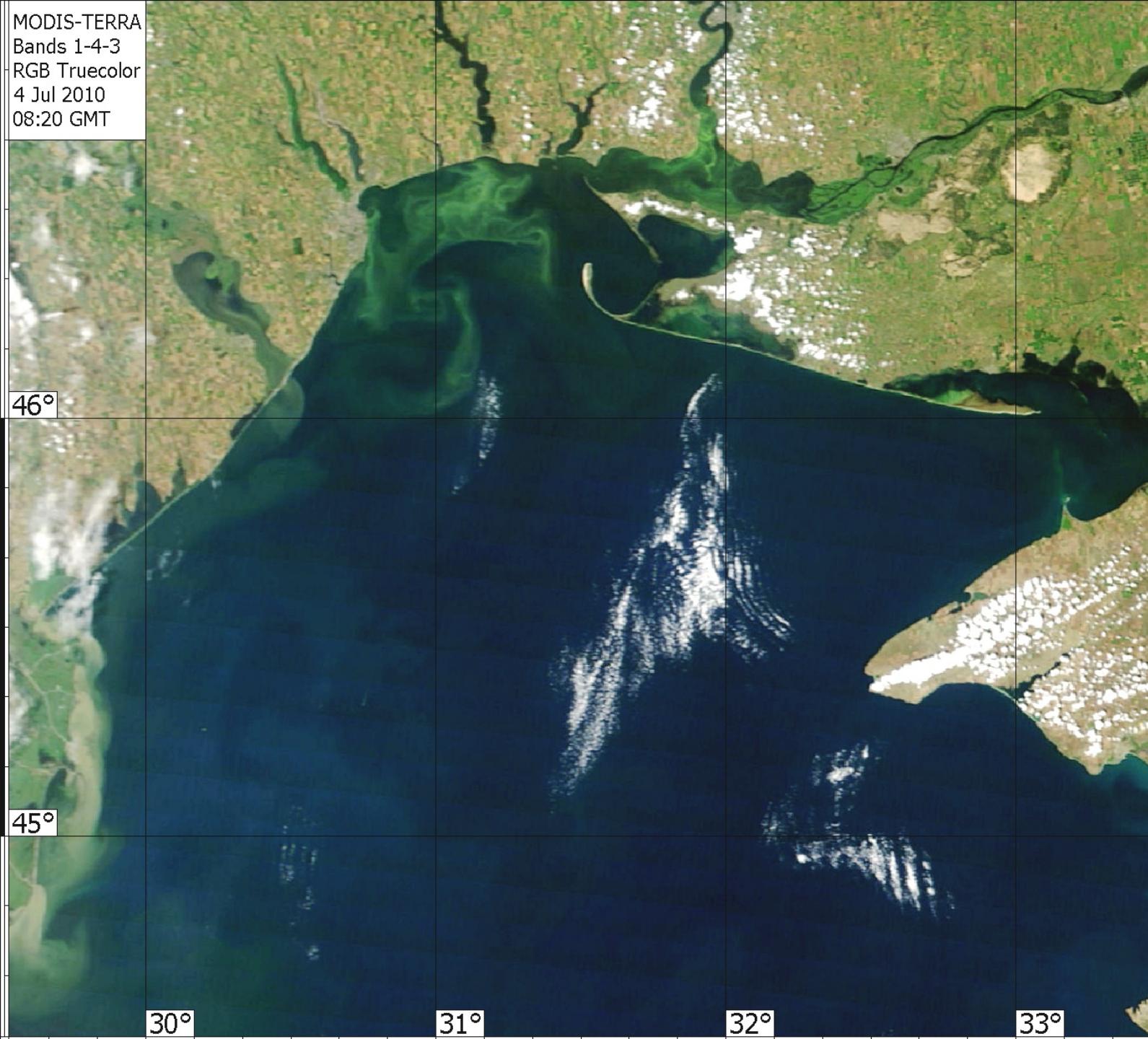
Jul 25 2009 Blue – green algae bloom



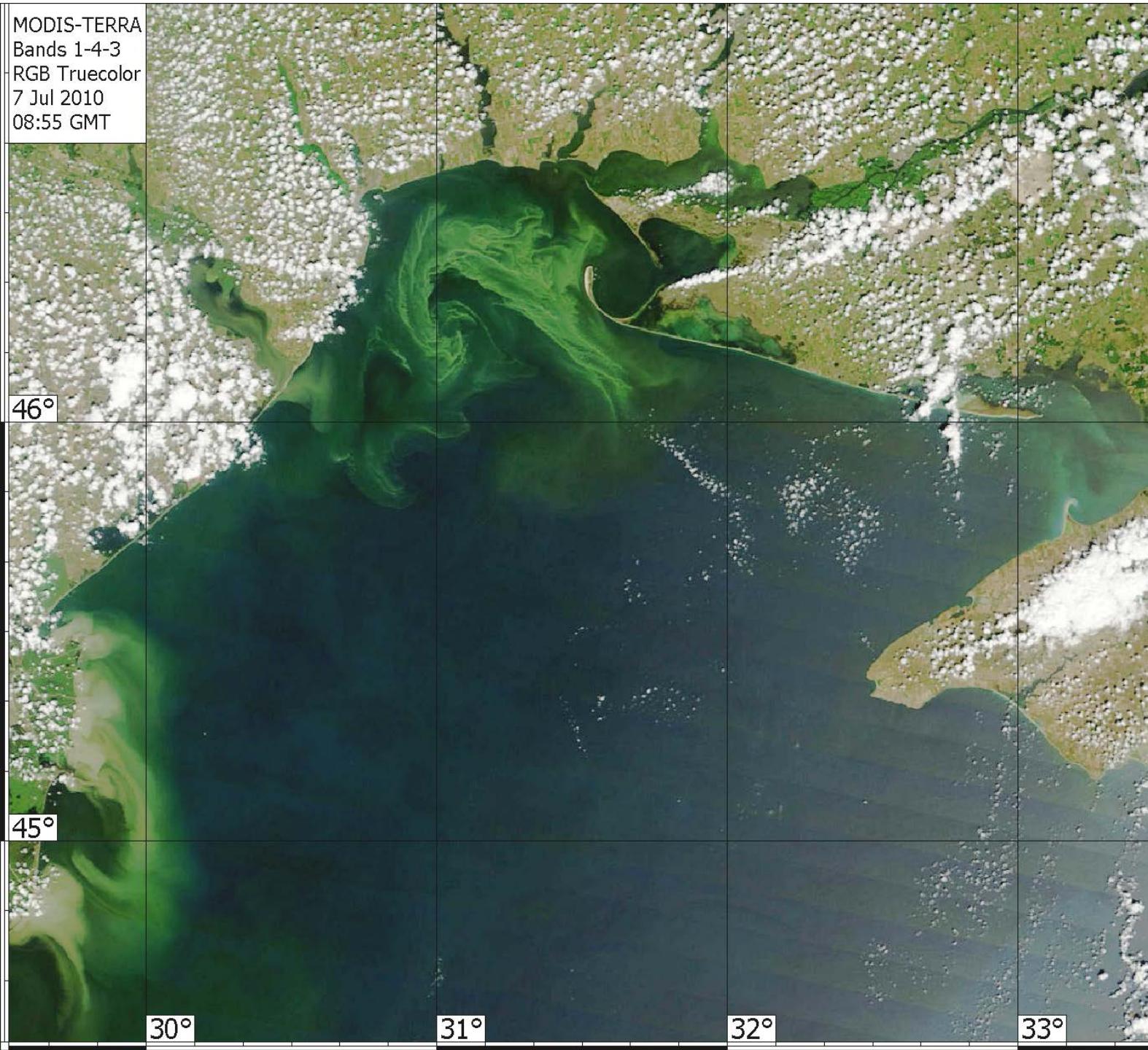
Landsat ETM+



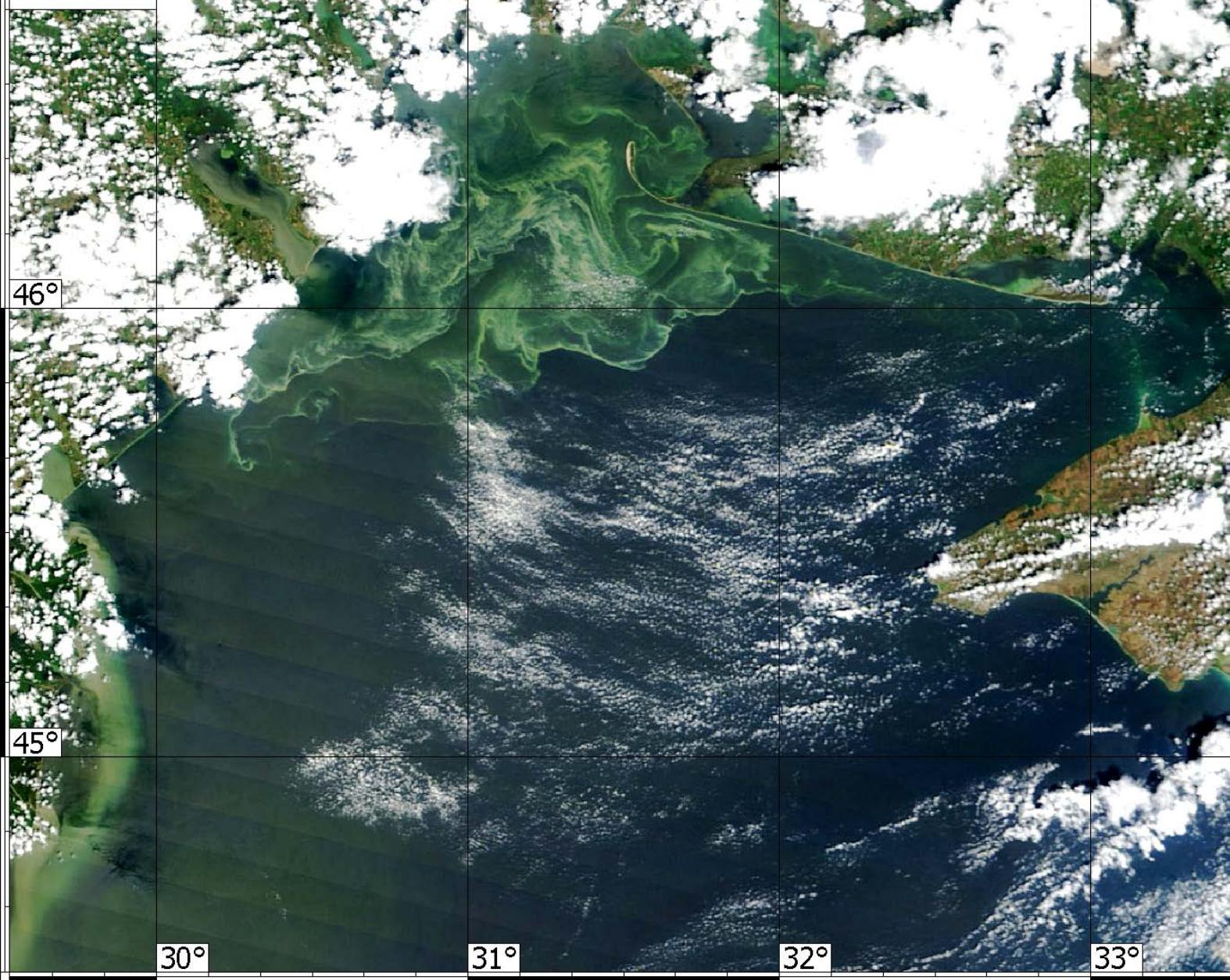
MODIS-TERRA
Bands 1-4-3
RGB Truecolor
4 Jul 2010
08:20 GMT



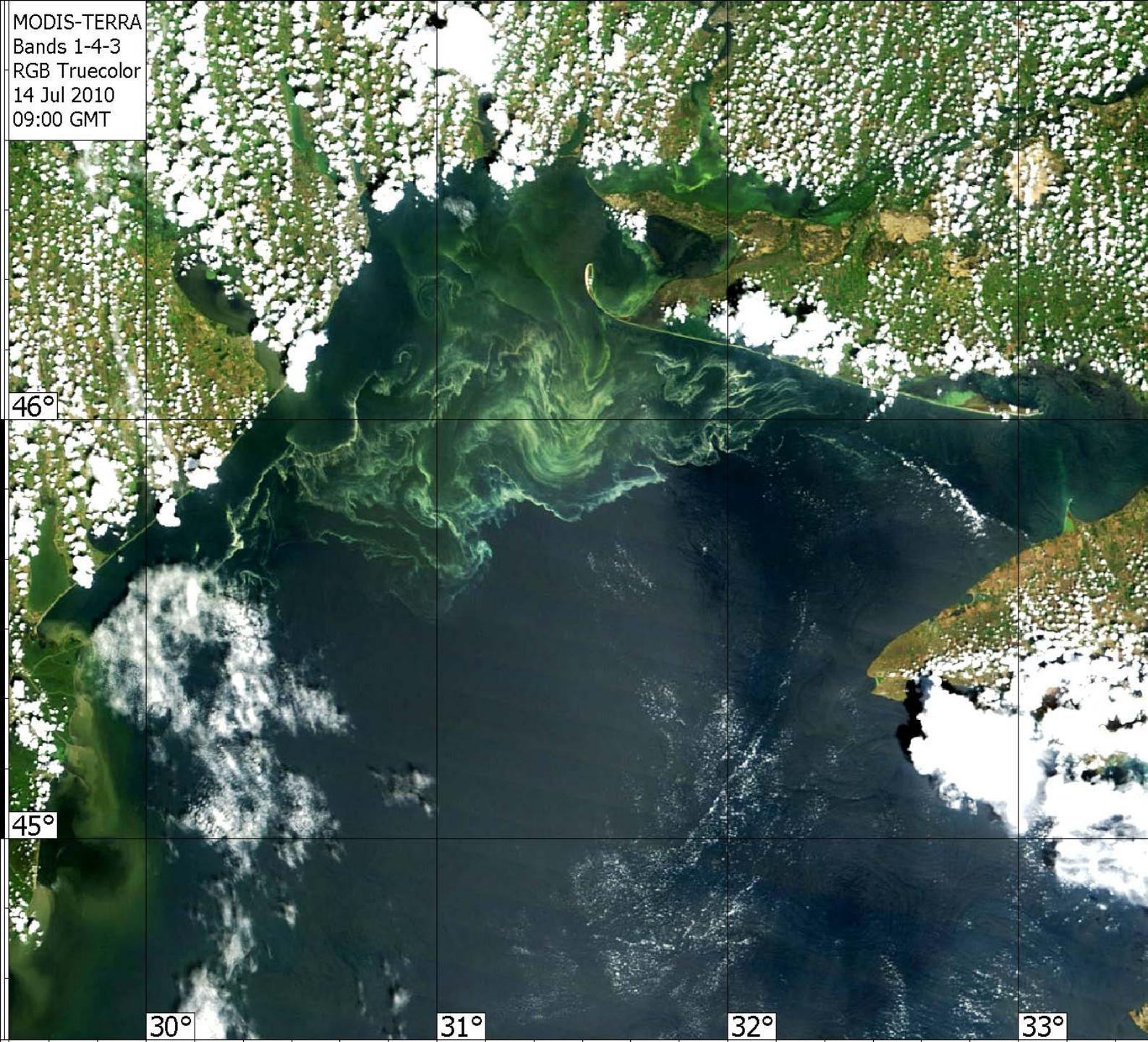
MODIS-TERRA
Bands 1-4-3
RGB Truecolor
7 Jul 2010
08:55 GMT



MODIS-TERRA
Bands 1-4-3
RGB Truecolor
12 Jul 2010
09:10 GMT



MODIS-TERRA
Bands 1-4-3
RGB Truecolor
14 Jul 2010
09:00 GMT



MODIS-TERRA
Bands 1-4-3
RGB Truecolor
18 Jul 2010
08:35 GMT

46°

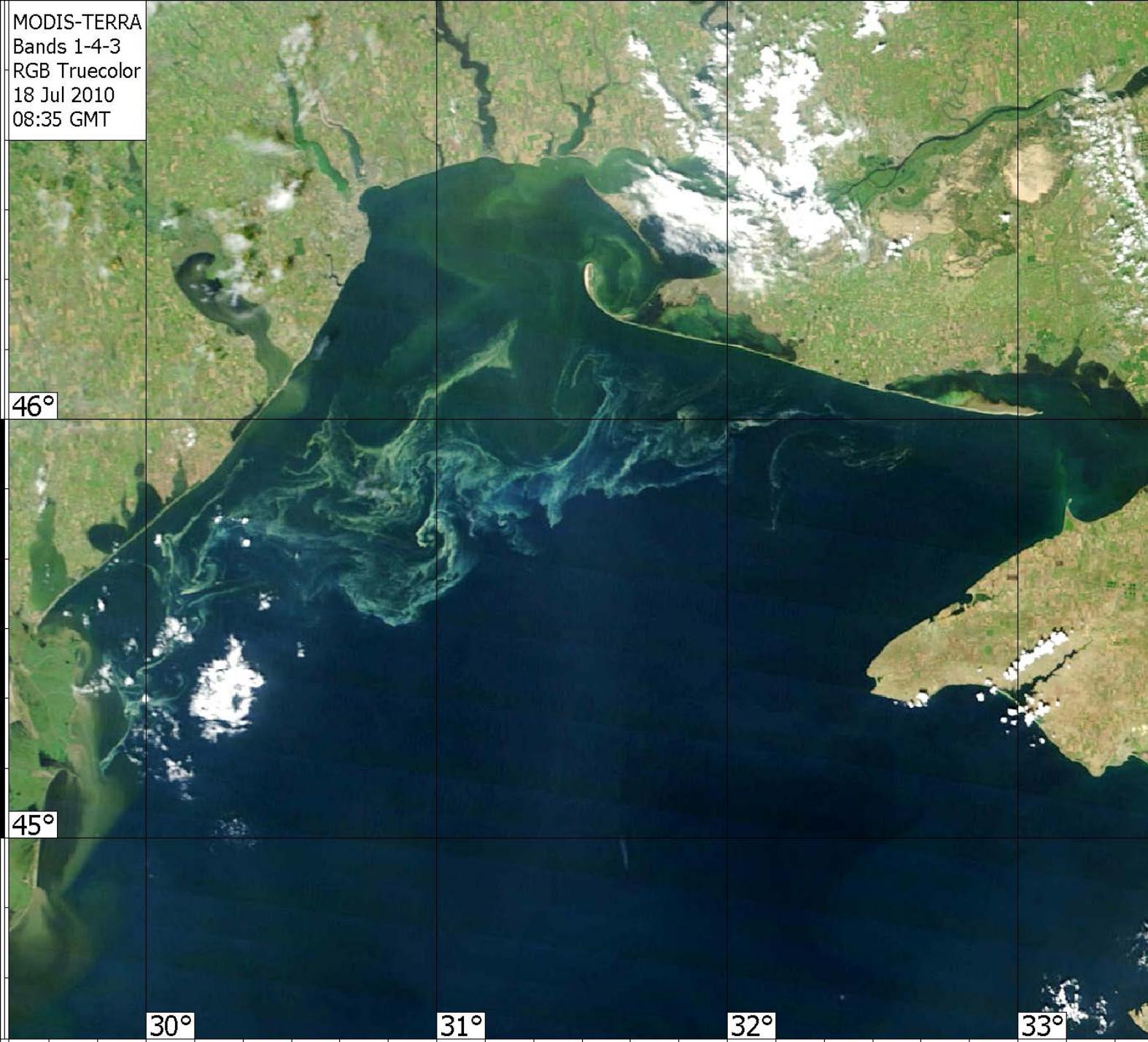
45°

30°

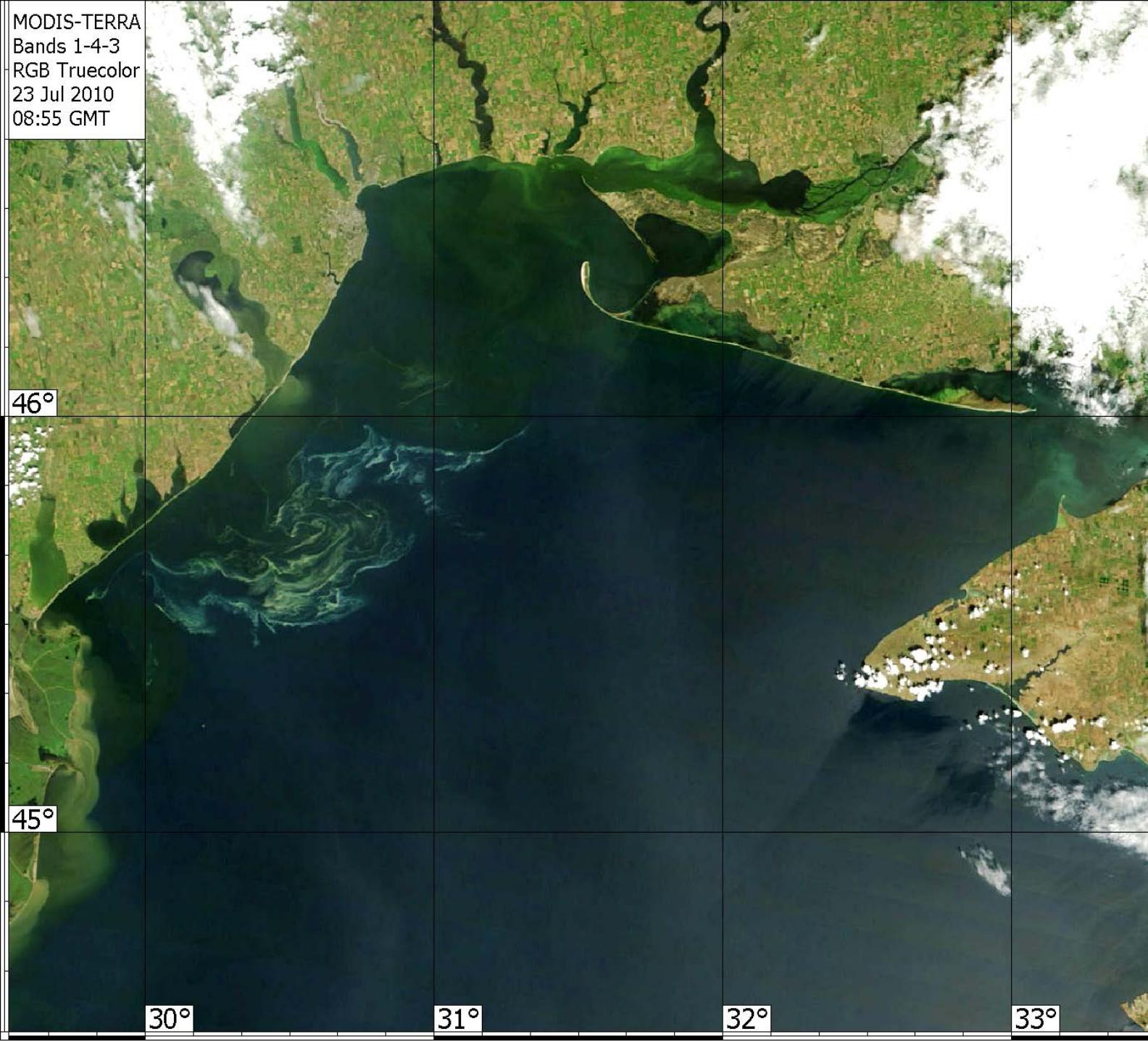
31°

32°

33°



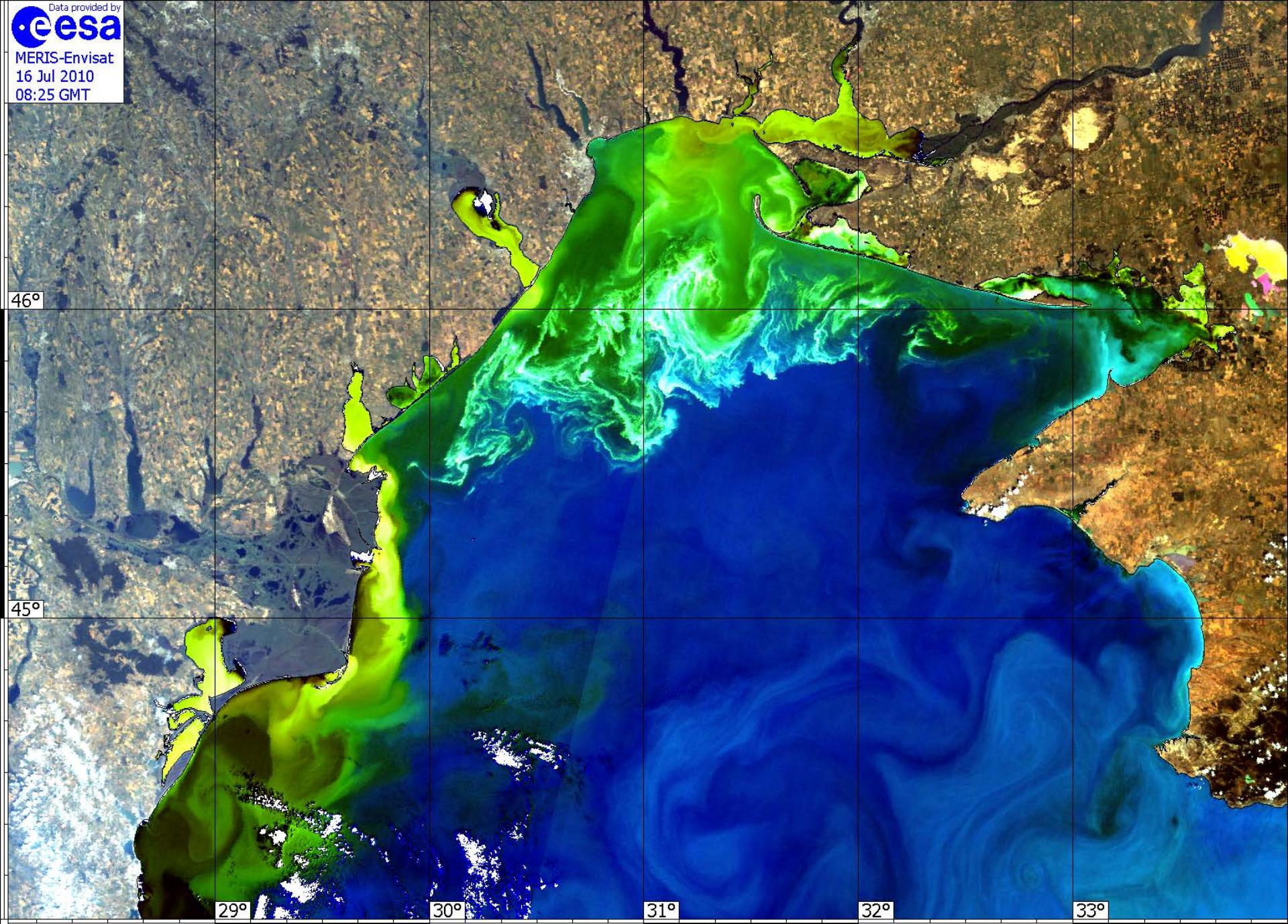
MODIS-TERRA
Bands 1-4-3
RGB Truecolor
23 Jul 2010
08:55 GMT

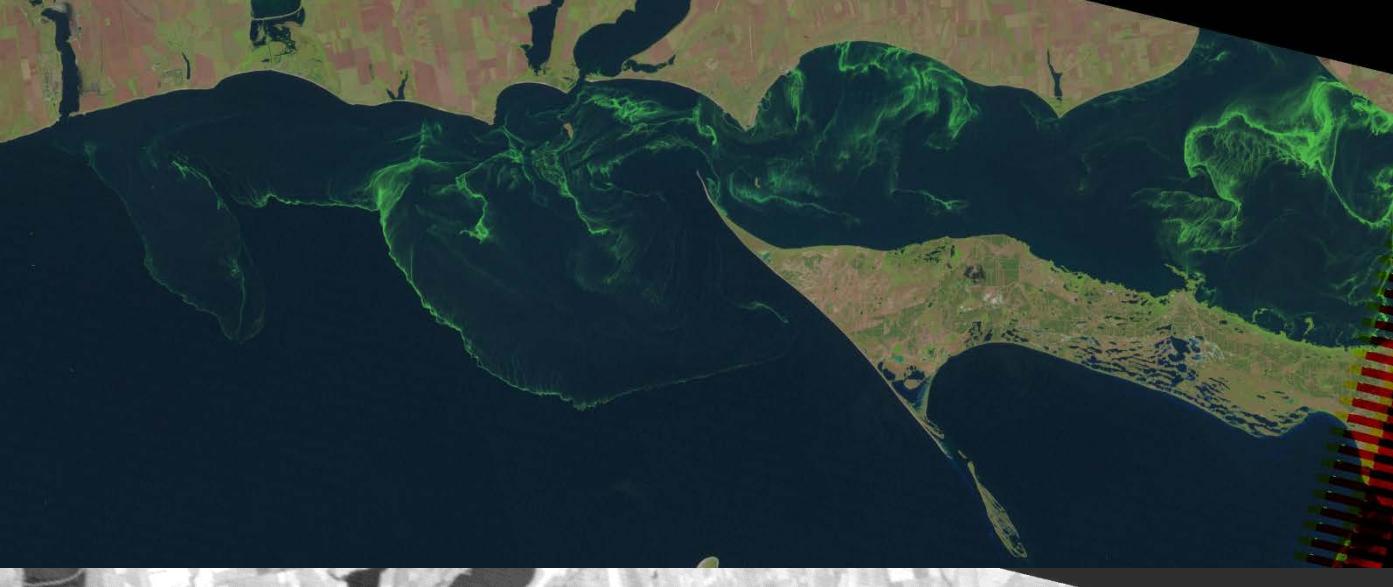


Data provided by
esa
MERIS-Envisat
16 Jul 2010
08:25 GMT



Data provided by
esa
MERIS-Envisat
16 Jul 2010
08:25 GMT





Blue –Green algae bloom manifestation in optical and thermal data of ETM+



Strong heating of the bloom area due to high absorption of the Sun radiation.



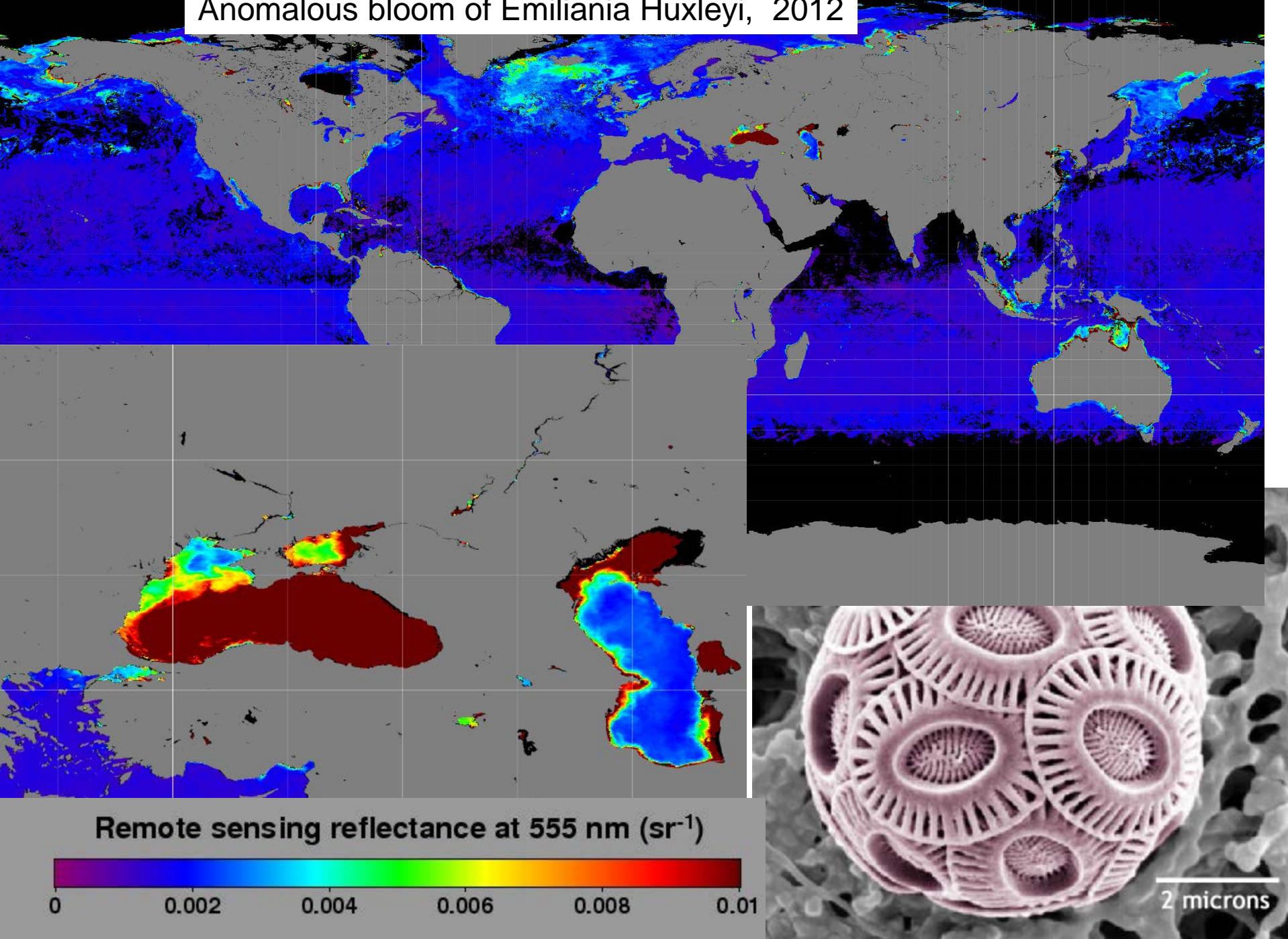
Examples of the induced by Dnepr
waters (nutrients) bloom in the NW
part of the Black Sea (ETM+ LANDSAT data) 30m resolution

Summary

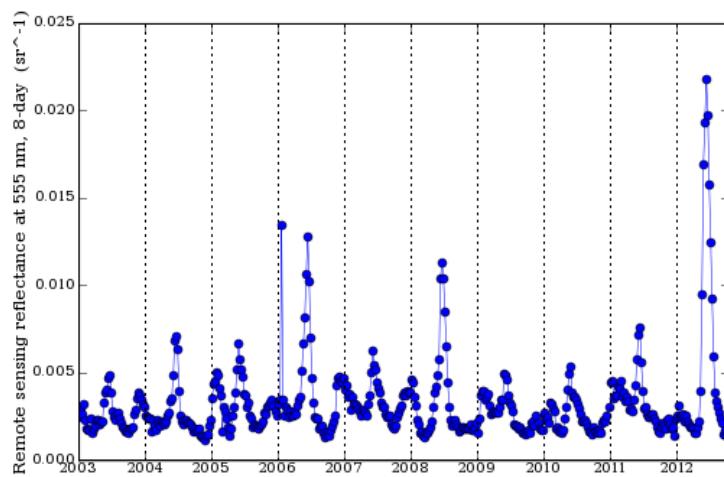
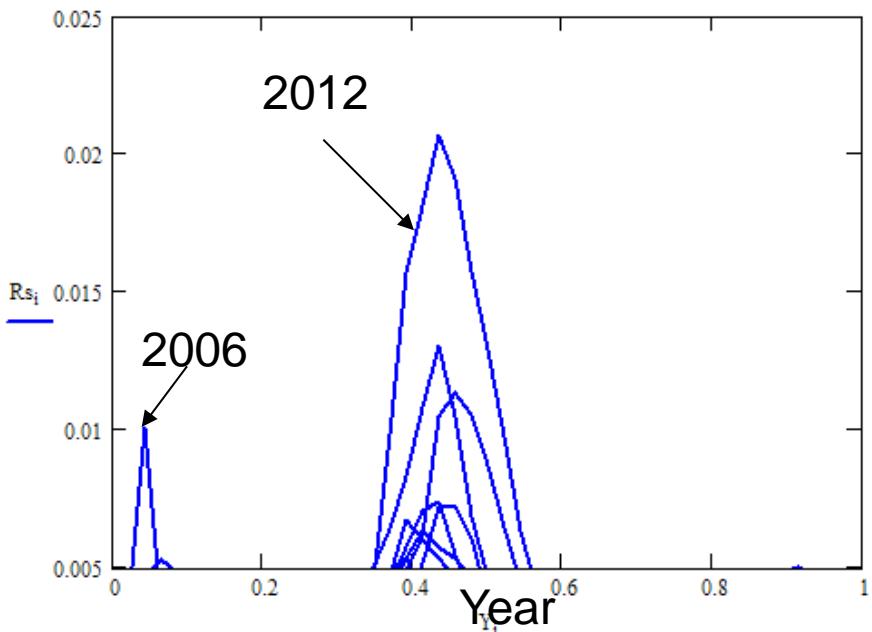
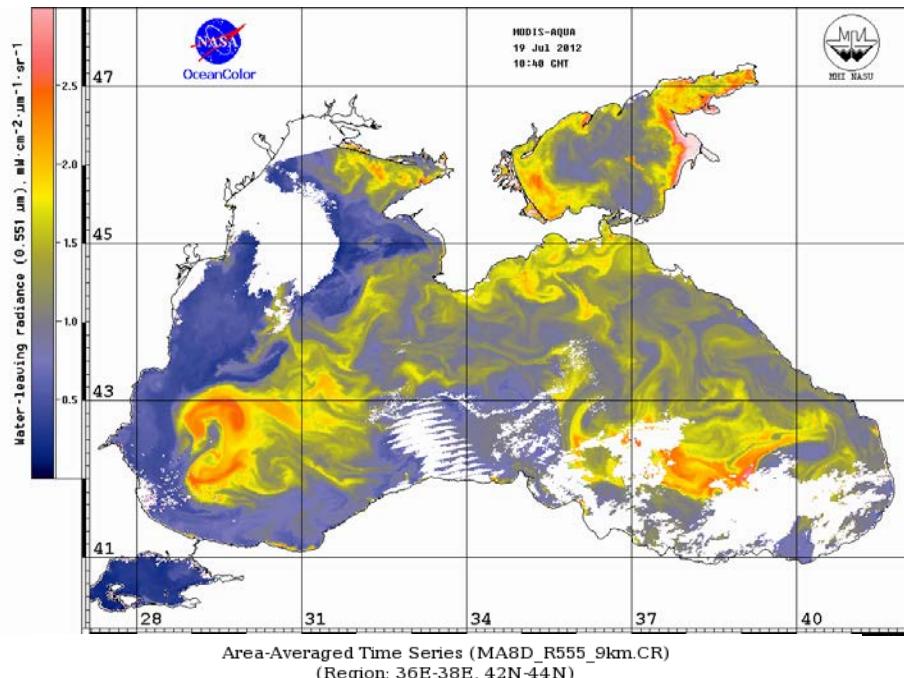
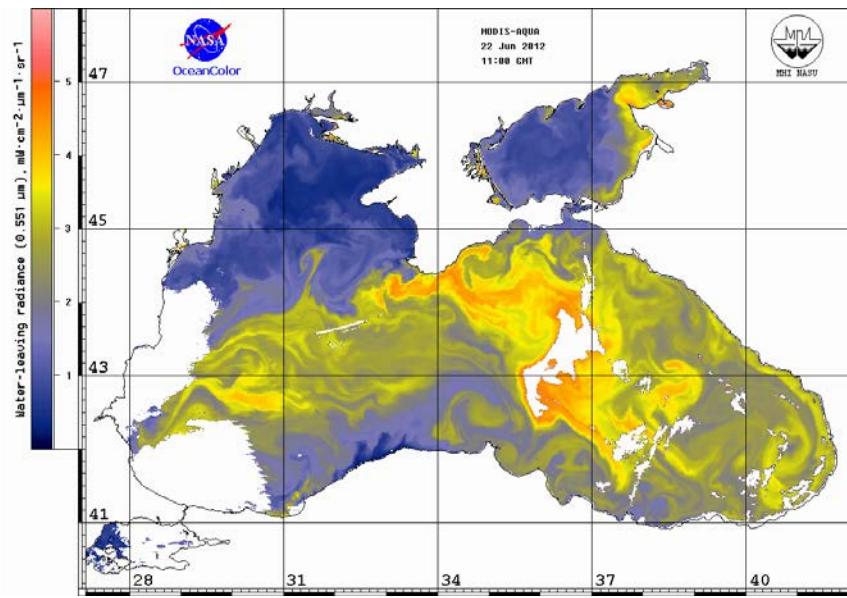
- Initial source – fresh waters (Dniepr, Kuban)
- Preferable conditions – high temperature and low wind
- Propagation related with frontal zone
- Strong impact on the thermal and optical properties of the upper layer
- Blocking of the surface gas transfer
- Shadowing deeper layers

- Coccolithophore bloom

Anomalous bloom of *Emiliania Huxleyi*, 2012

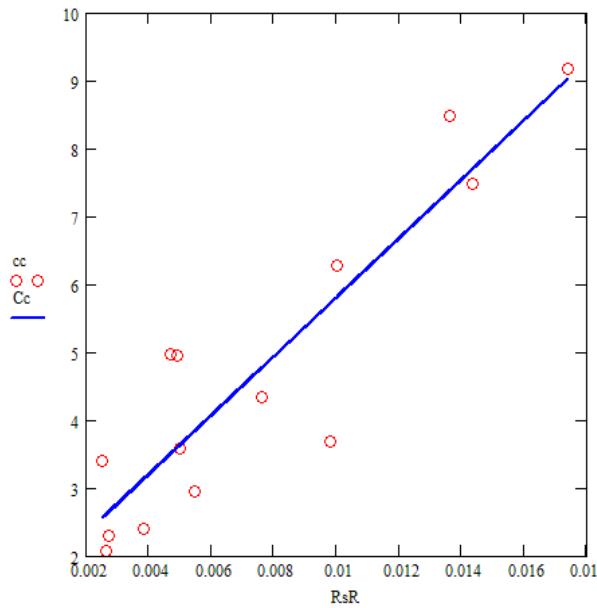


ANOMALOUS INTENACITY AND DURATION OF THE BLOOM 2012



Comparison with in situ data for 2009 -2012 year near Novorossiisk

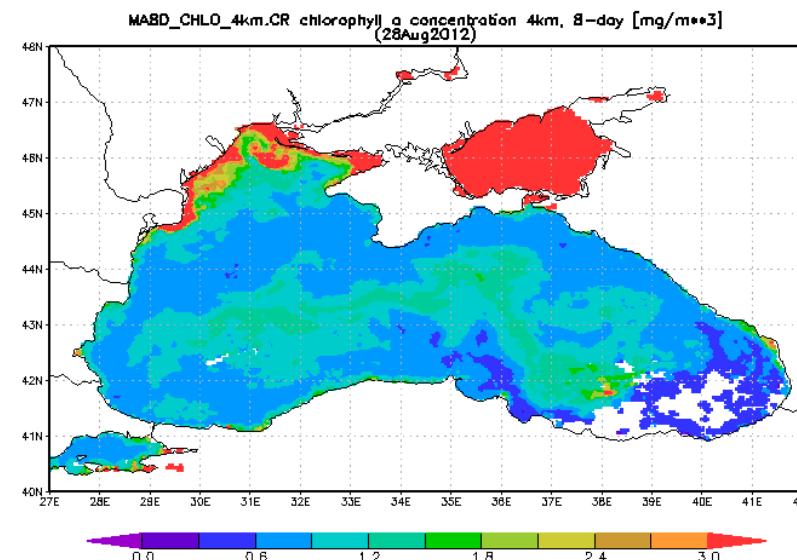
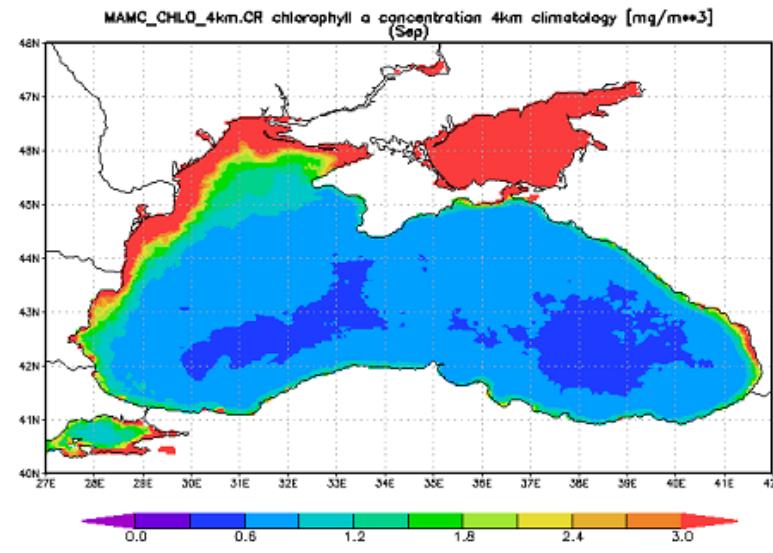
Log(C(cell/liter))as a function of the Reflectance on 0.55мкм



Concentration 2012 $> 2 \times 10^7$ cells/liter

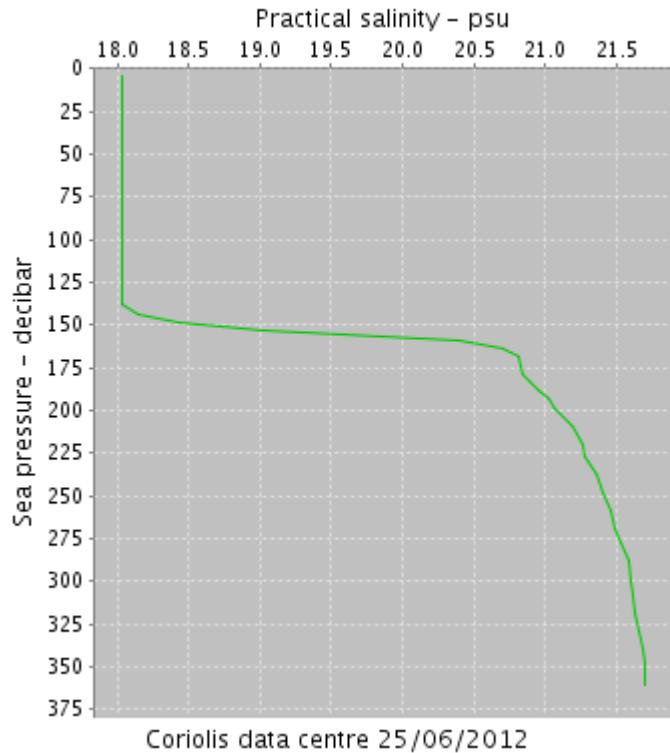
Estimated mass of the coccolith – 4×10^{-3} g/liter

September 2012 high concentration of the chl – recycling??



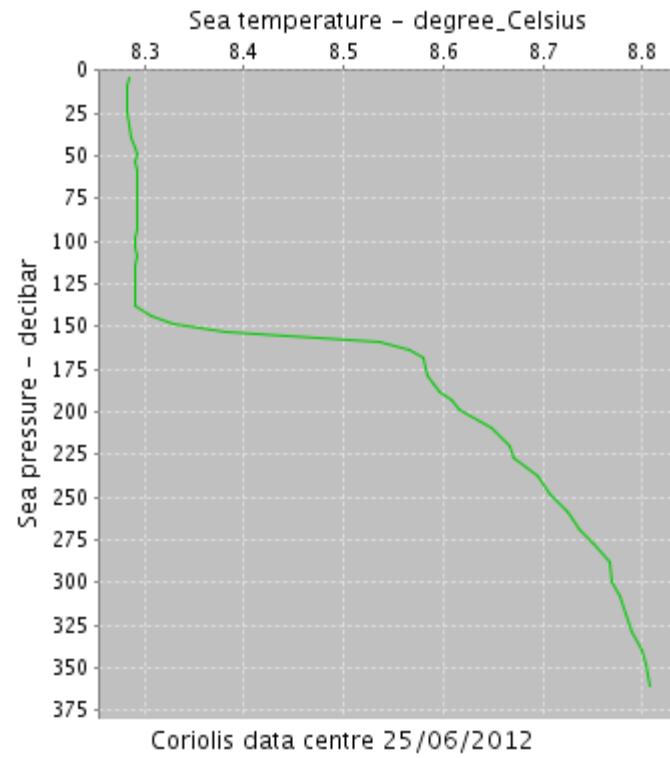
Reason – deep winter convection ARGO float mixing layer - 150M

Float 6900804, Cycle #65, 02/02/2012 08:58:06, A



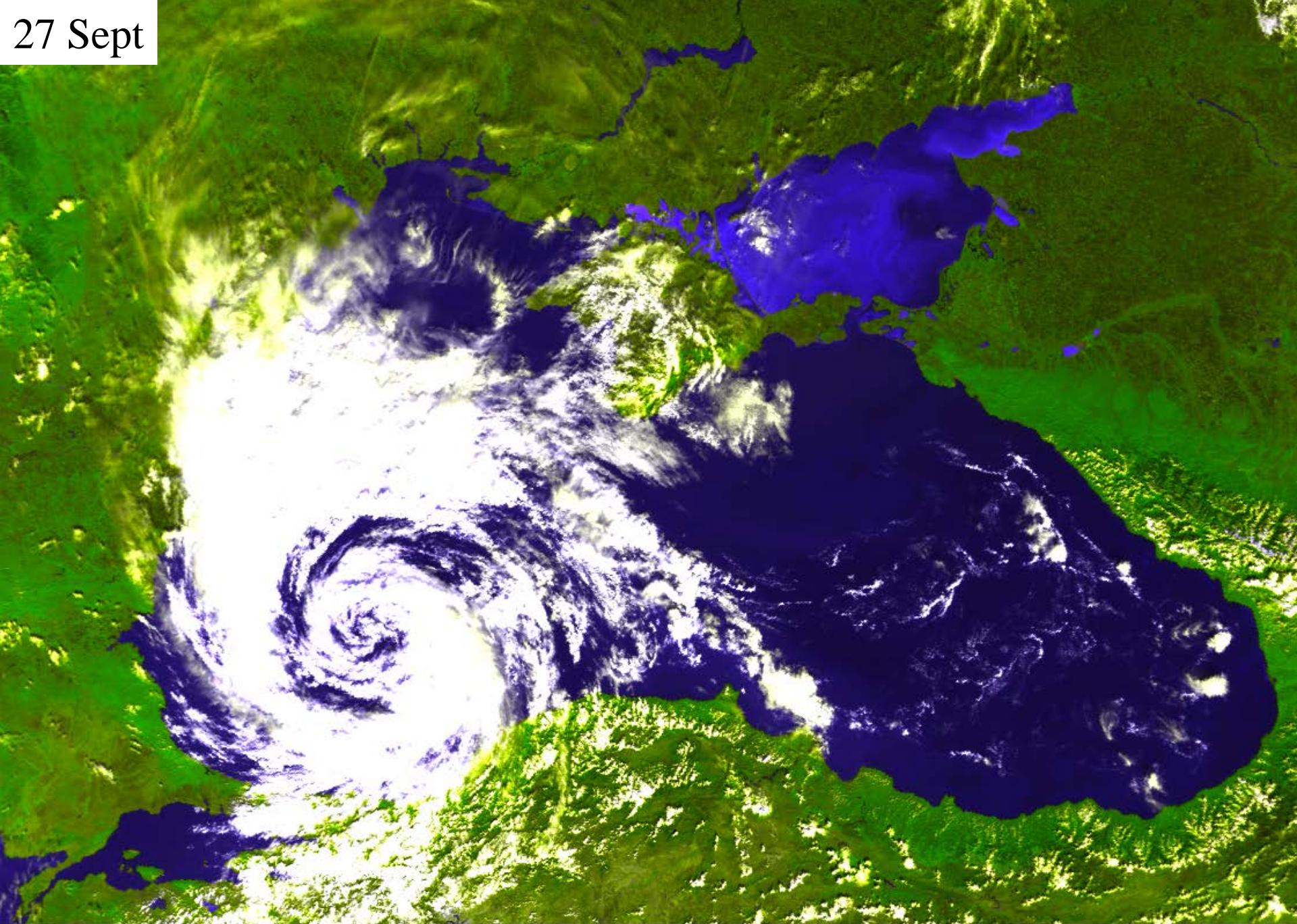
Salinity

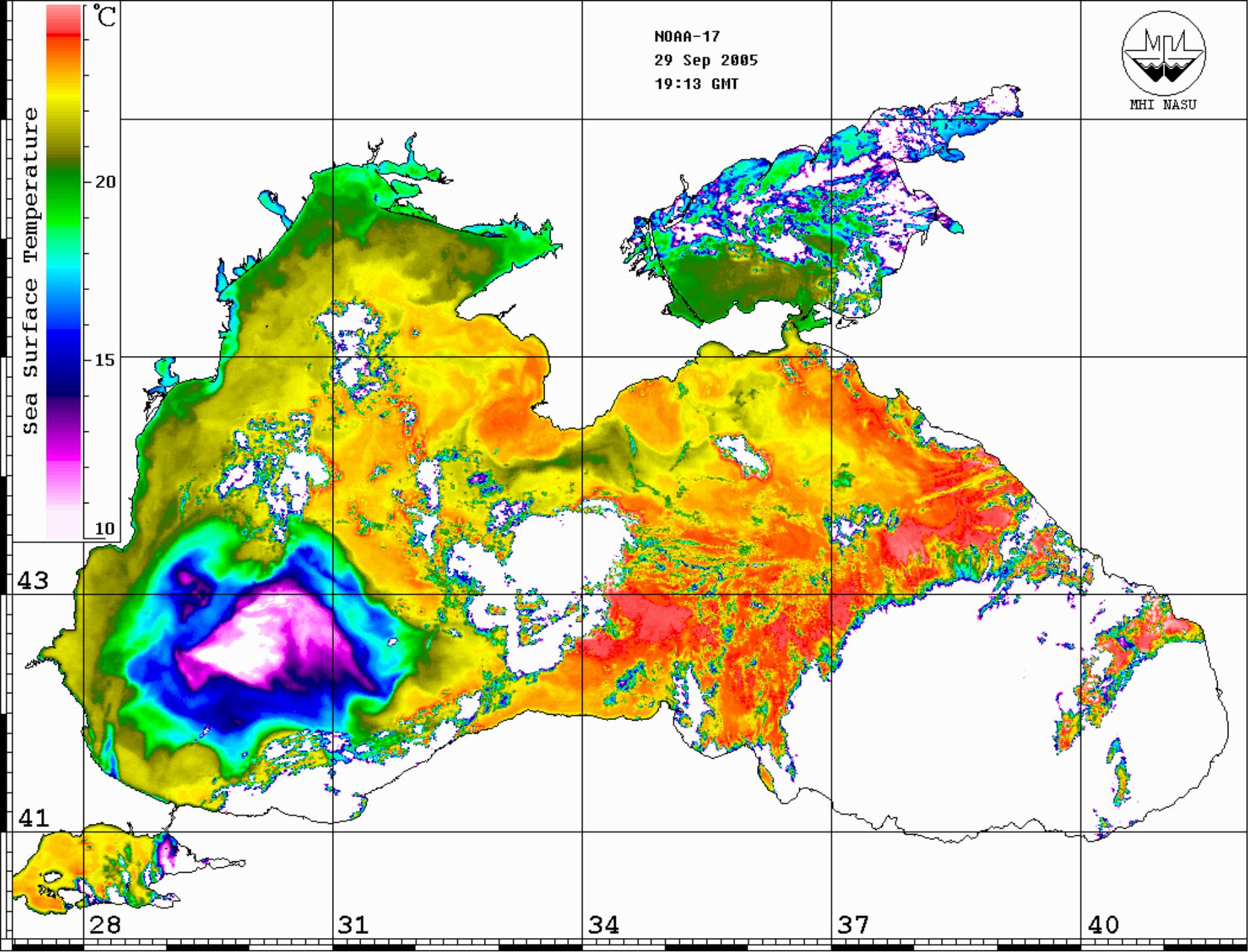
Float 6900804, Cycle #65, 02/02/2012 08:58:06, A

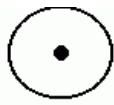


Temperature

27 Sept



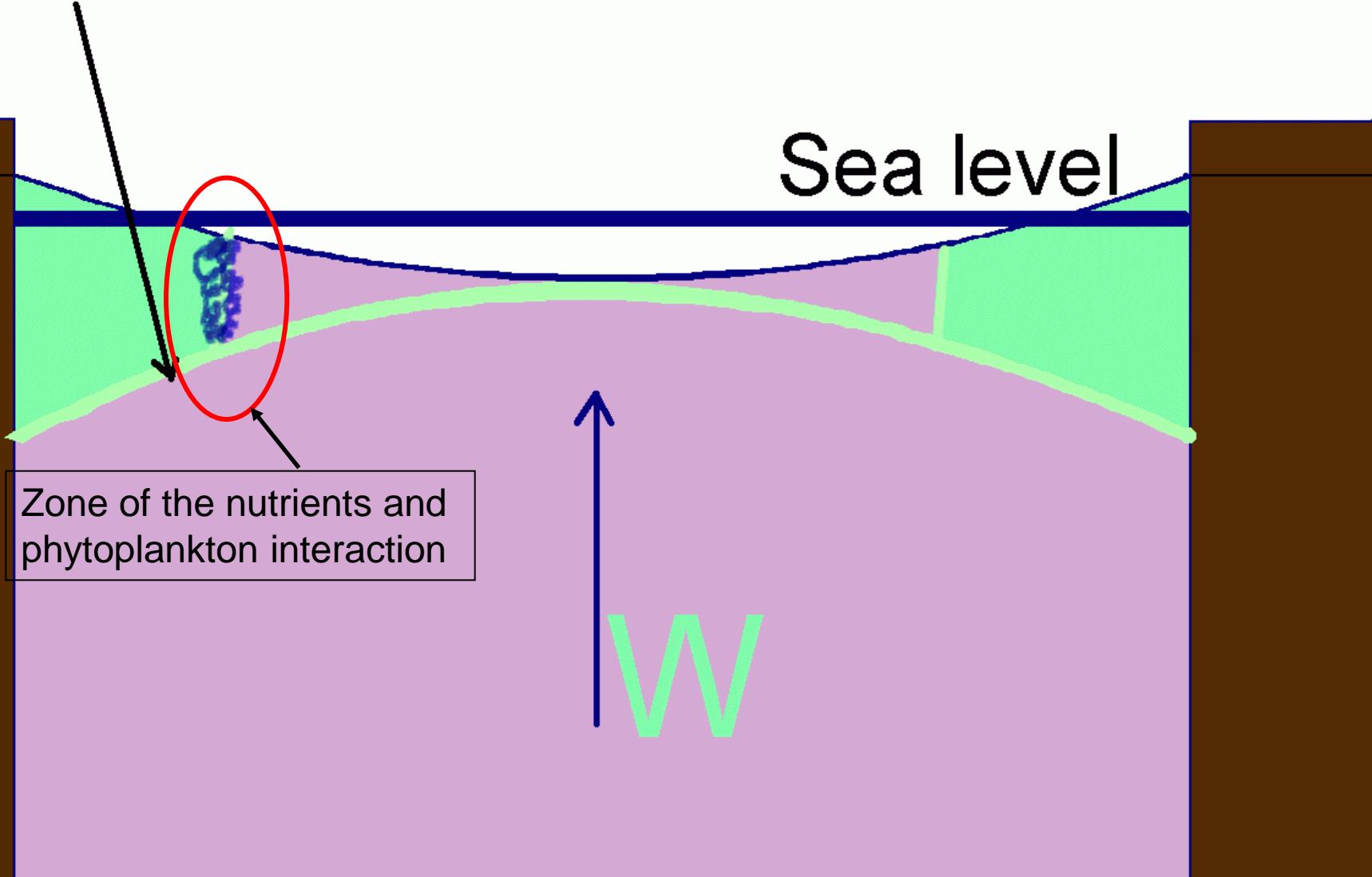




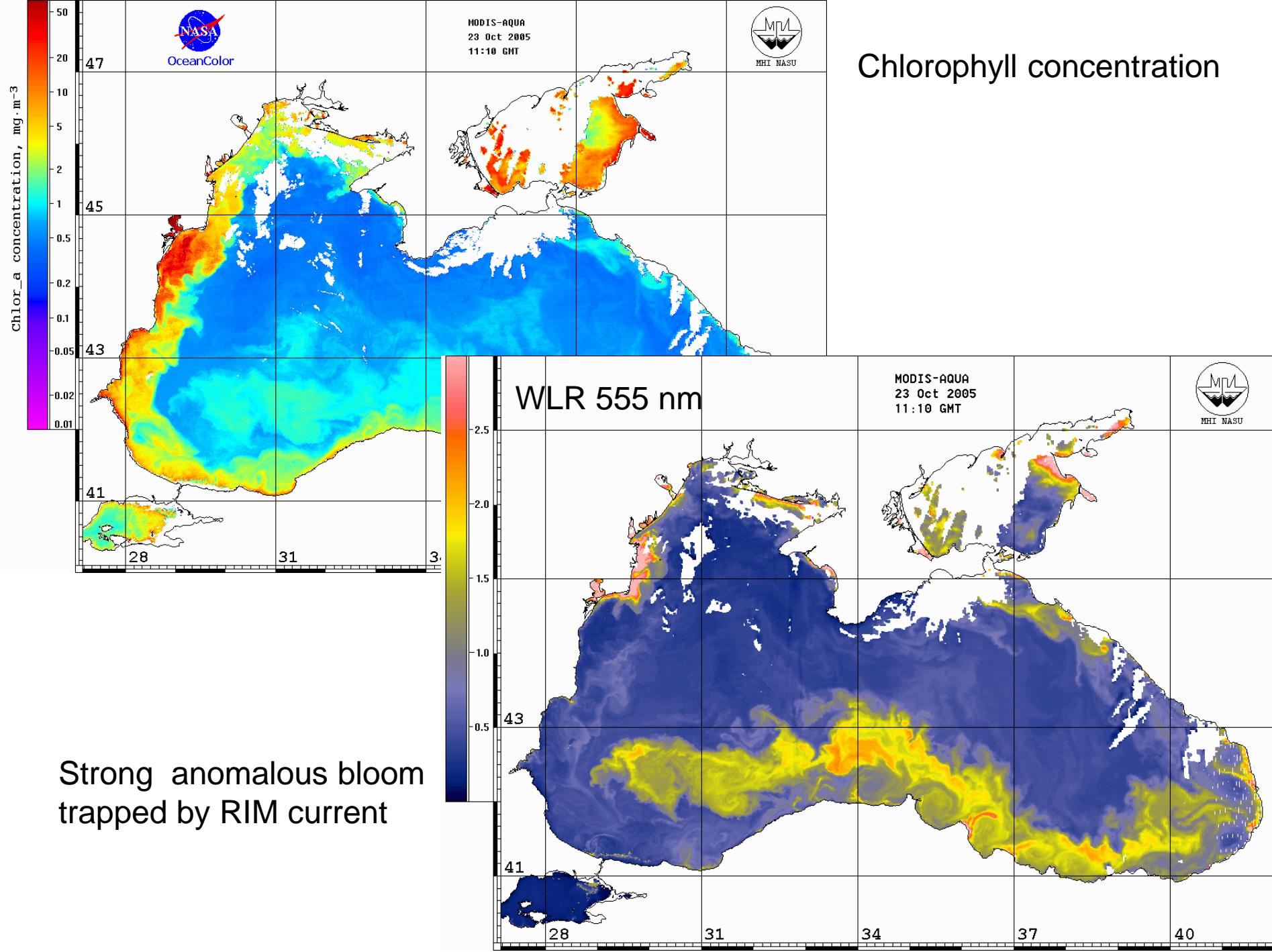
WIND



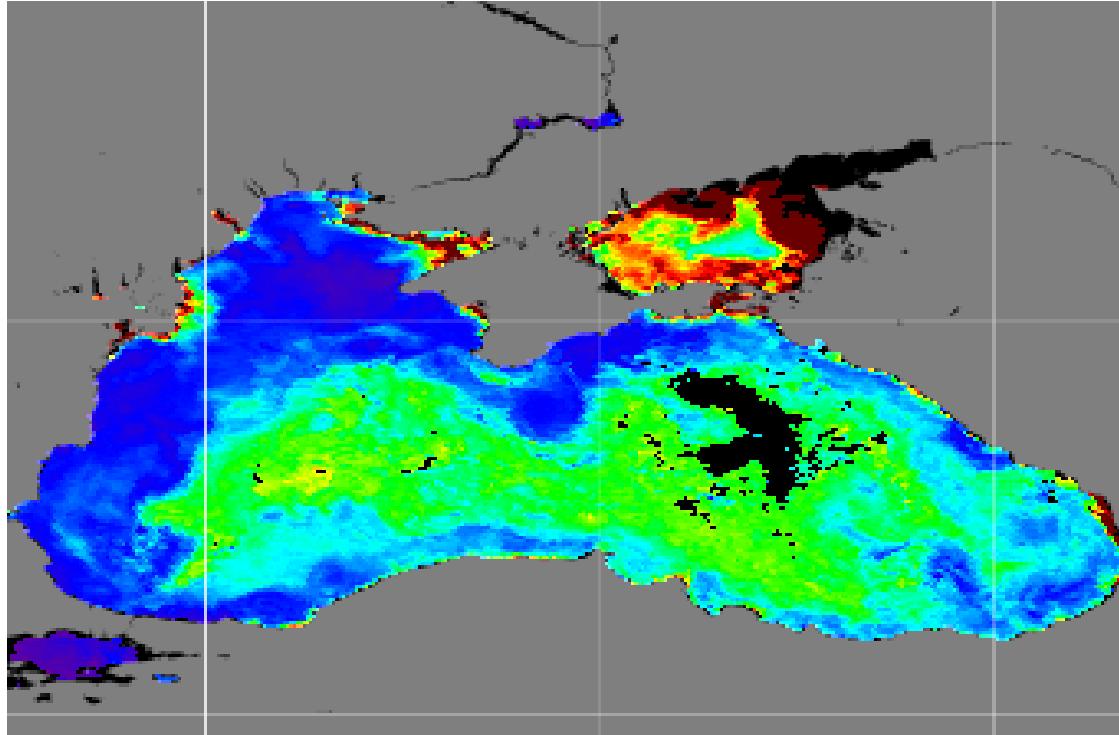
PYCNOCLINE



Zone of the nutrients and
phytoplankton interaction



January 2006



Remote sensing reflectance at 555 nm (sr^{-1})

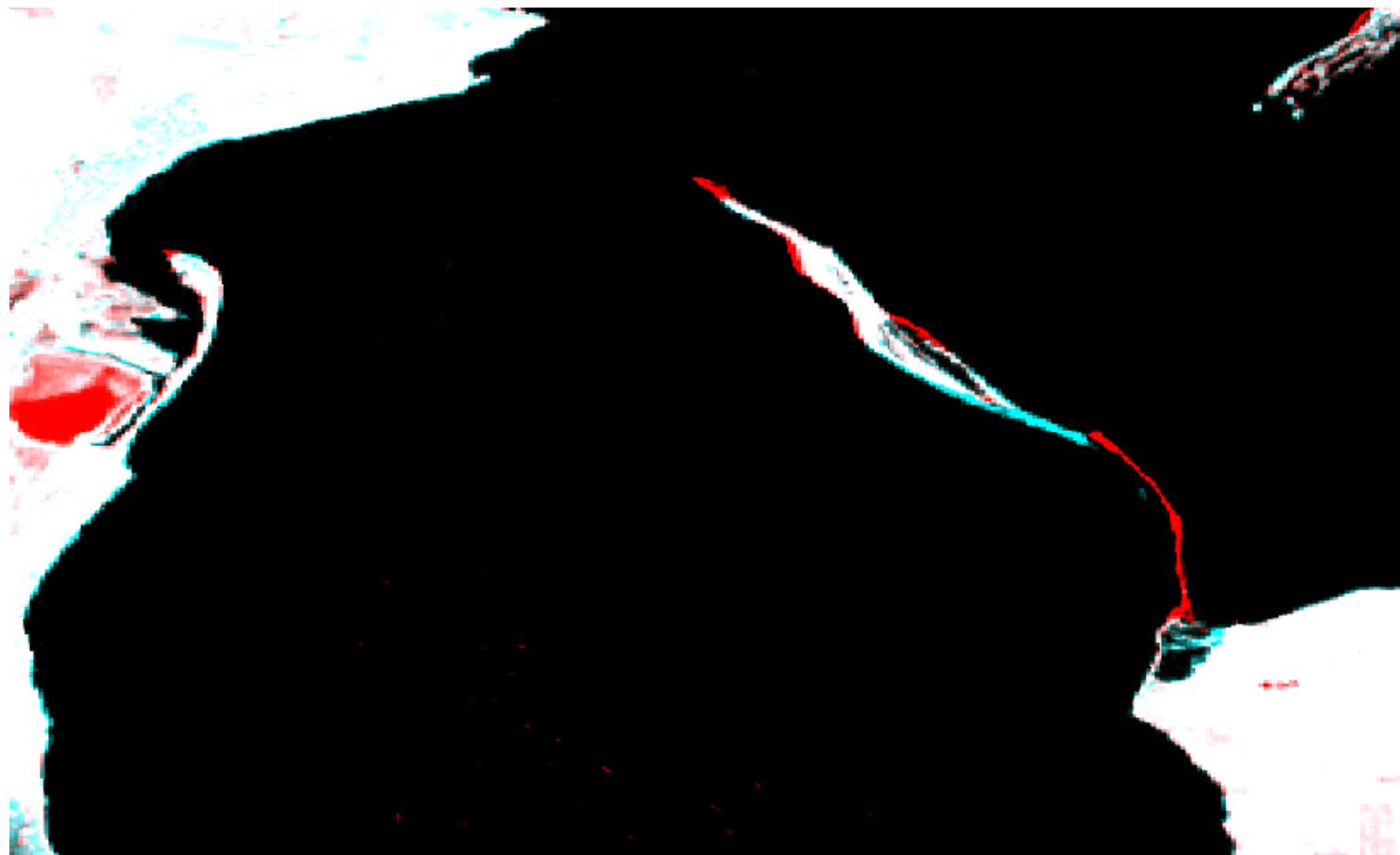


Bloom area in the central part of the sea on monthly mean map

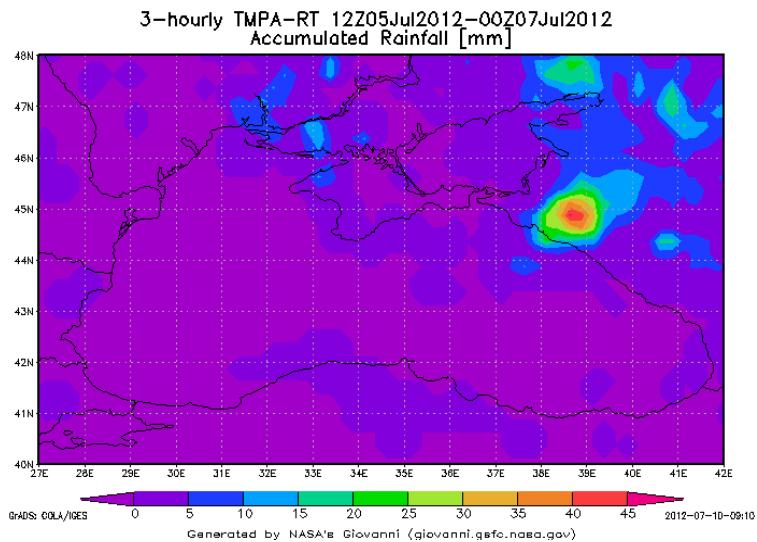
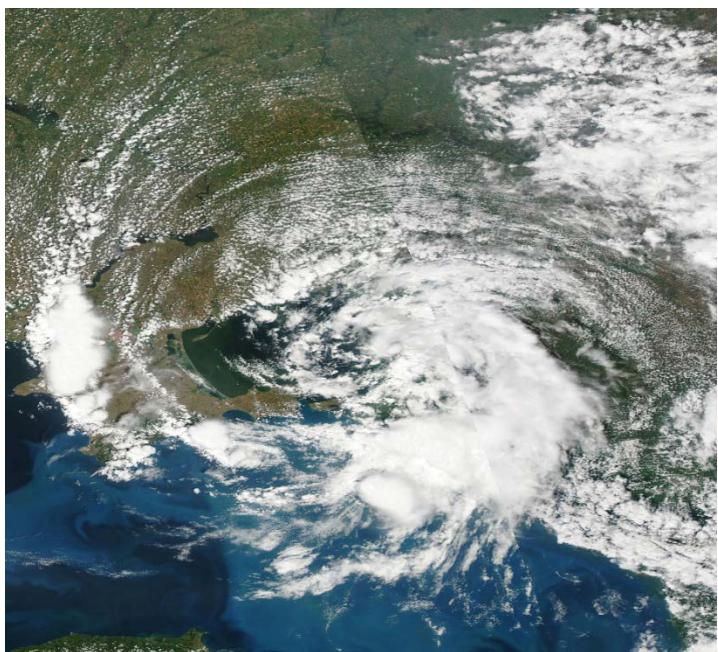
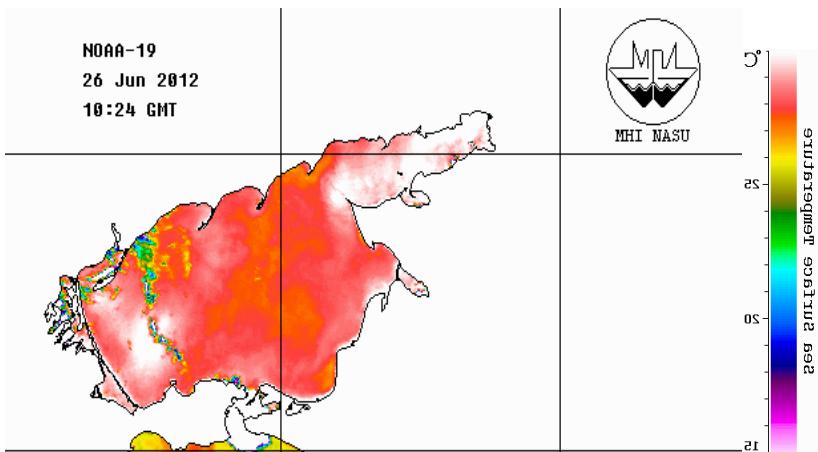
Summary

- Coccolithophore bloom May-July 2012 was the strongest in “satellite optical era”
- Possible reason – anomalous winter mixing and nutrient supply
- Estimated mass of the coccolith was 4×10^{-3} g/liter
- High values of the chl concentration in September 2012 – may be result of the recycling of nutrients
- Strong mixing induced by anomalous atmospheric cyclone in Sept 2005 – led to the winter coccolithophore bloom

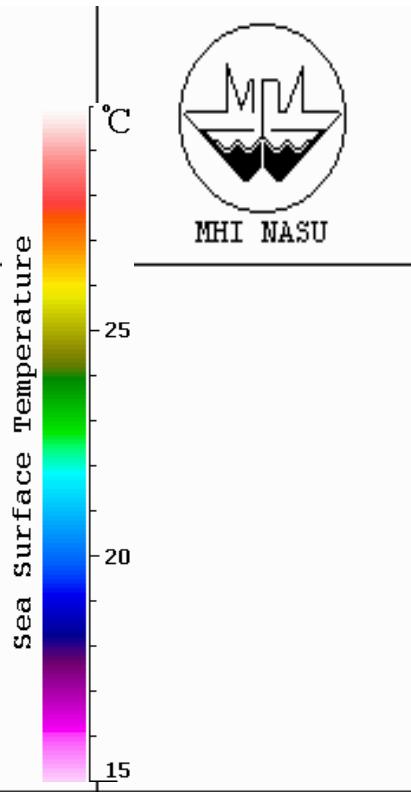
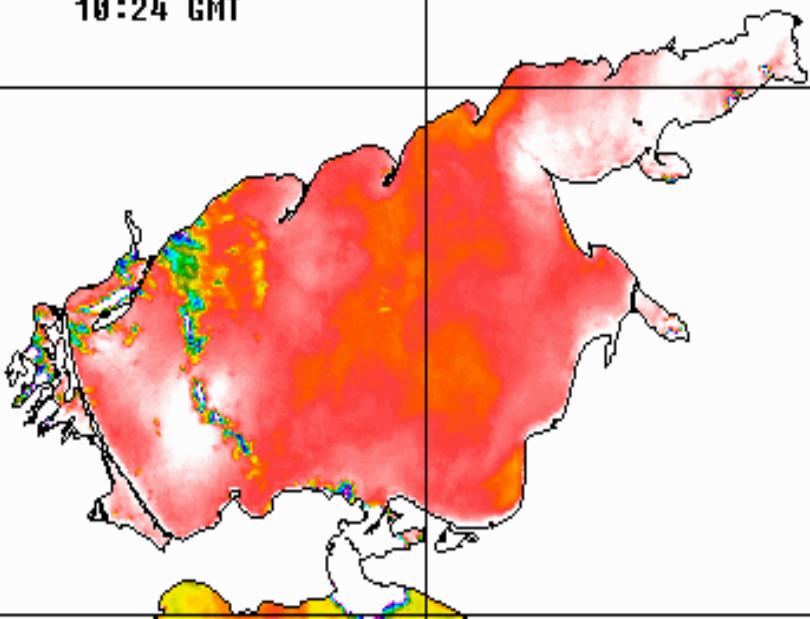
*Coast transformation
30 years*



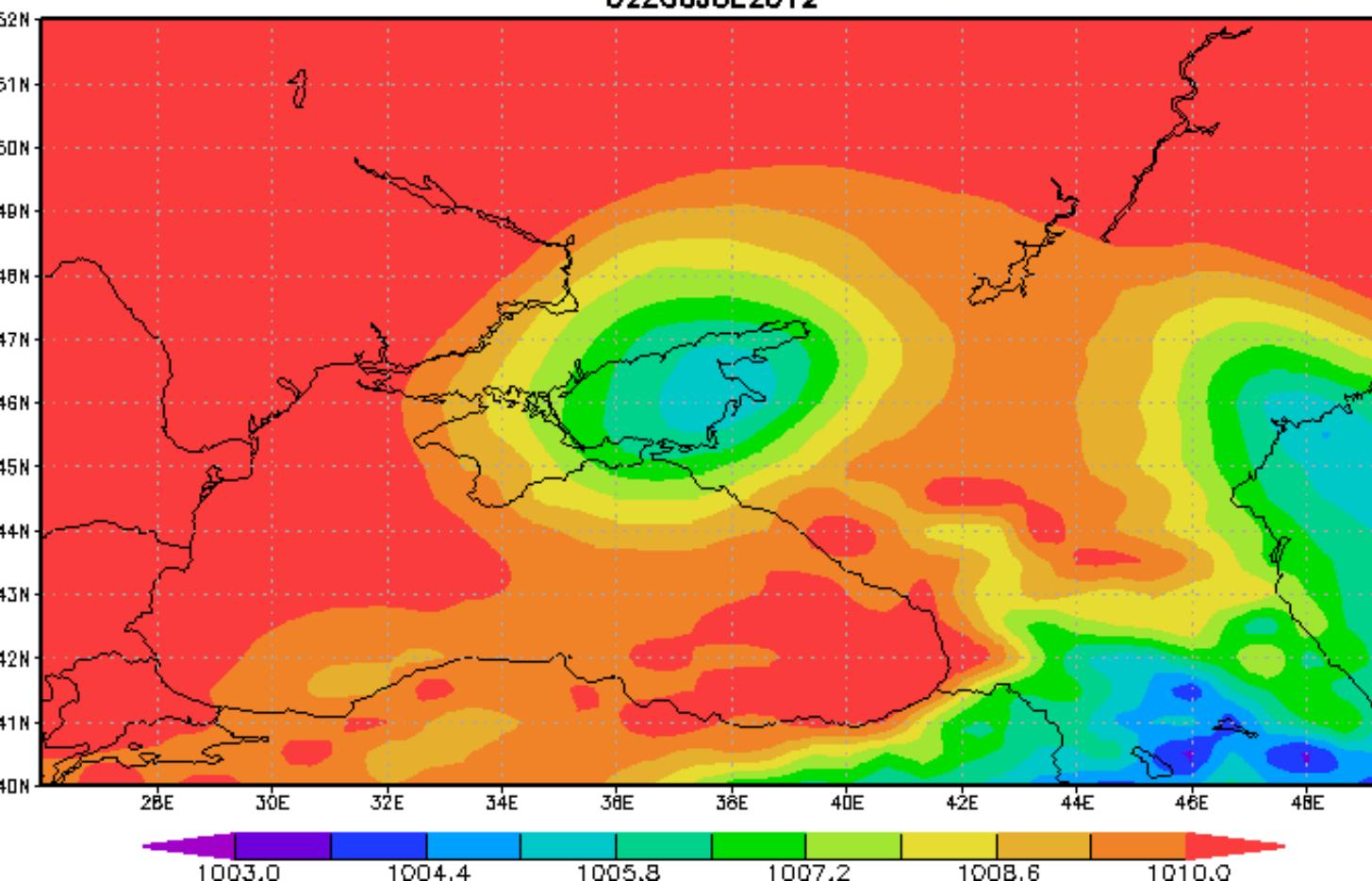
ГИБЕЛЬ РЫБЫ в АЗОВЕ и НАВОДНение в Крымске



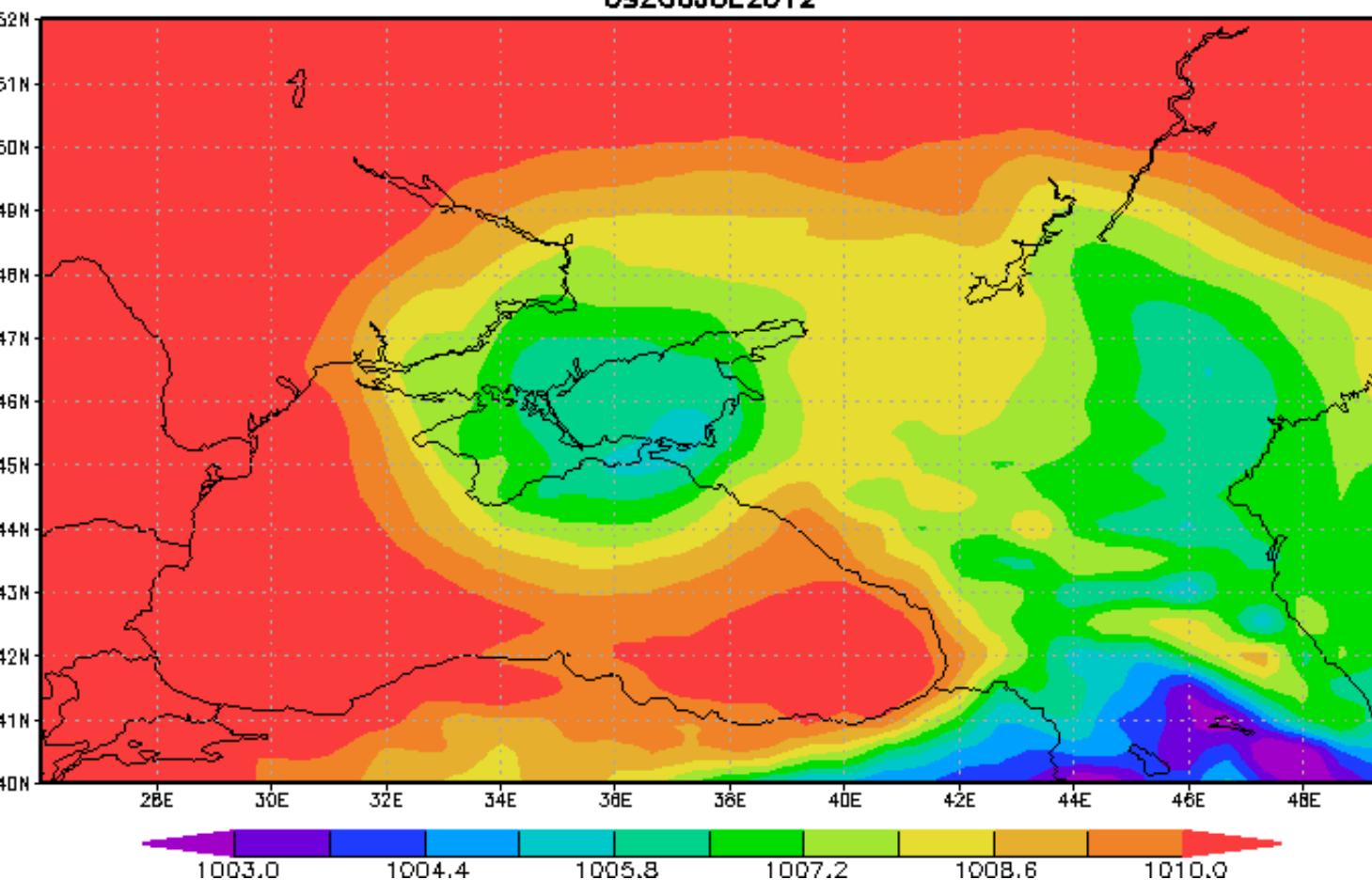
NOAA-19
26 Jun 2012
10:24 GMT



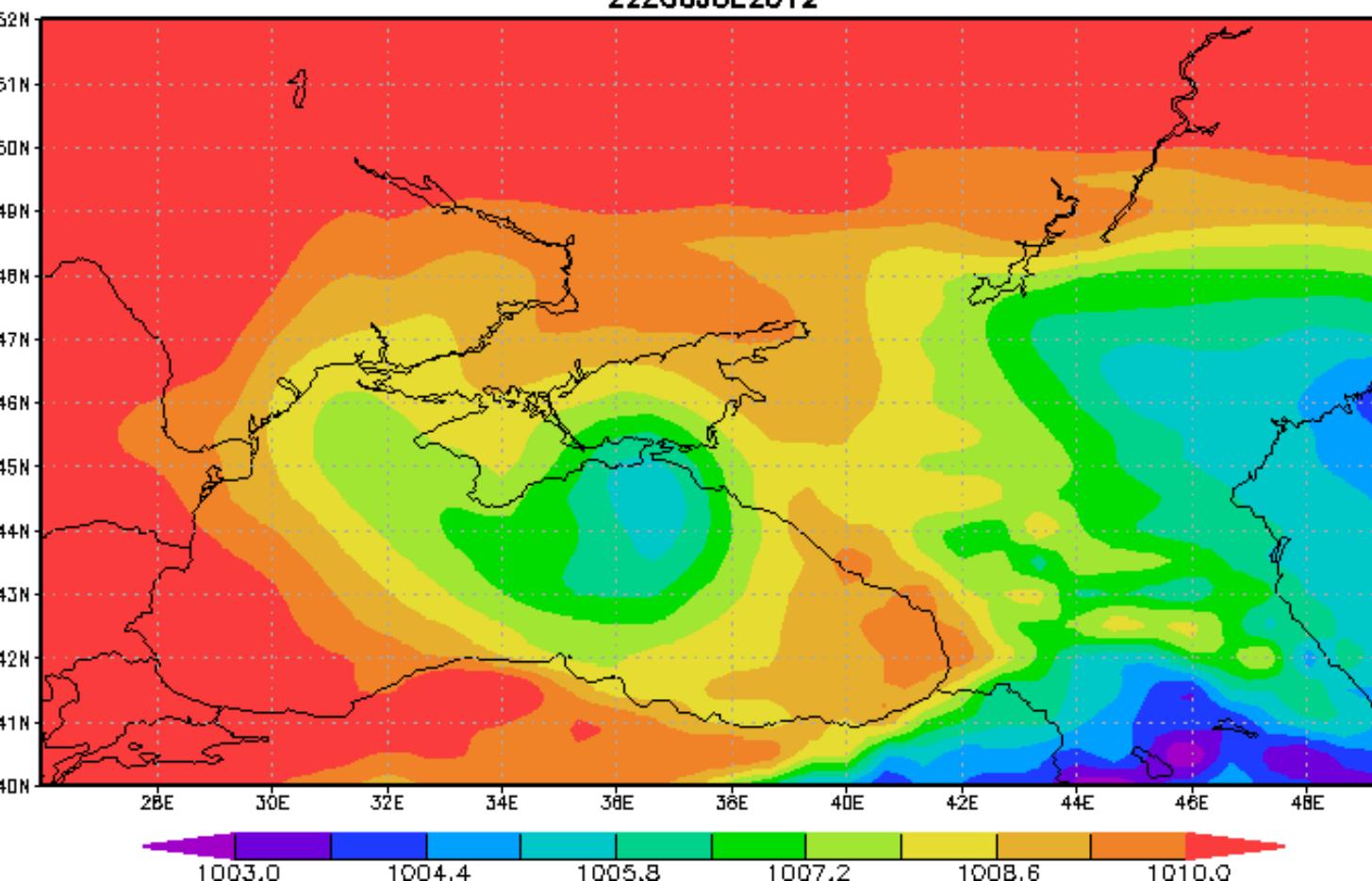
MAT1NXSLV.5.2.0 Sea level pressure [hPa]
02Z06JUL2012

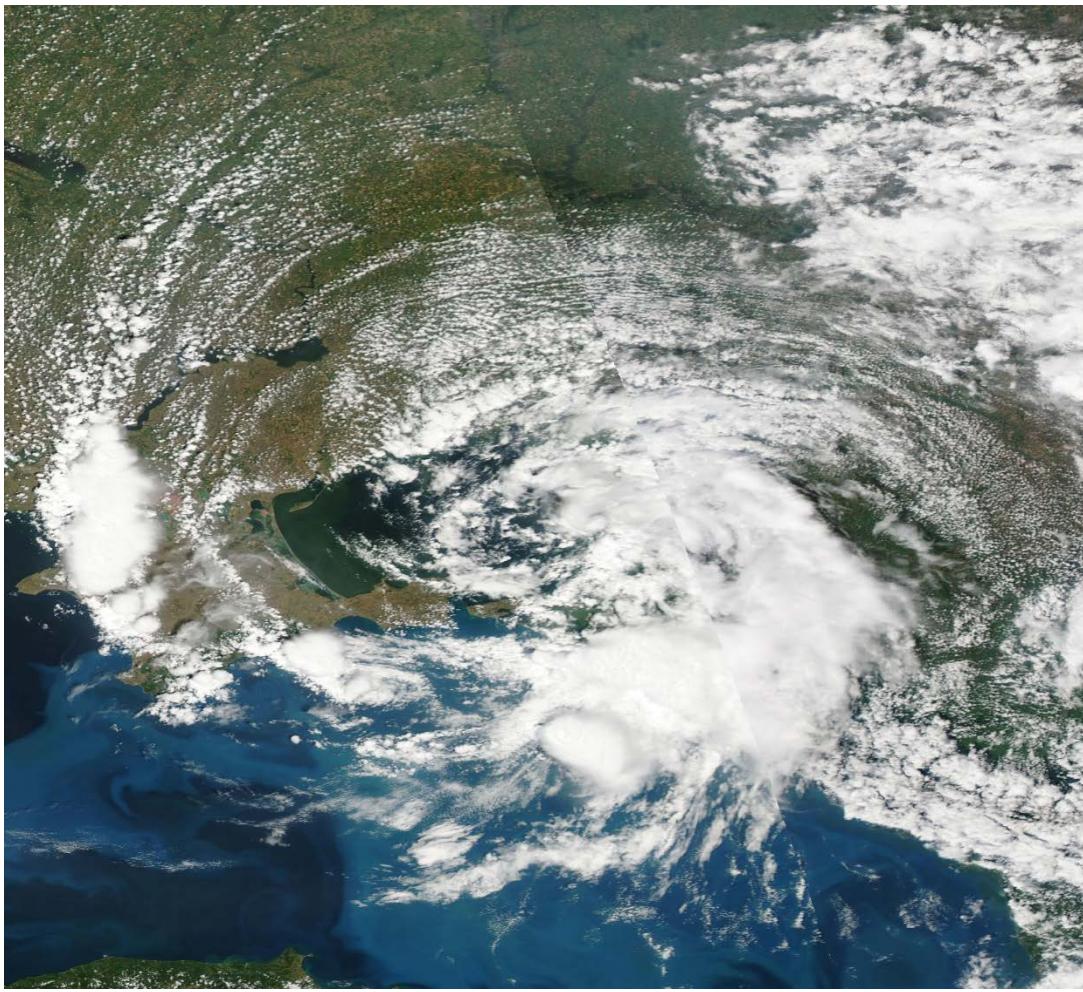


MAT1NXSLV.5.2.0 Sea level pressure [hPa]
09Z06JUL2012

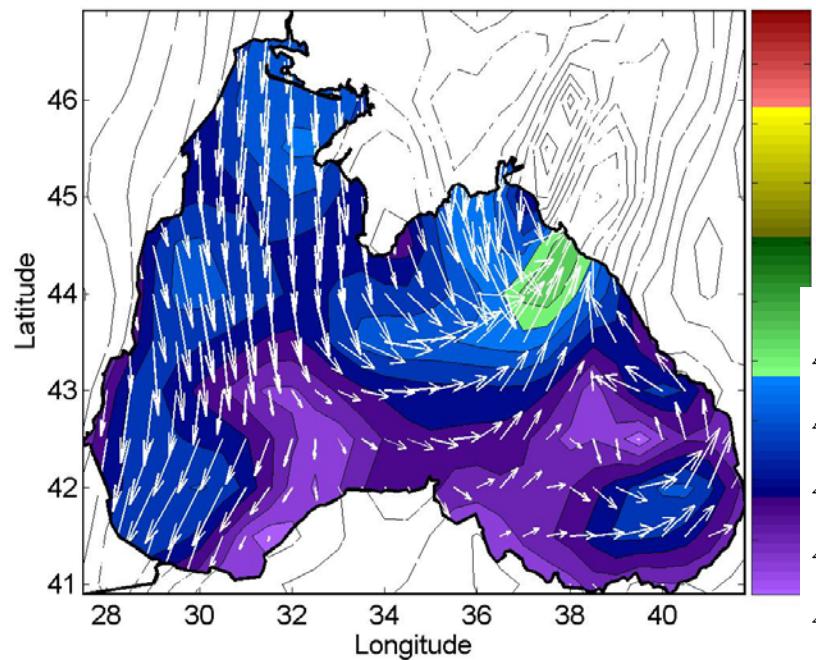


MAT1NXSLV.5.2.0 Sea level pressure [hPa]
22Z06JUL2012

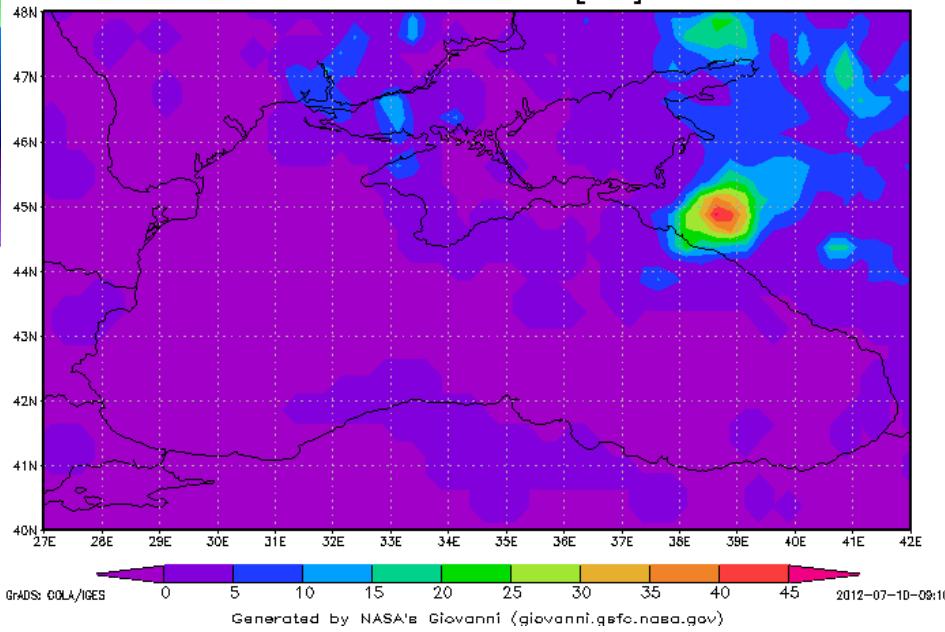




Wind speed 2012070606



3-hourly TMPA-RT 12Z05Jul2012–00Z07Jul2012
Accumulated Rainfall [mm]

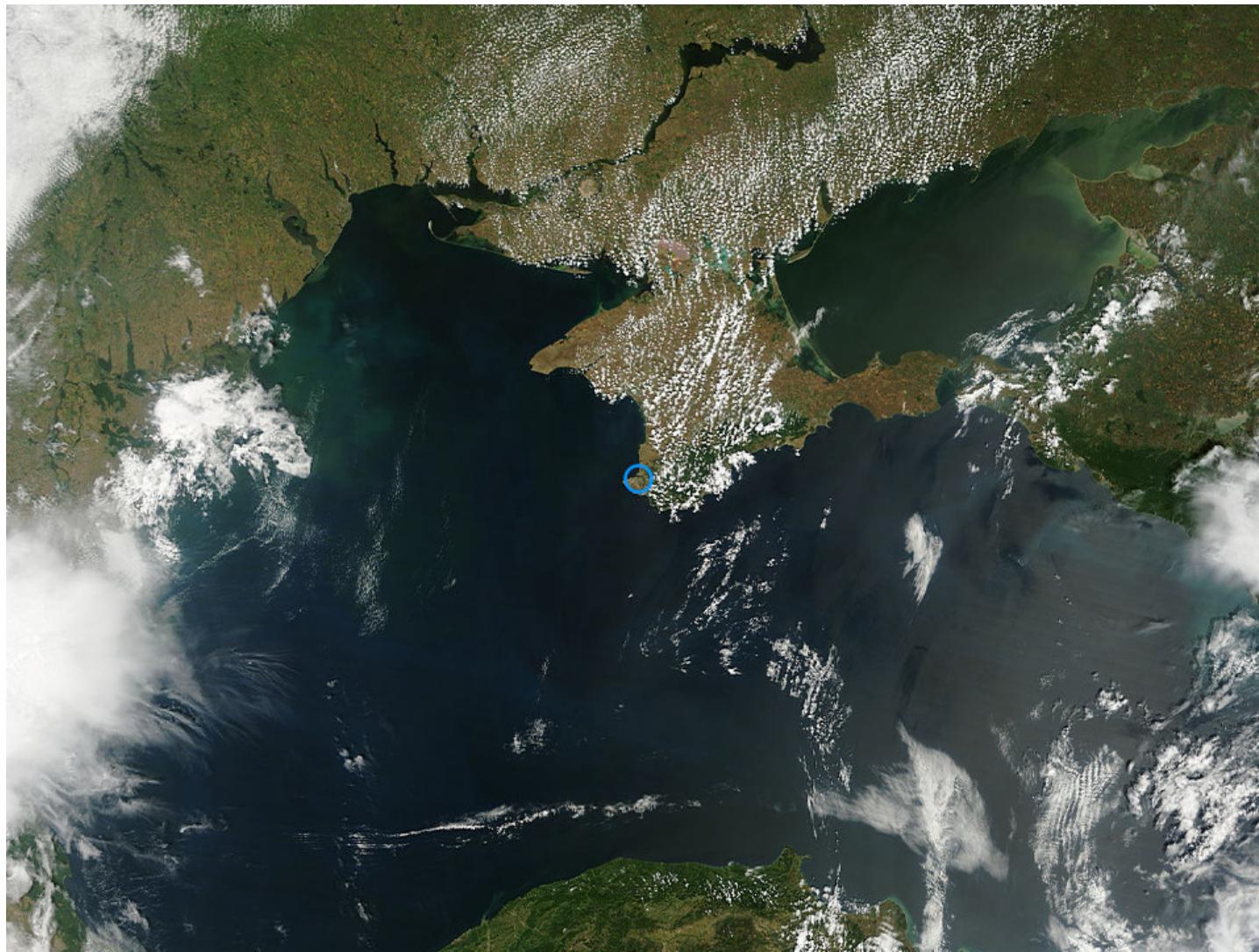


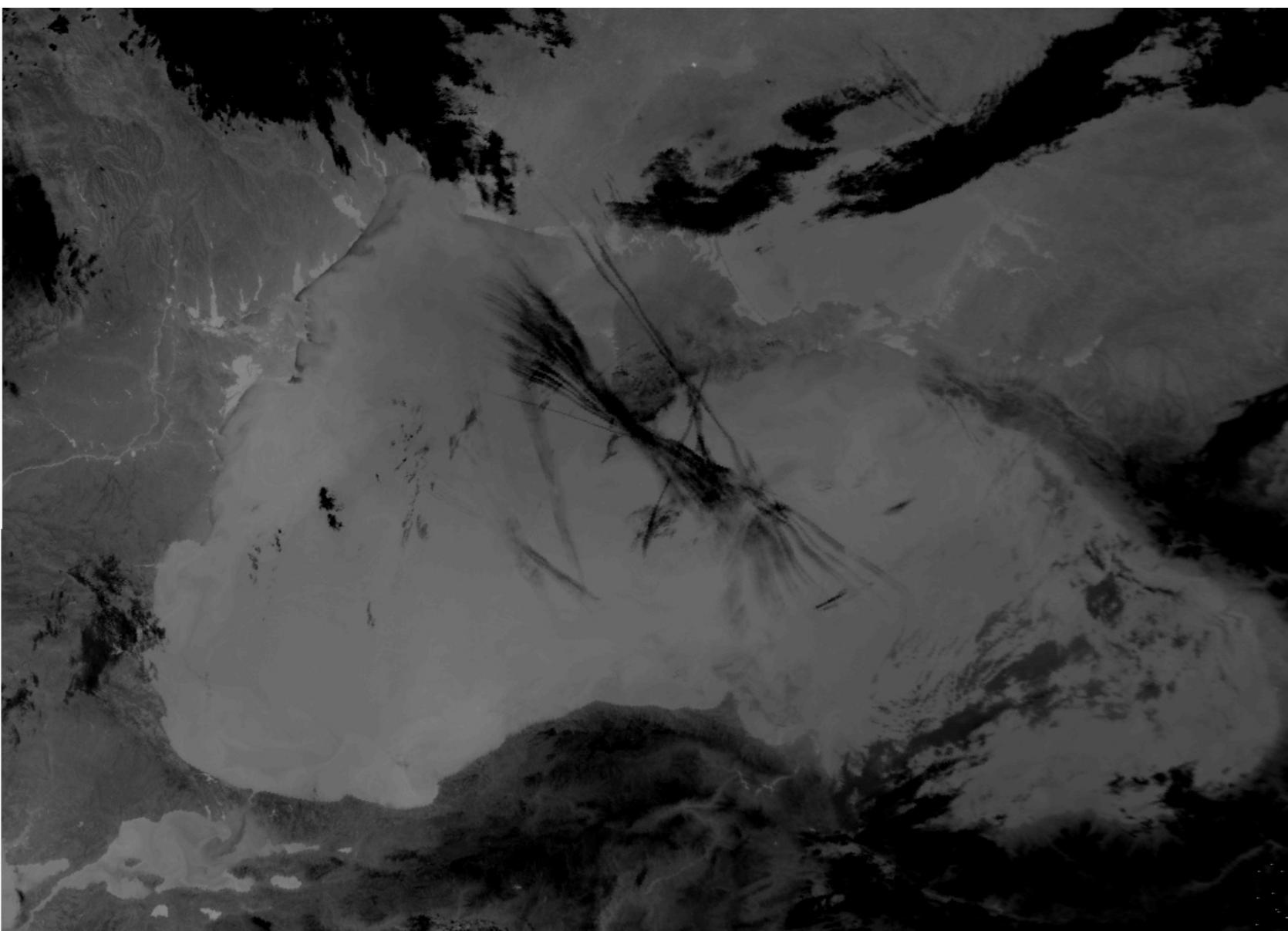
GrADS: GOLA/IGES

0 5 10 15 20 25 30 35 40 45 2012-07-10-09:10

Generated by NASA's Giovanni (giovanni.gsfc.nasa.gov)

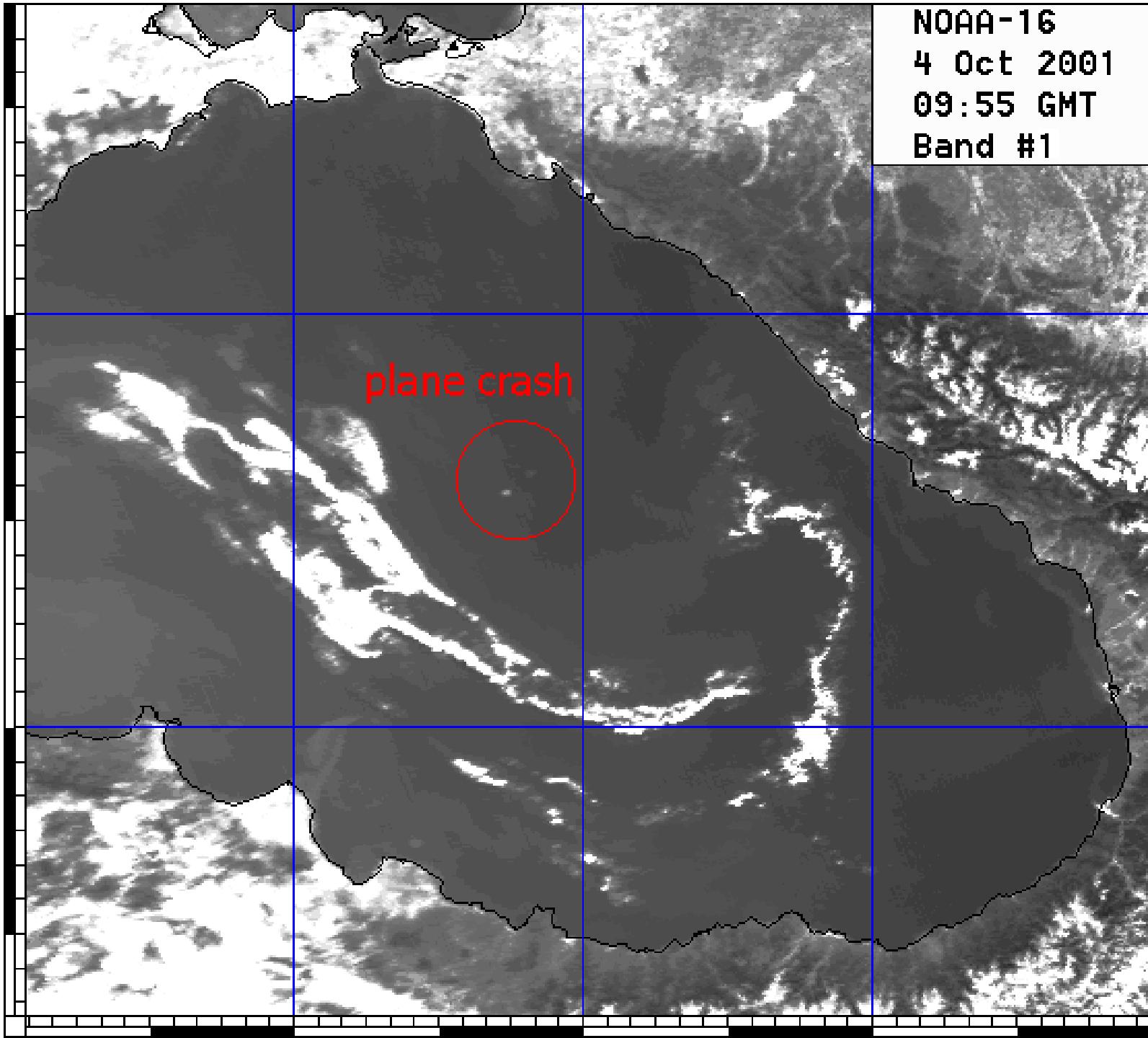
AIRPLANES



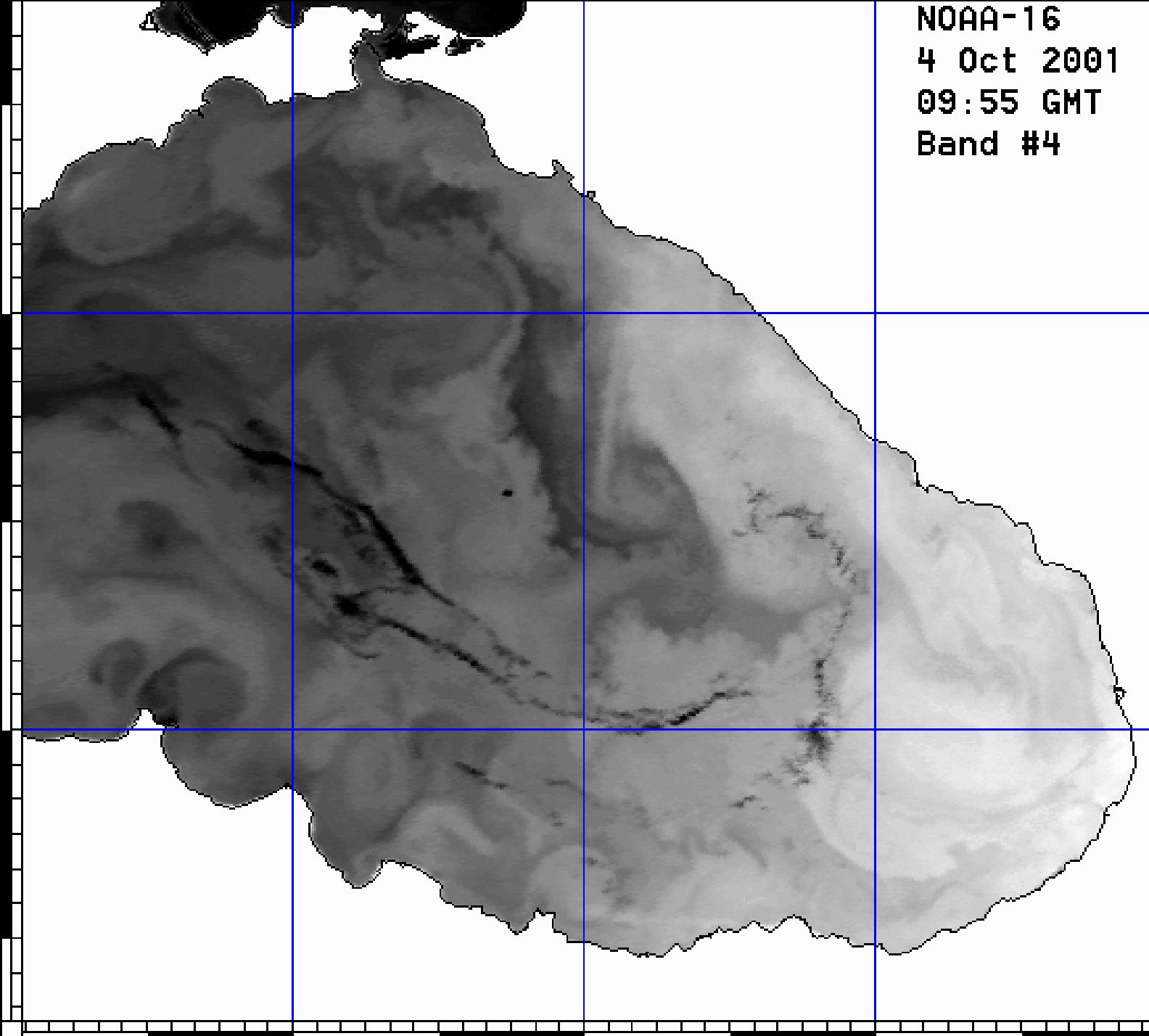


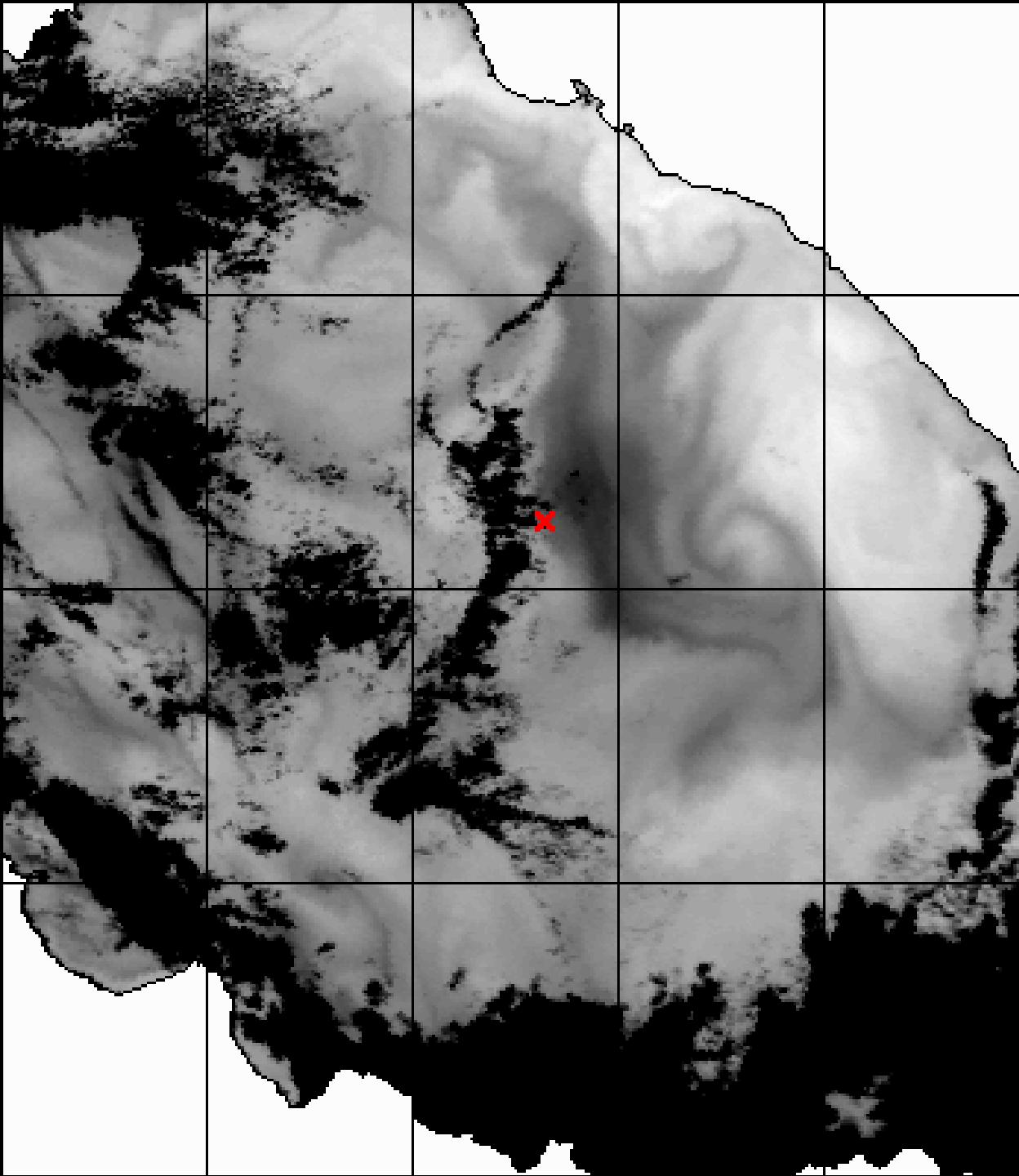
NOAA-16
4 Oct 2001
09:55 GMT
Band #1

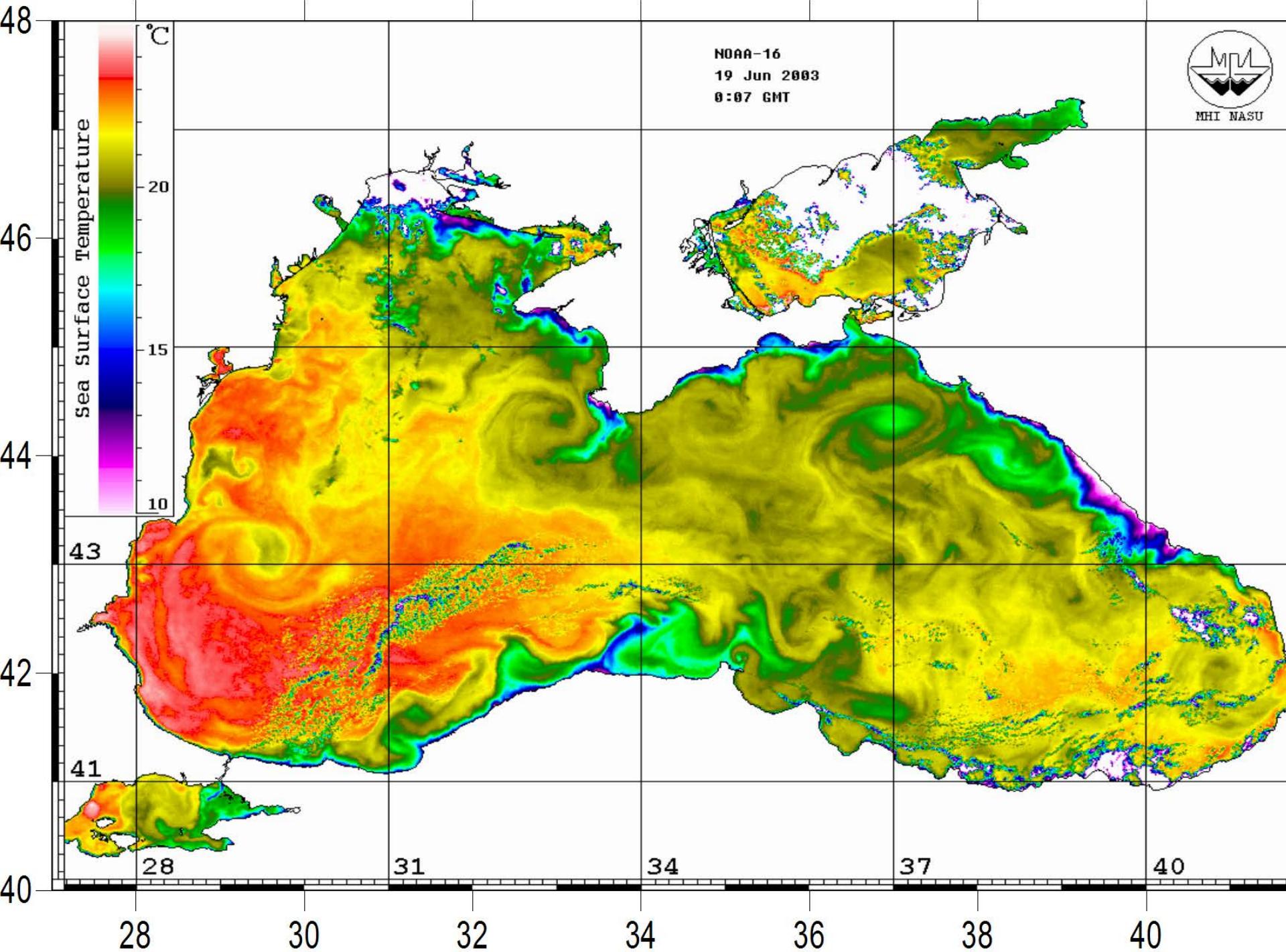
plane crash

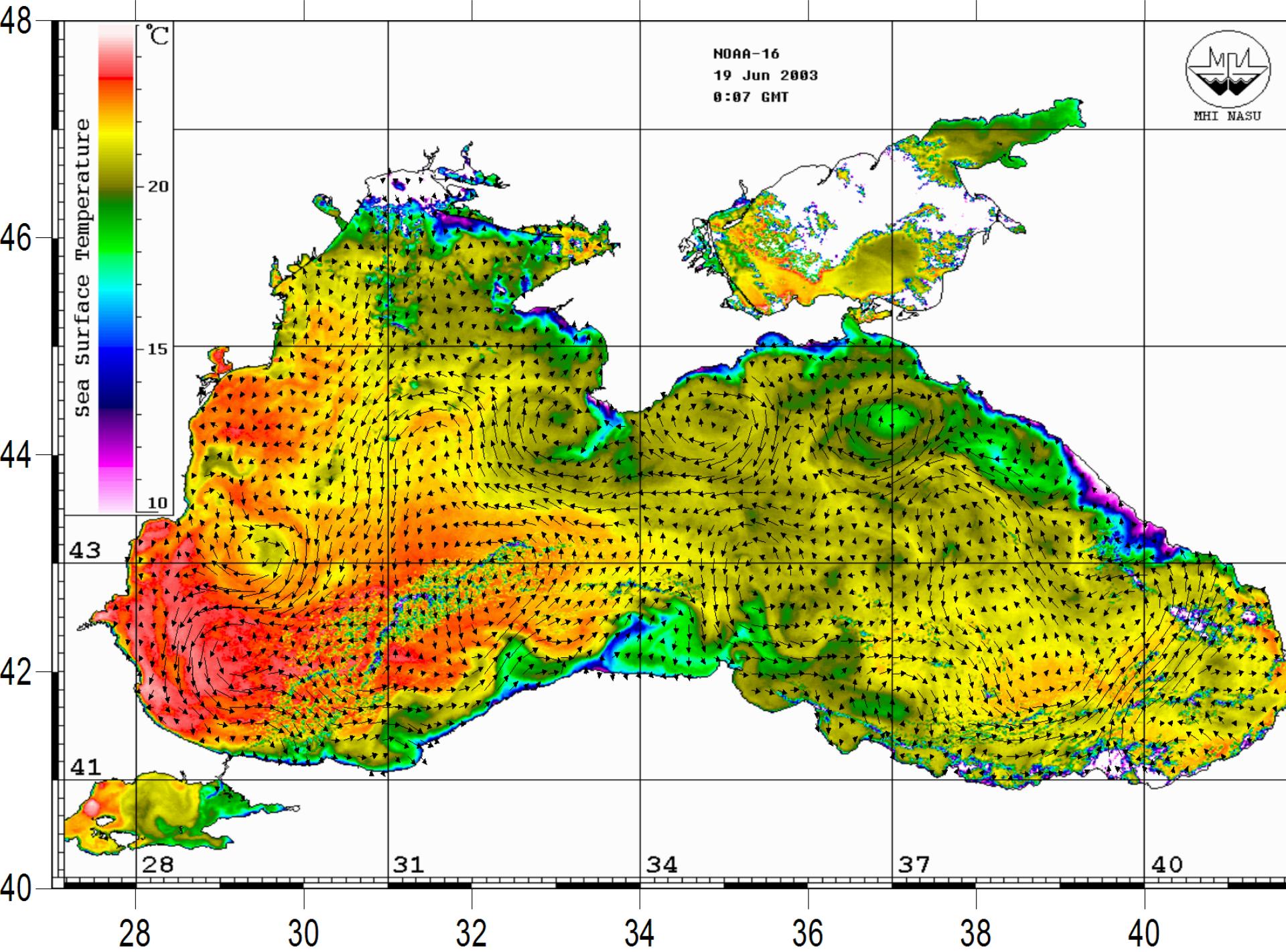


NOAA-16
4 Oct 2001
09:55 GMT
Band #4

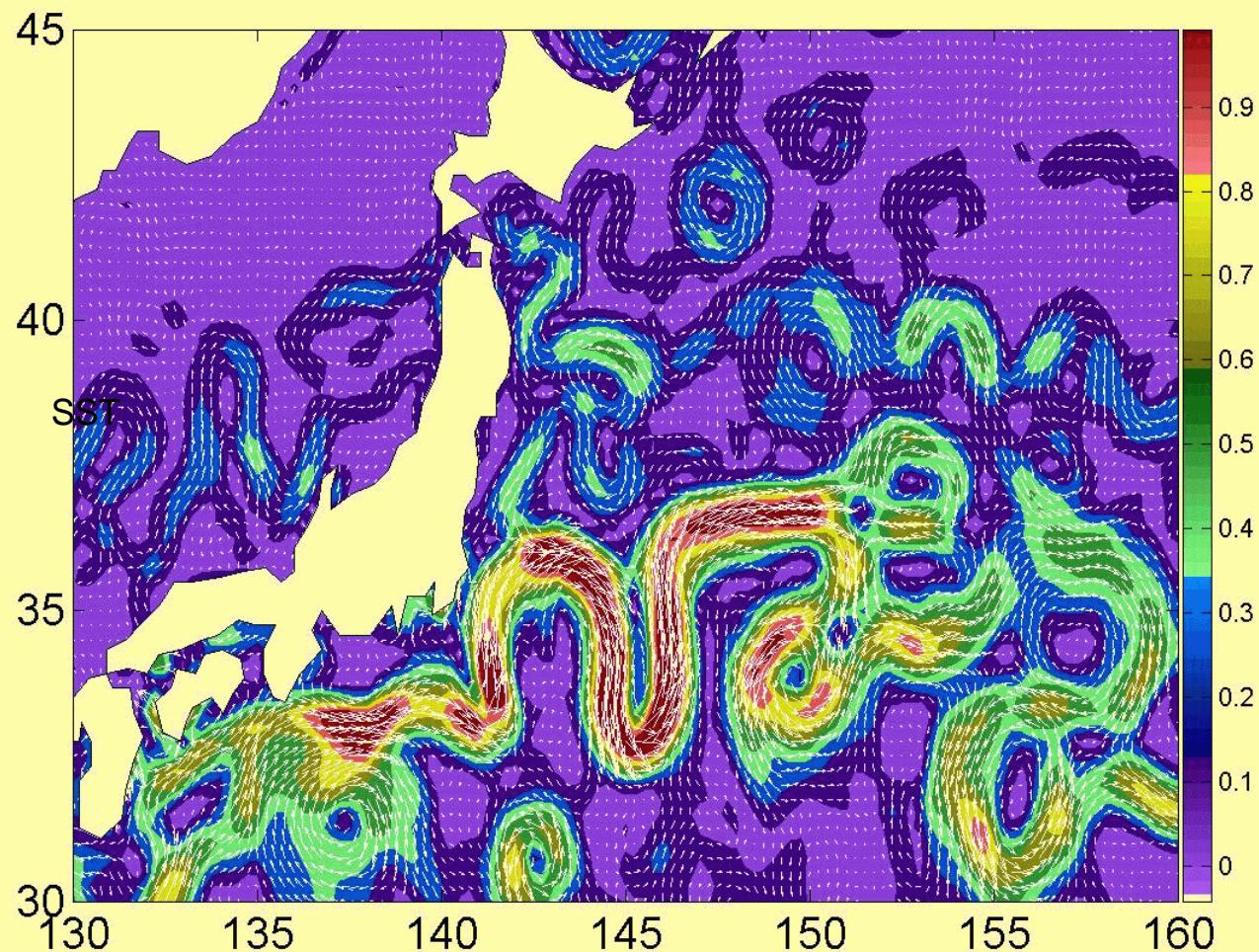




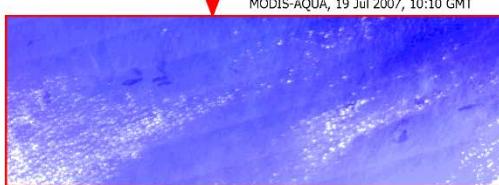
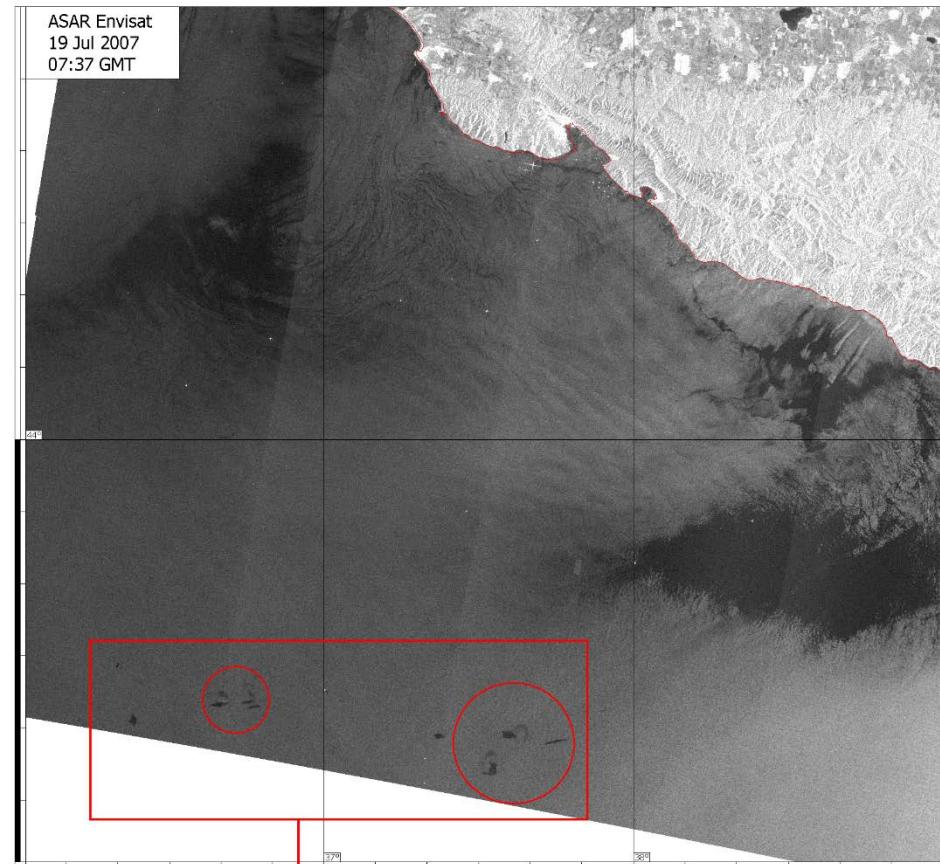




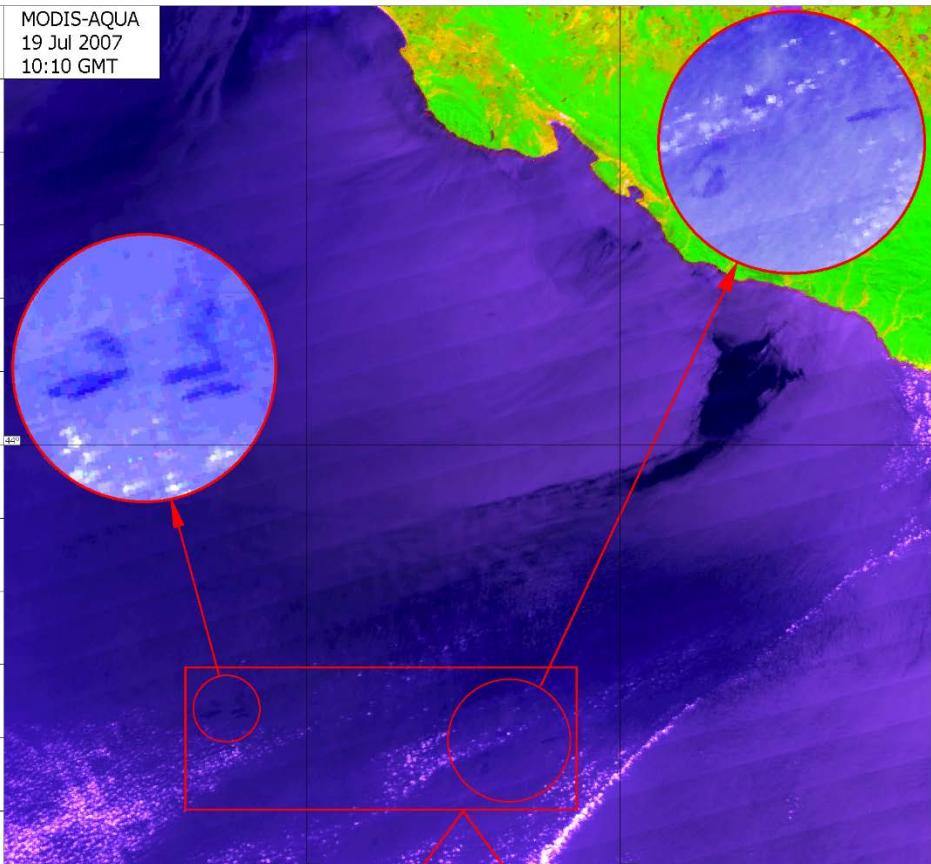
2007-12-26-00



ASAR Envisat
19 Jul 2007
07:37 GMT

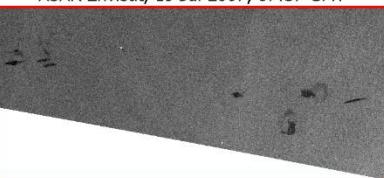


MODIS-AQUA, 19 Jul 2007, 10:10 GMT



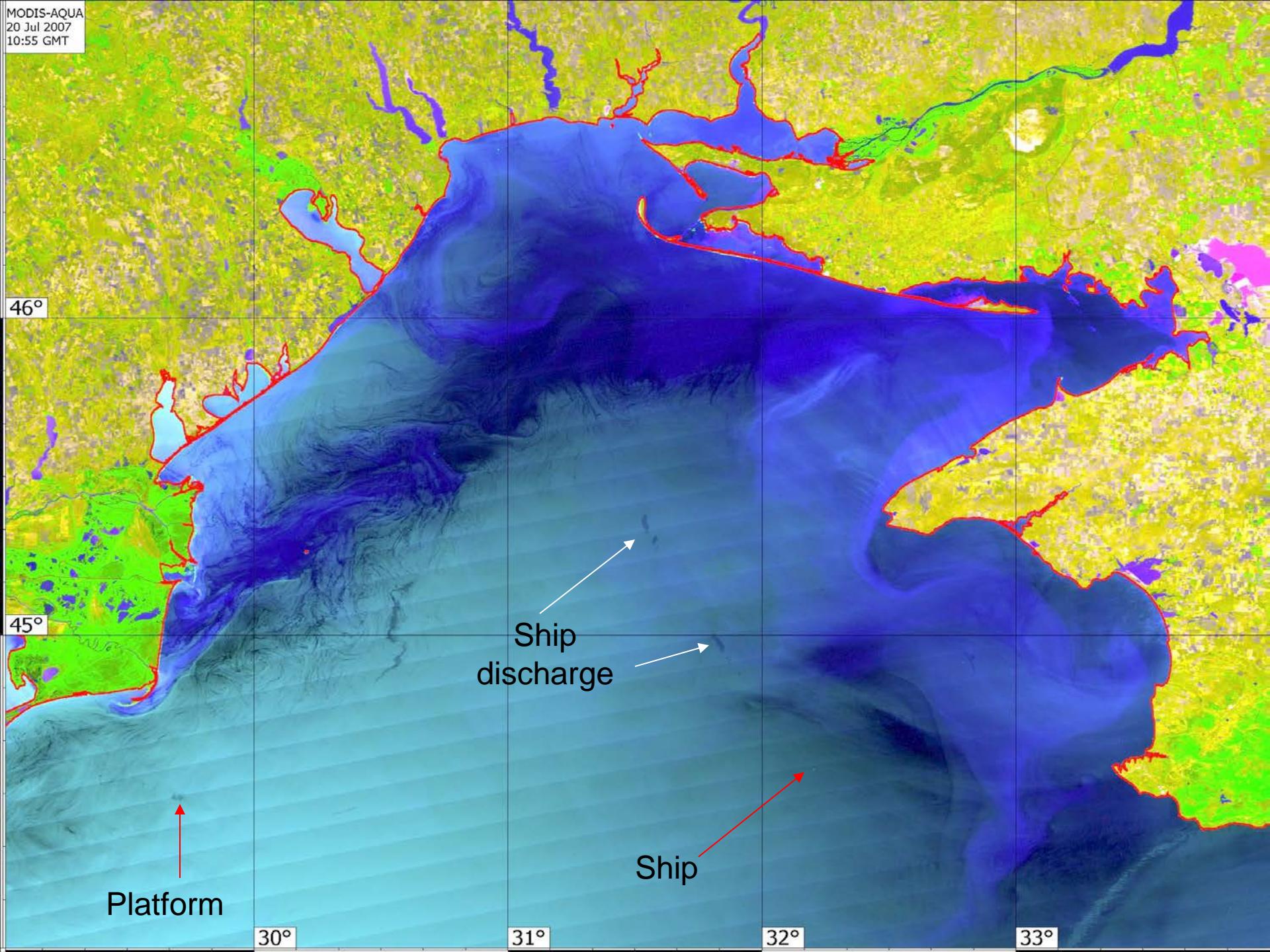
ASAR Envisat, 19 Jul 2007, 07:37 GMT

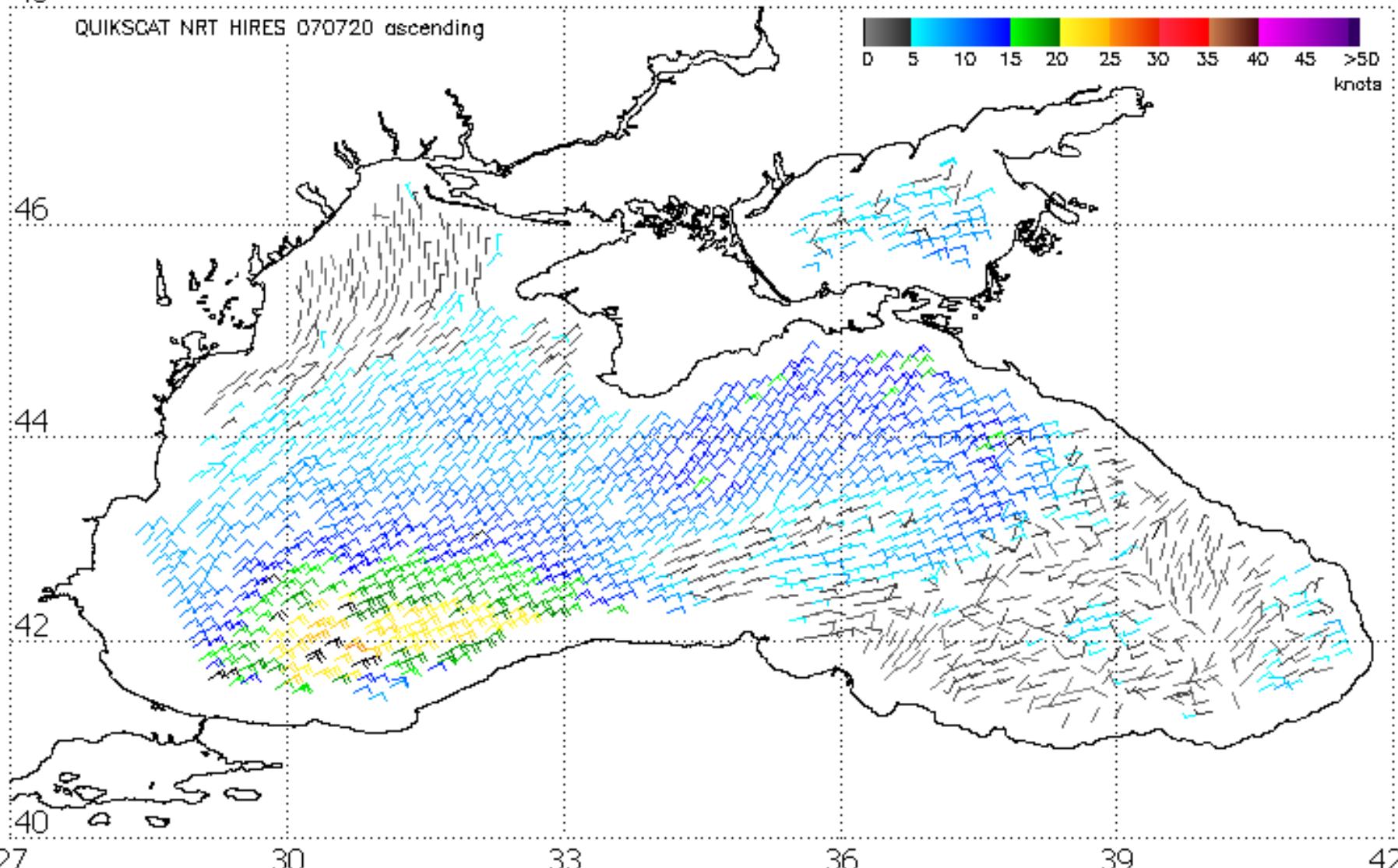
MODIS-AQUA, 19 Jul 2007, 10:10 GMT



ASAR and MODIS (in sun glitter pattern) data detect oil pollution by ship discharge

MODIS-AQUA
20 Jul 2007
10:55 GMT

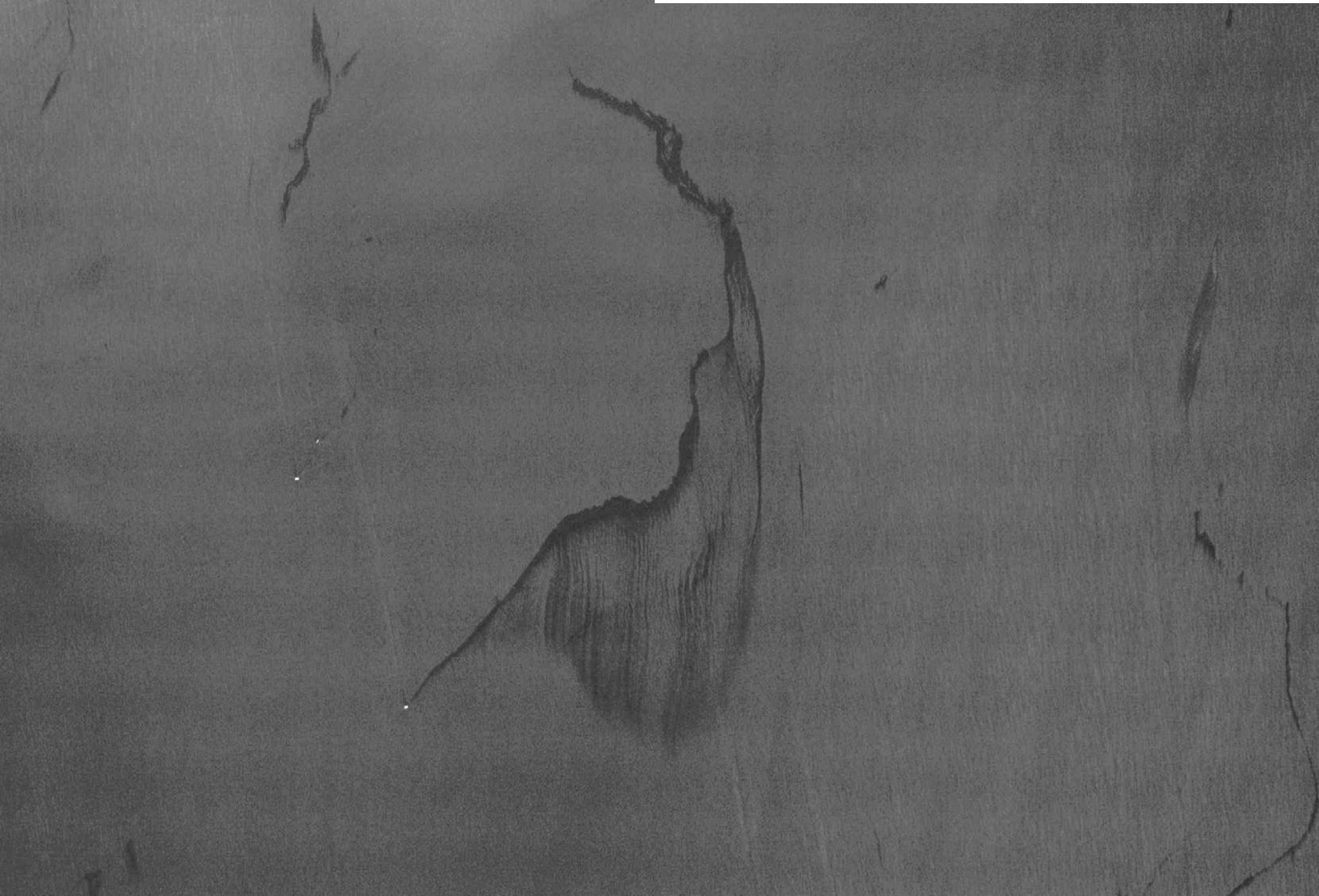




Note: 1) Times are GMT 2)Times correspond to 50N at right swath edge - time is right swath for overlapping swaths at 50N
3)Data buffer is 24 hrs for 070720 4)Black bars indicate possible rain contamination

NOAA/NESDIS/Office of Research and Applications

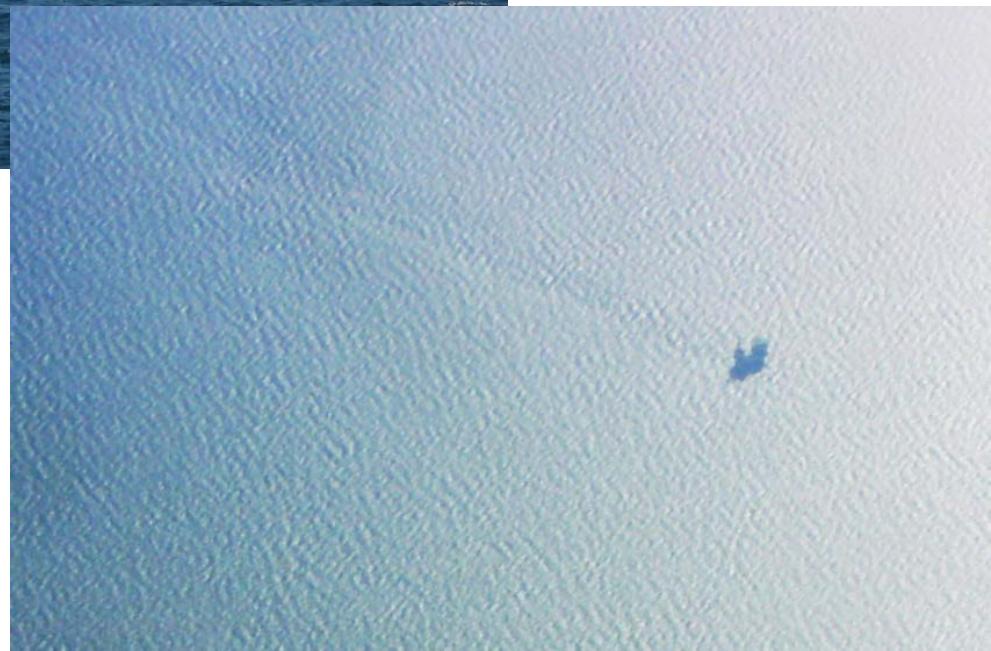
**Oil spill pollutions, Black Sea,
Romanian oil platforms.
ASTER image**

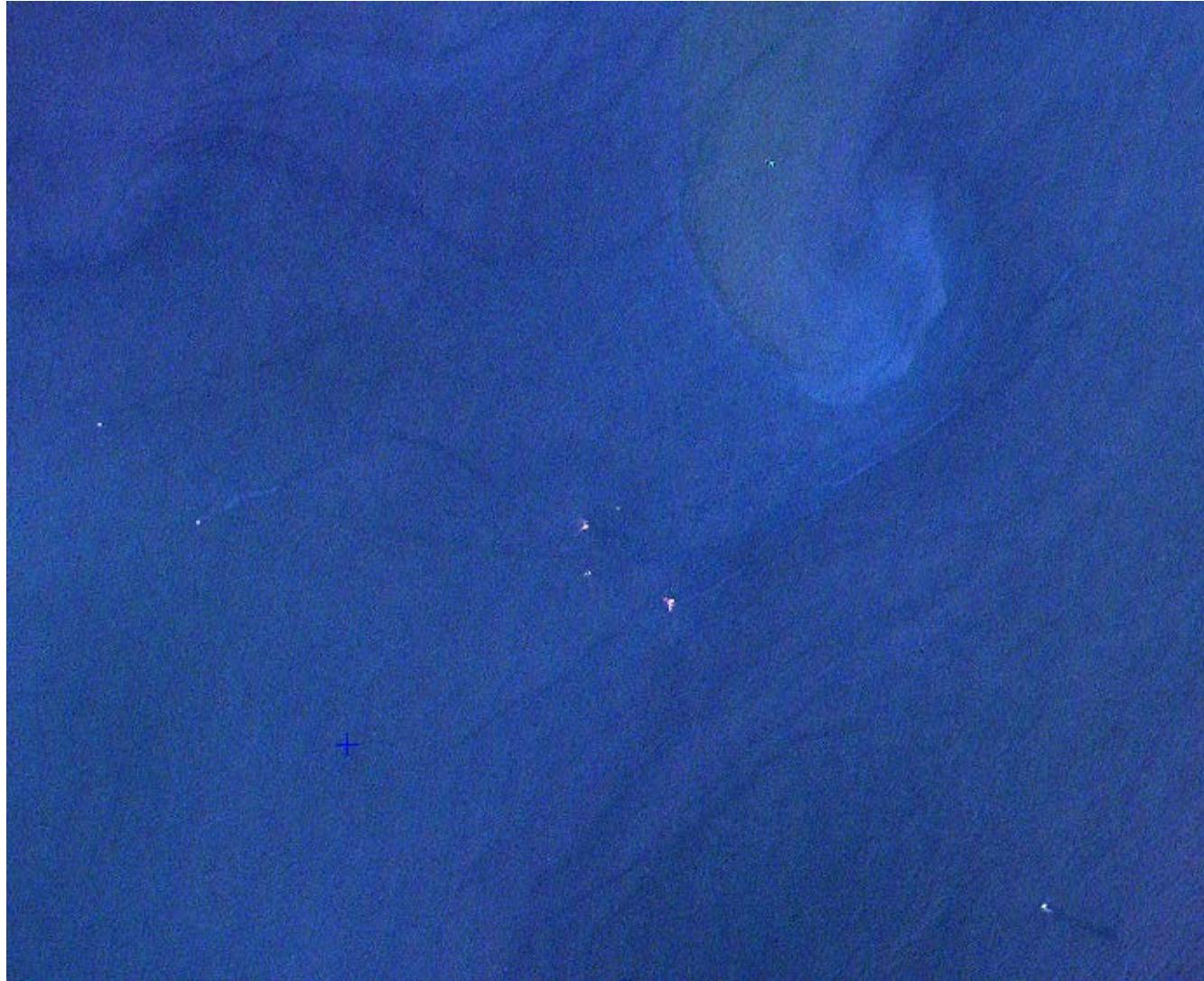


Platform



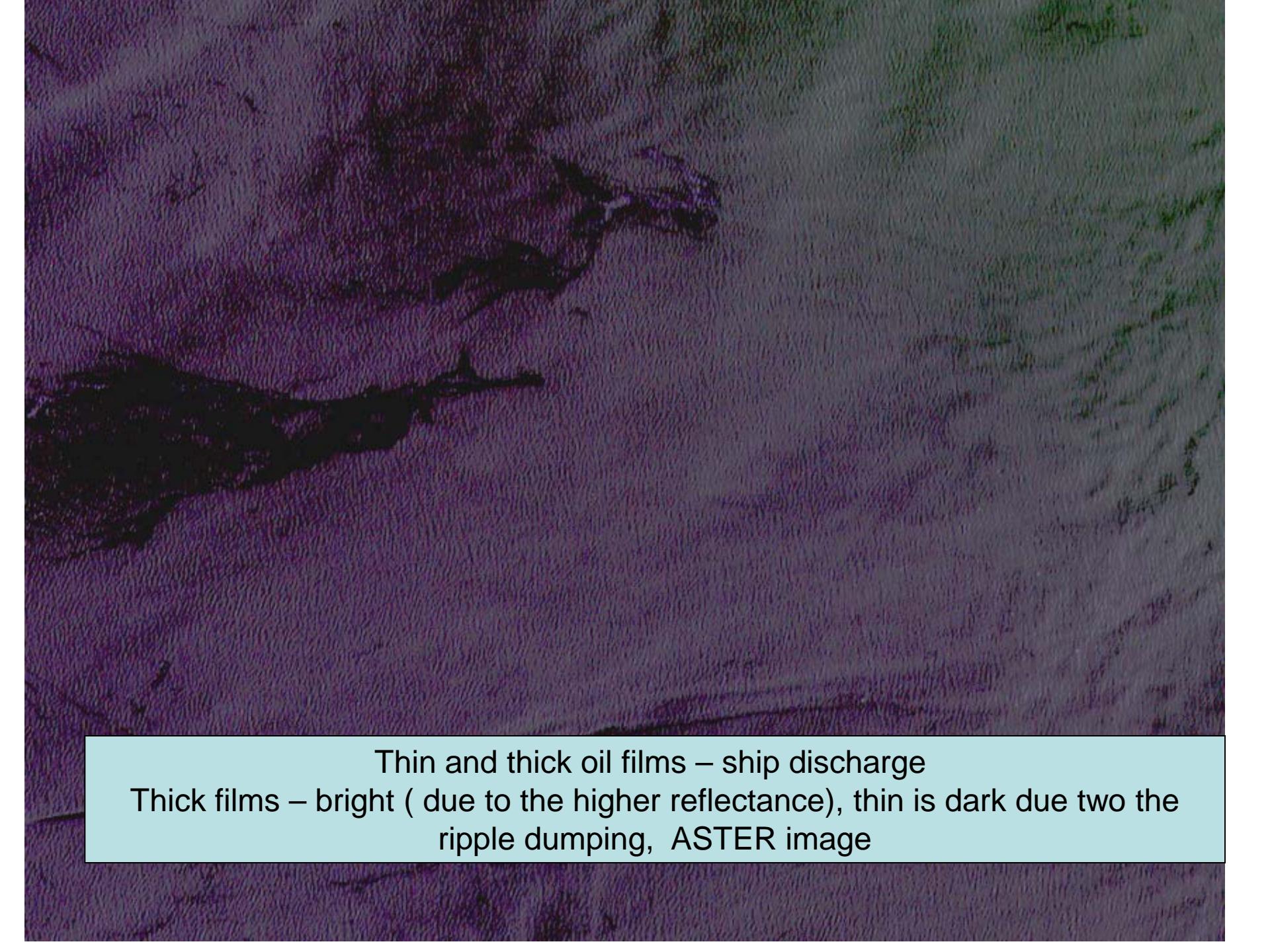
Airplane foto of the platform
with oil slick , 2008





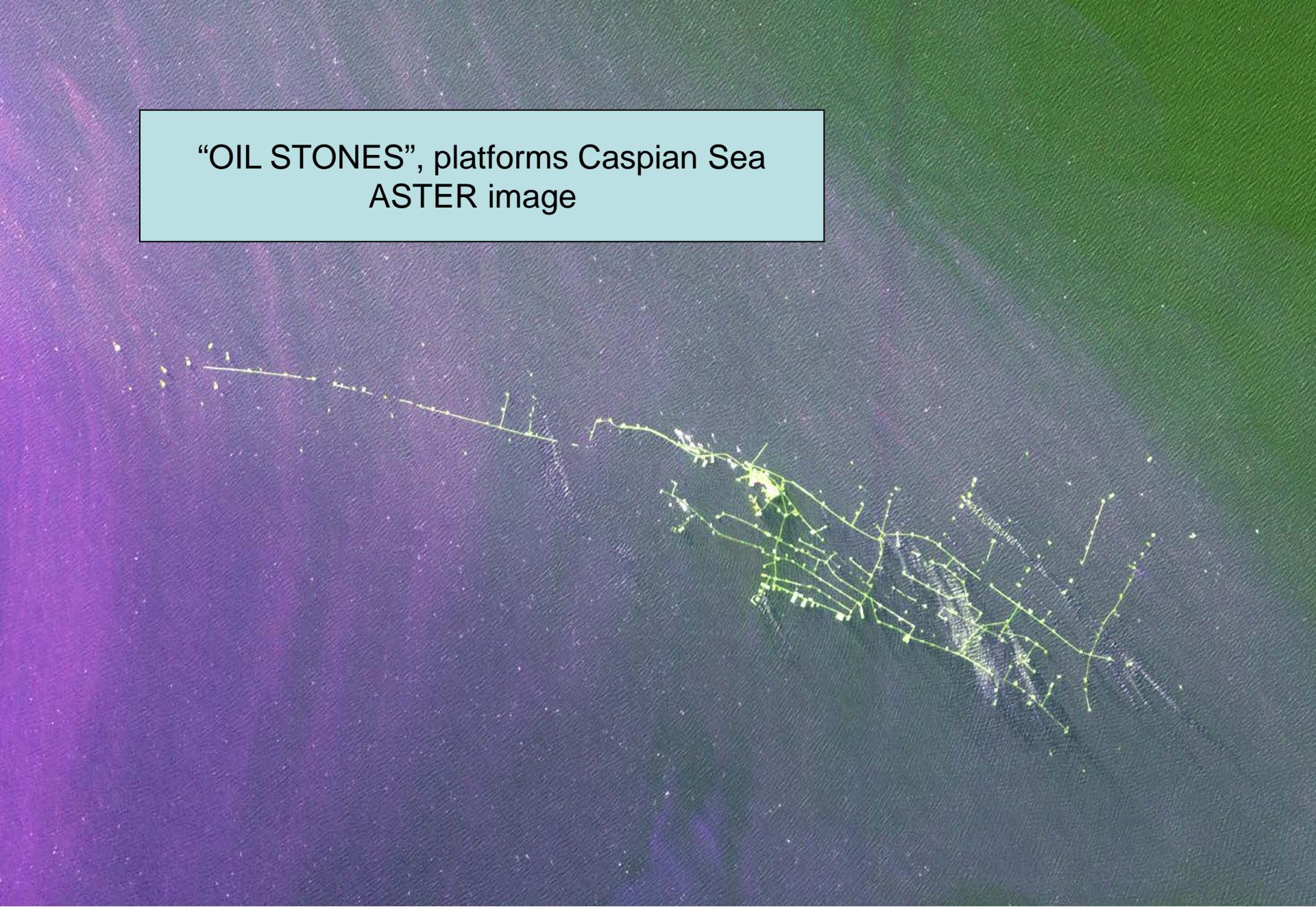
Landsat, 2000

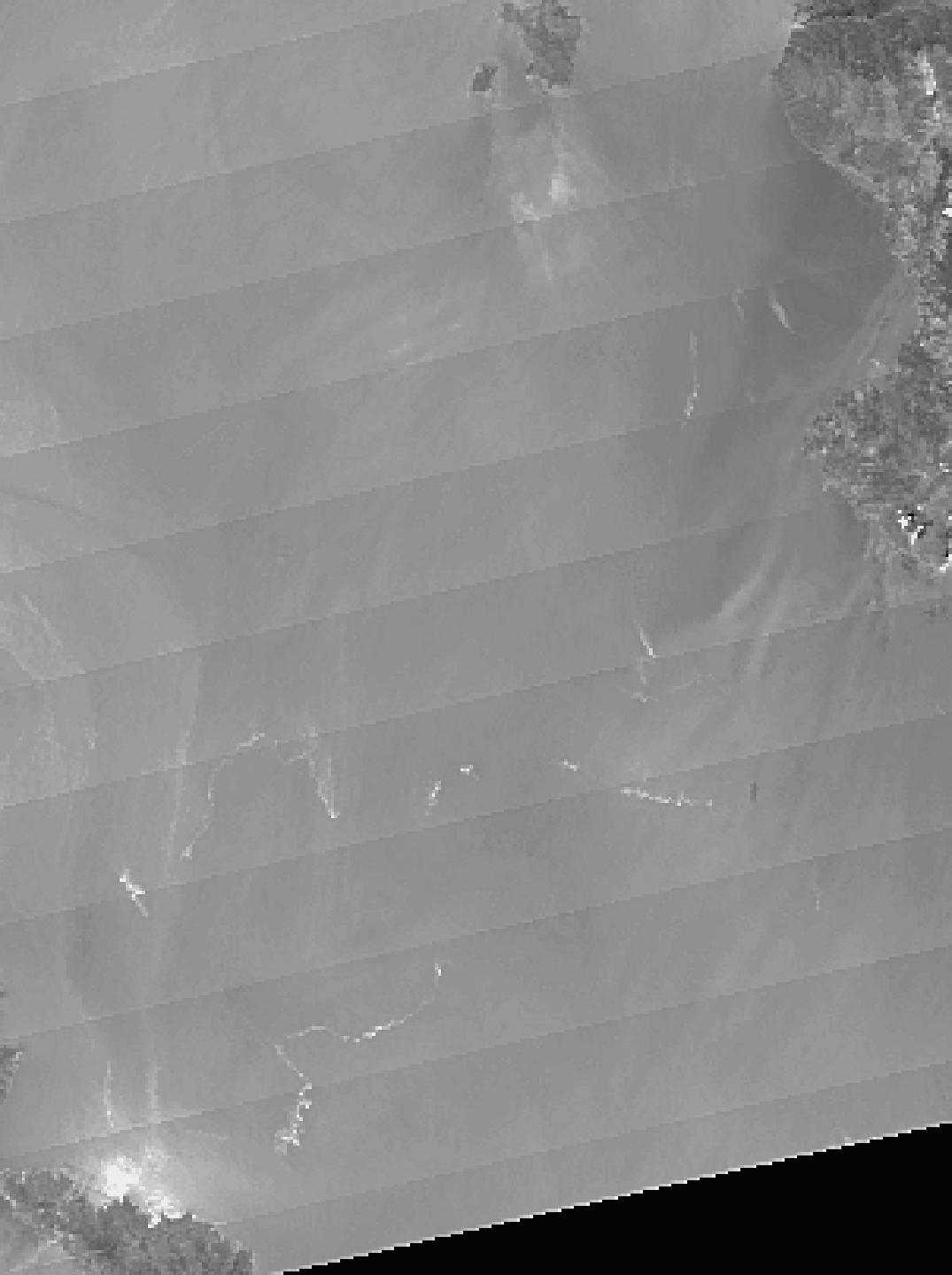
Thin and thick oil films near oil platforms in near Romanian coast in the Black Sea
Thick films – bright (due to the higher reflectance), thin is dark due two the
ripple dumping. Different directions of the oil propagation defined by mesoscale currents.

An ASTER satellite image showing a large area of water with various oil slick patterns. In the upper left, there is a prominent dark, irregularly shaped slick. To its right, a long, thin, bright white streak extends diagonally downwards. The water surrounding these slicks appears darker and more textured. The overall image has a grainy, high-resolution satellite appearance.

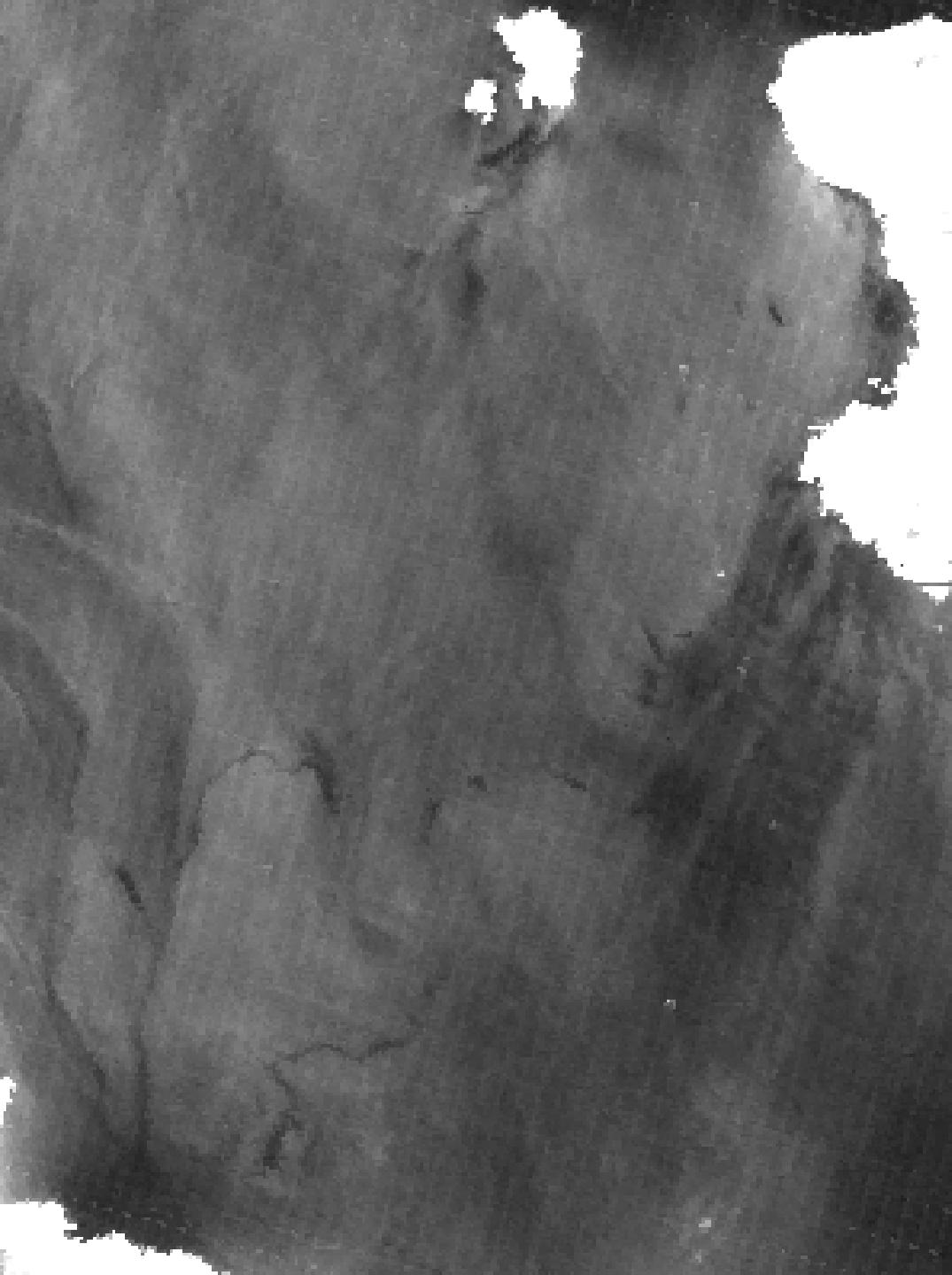
Thin and thick oil films – ship discharge
Thick films – bright (due to the higher reflectance), thin is dark due two the
ripple dumping, ASTER image

“OIL STONES”, platforms Caspian Sea
ASTER image

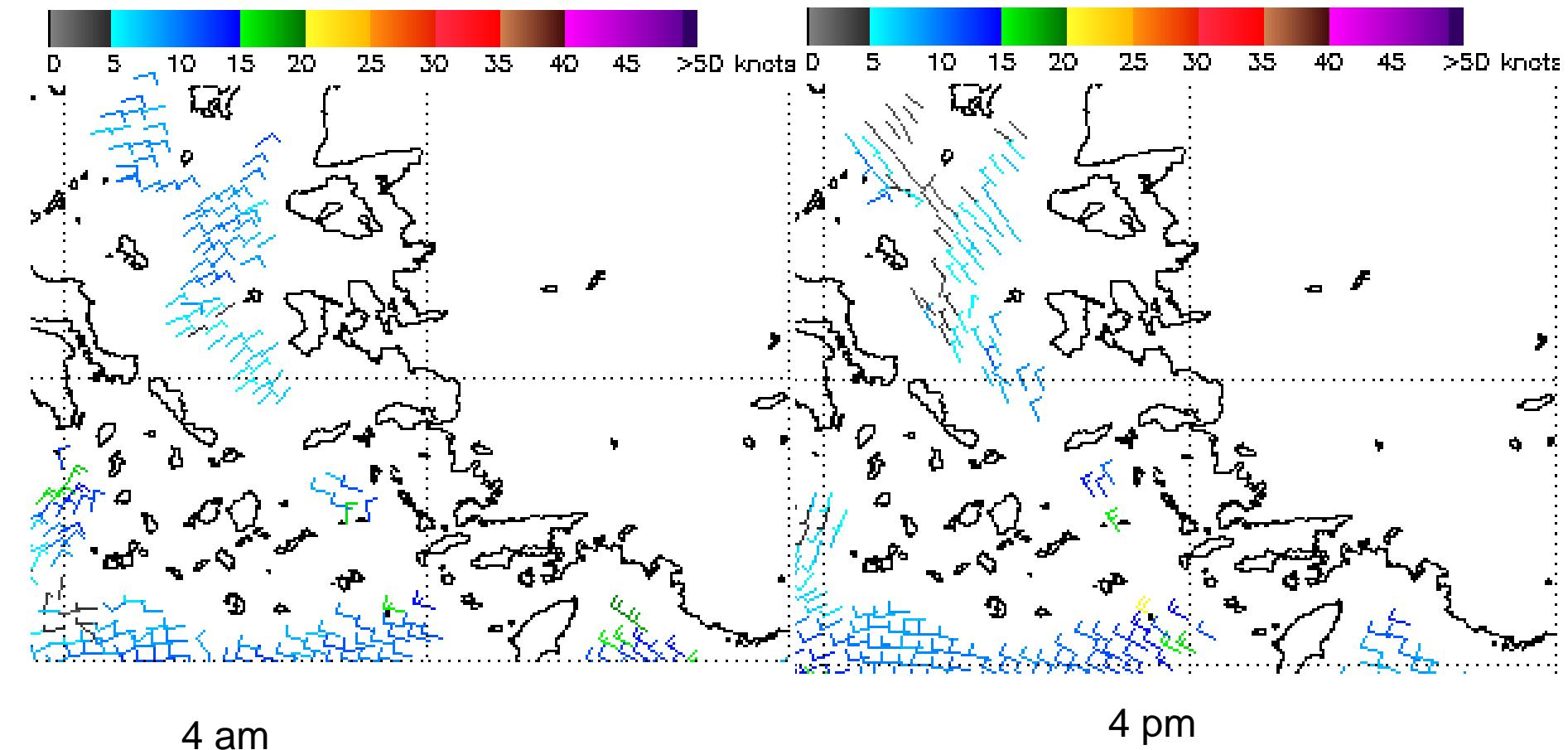




11-20 MODIS AQUA



9-40 MODIS TERRA

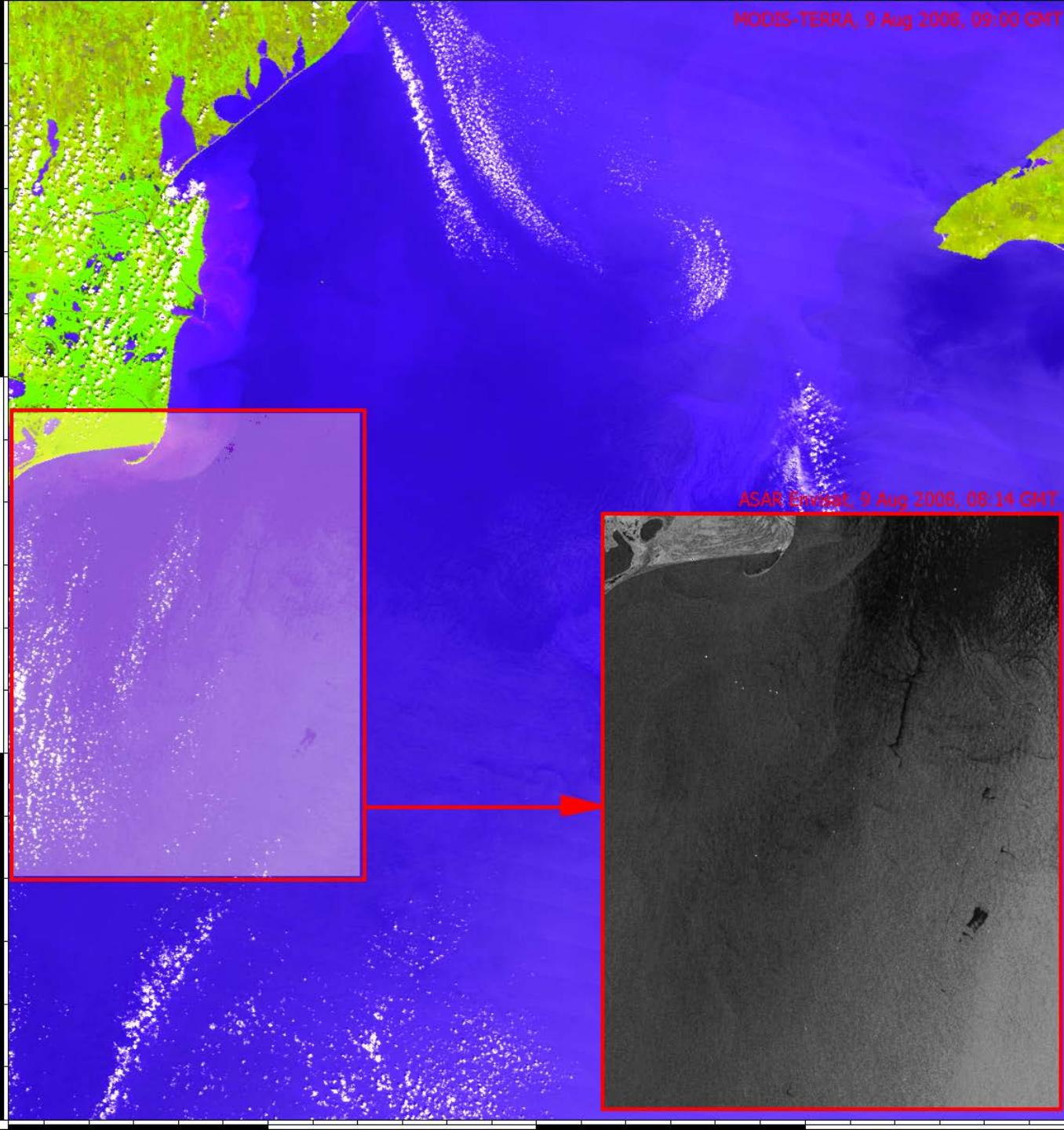


4 am

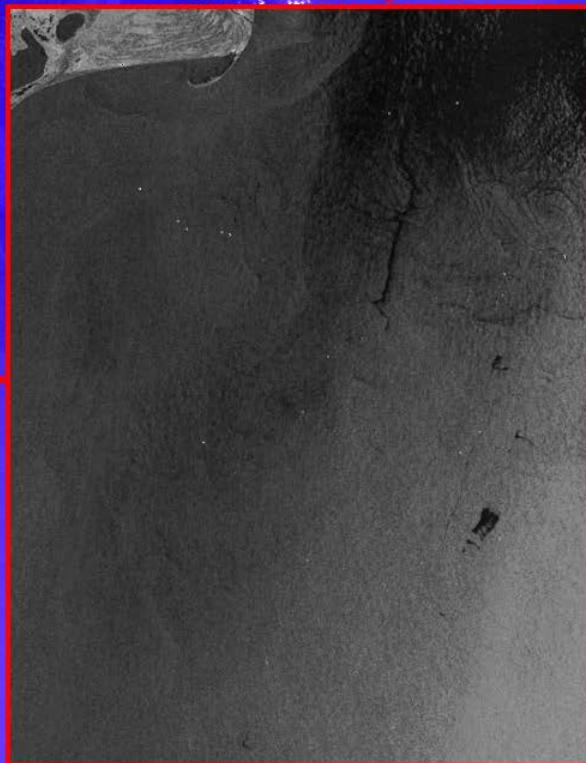
4 pm

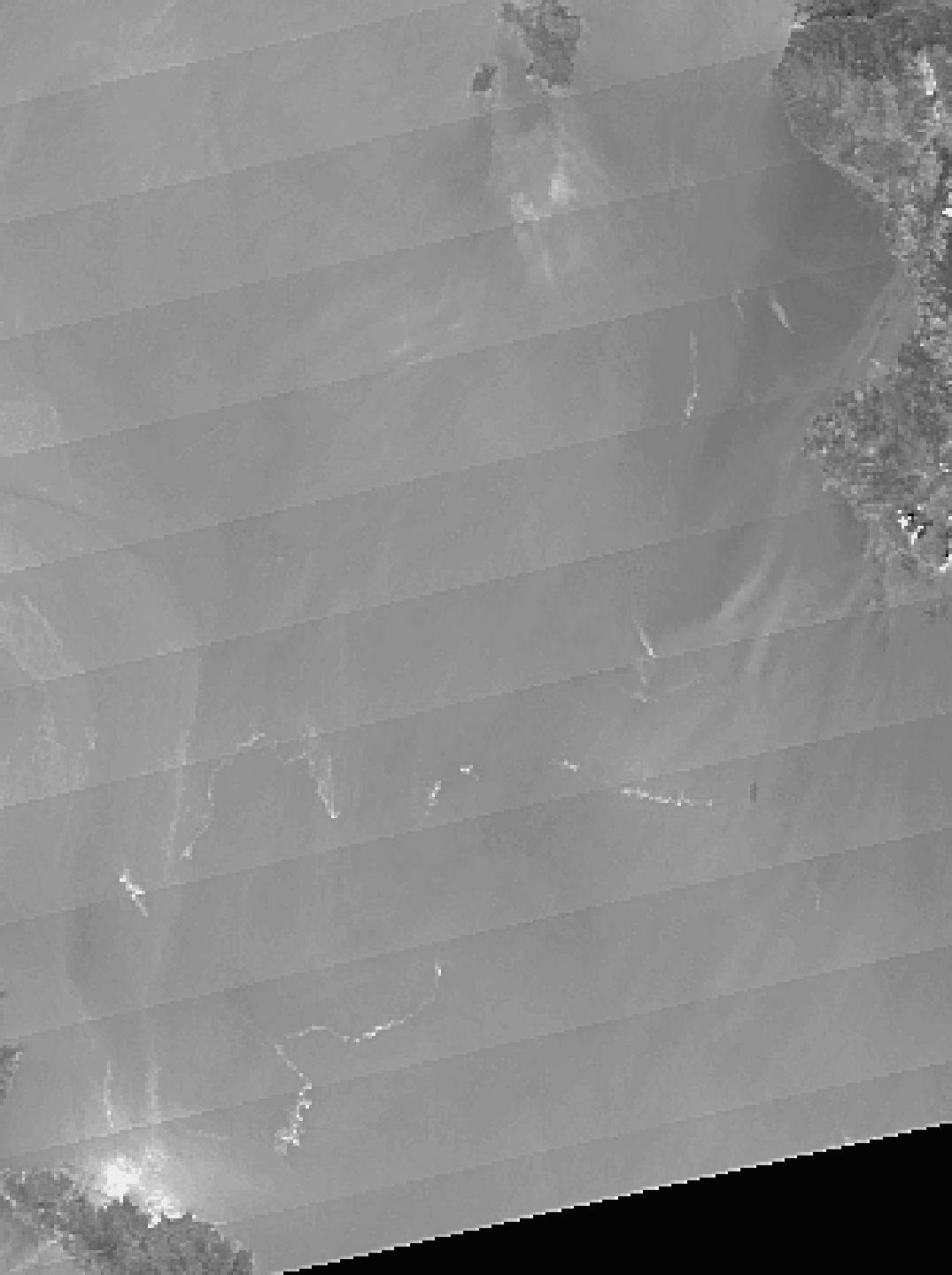
Day168,2008

MODIS-TERRA, 9 Aug 2008, 09:00 GMT

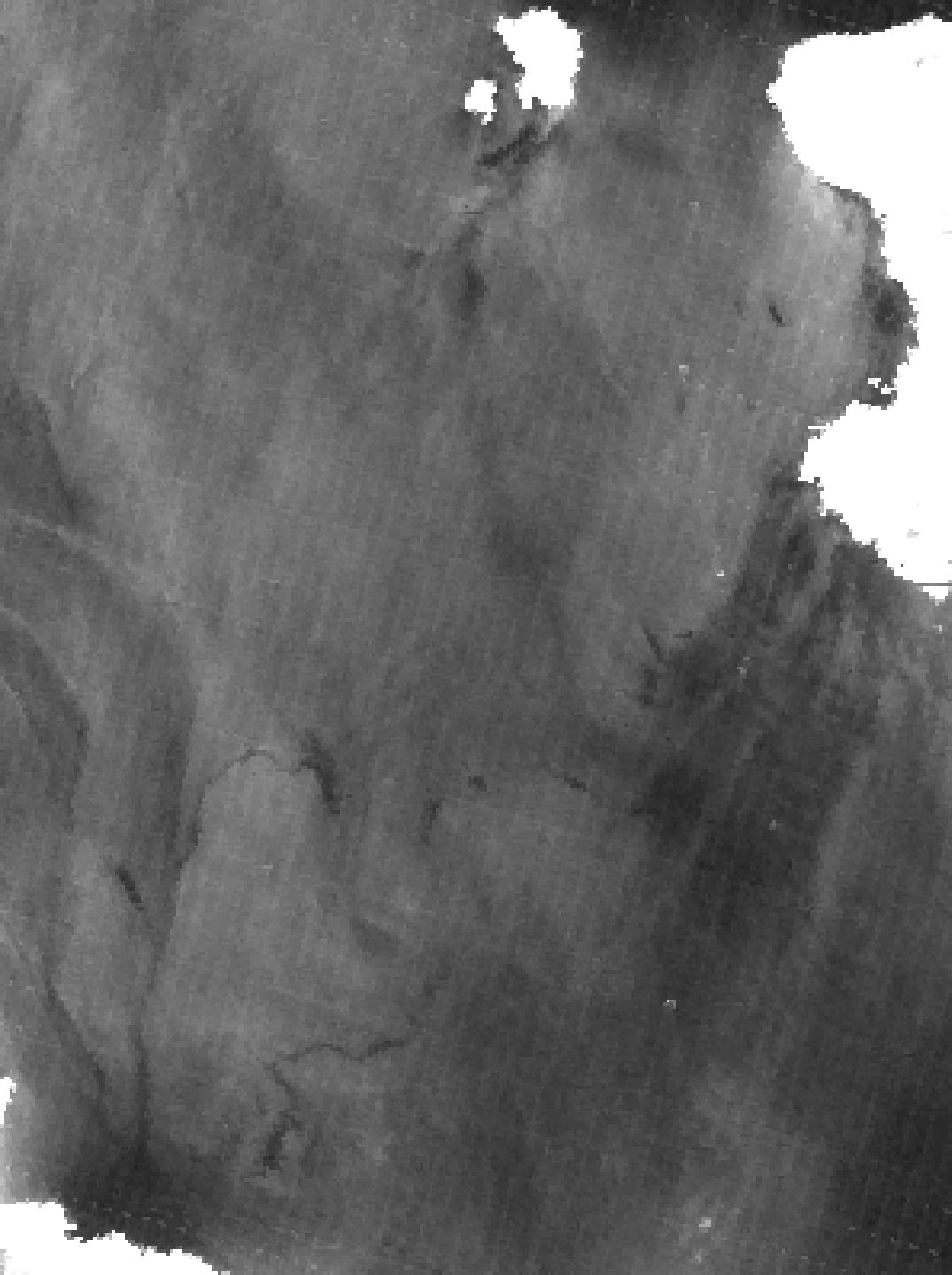


ASAR Envisat, 9 Aug 2008, 08:14 GMT

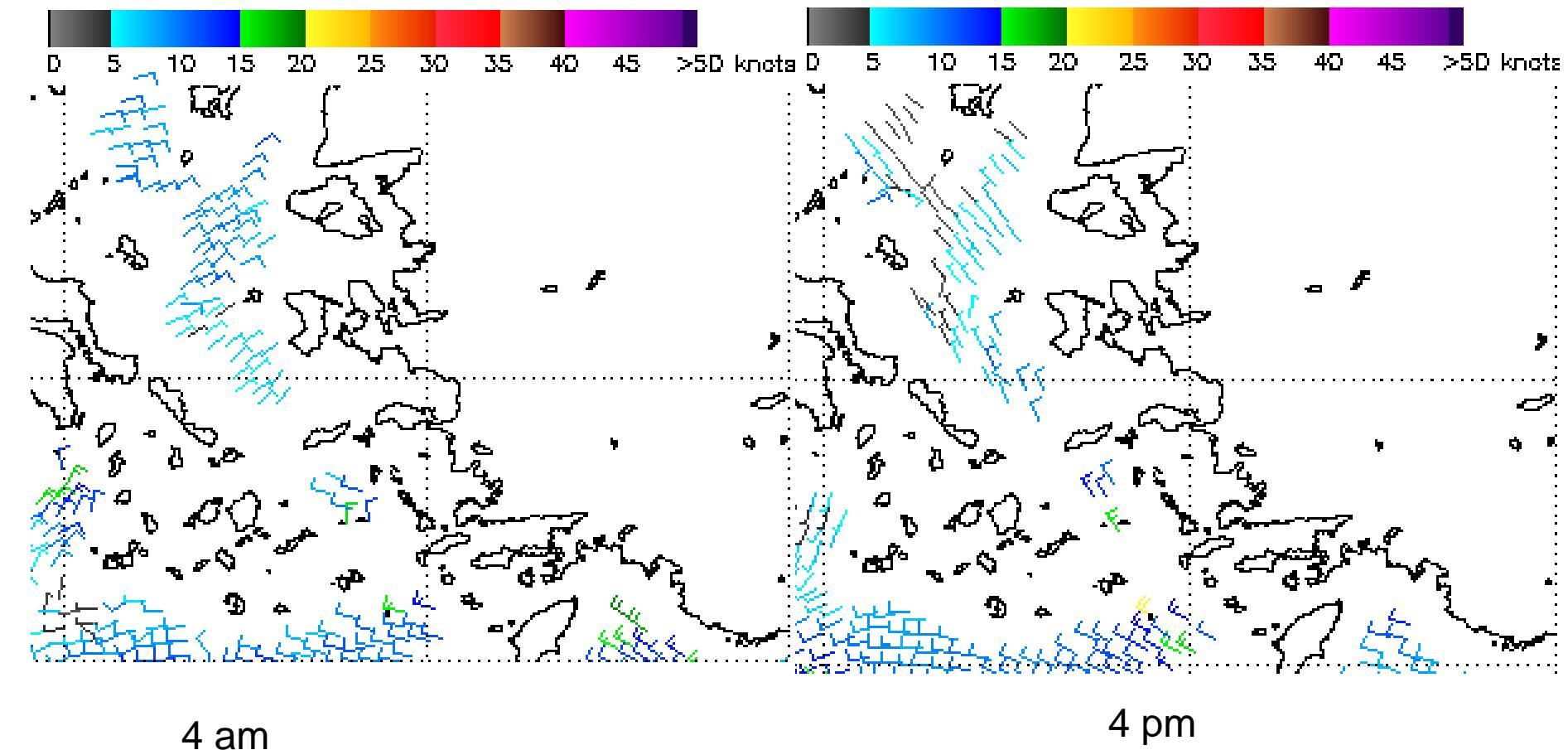




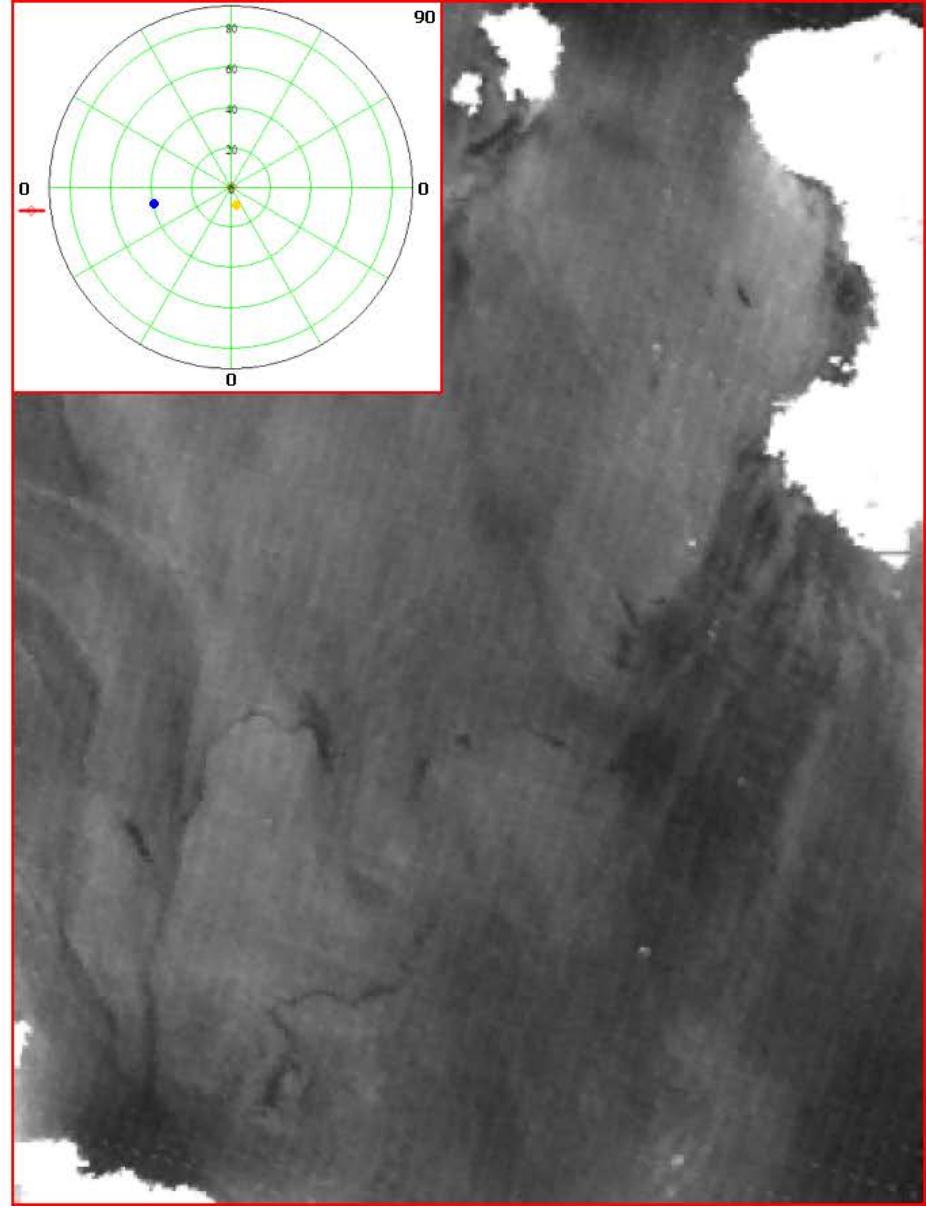
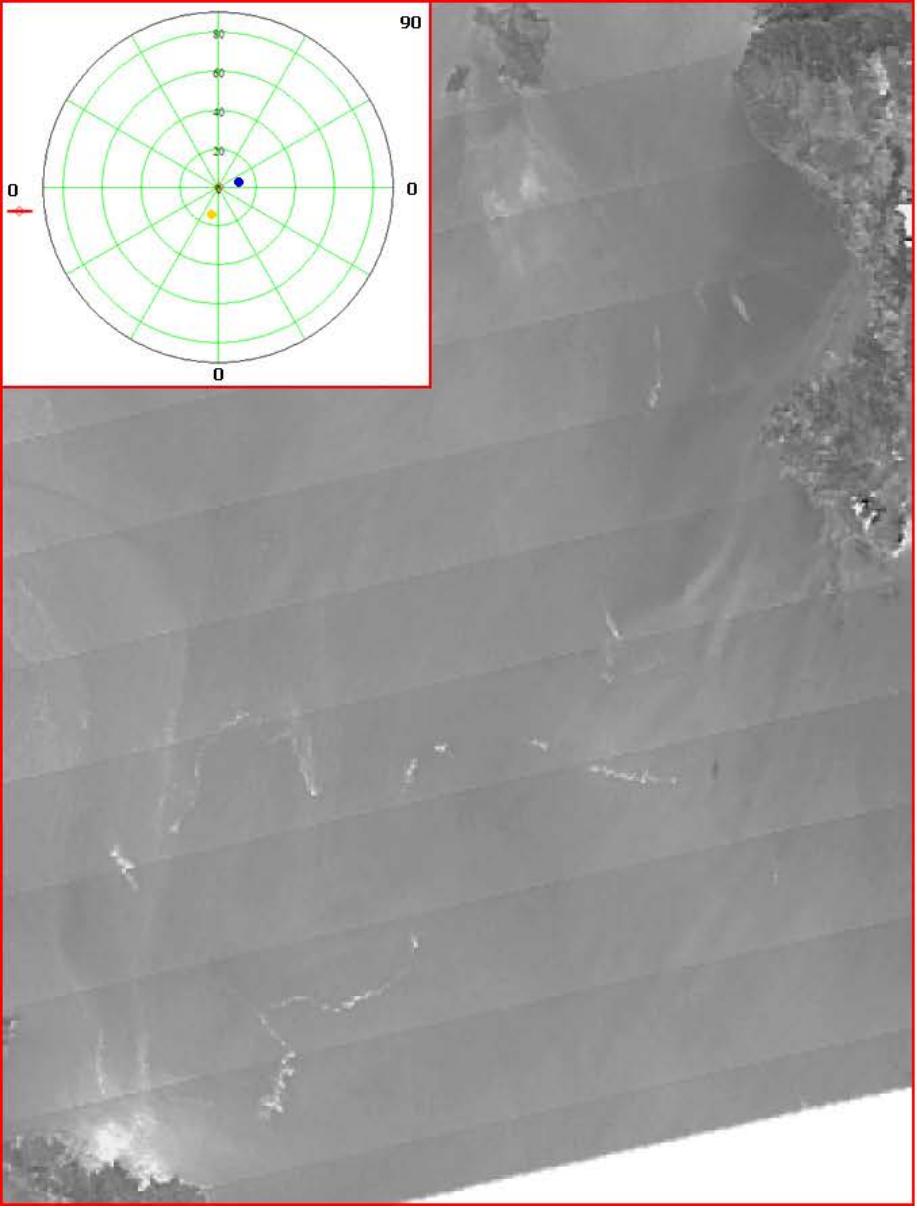
11-20 MODIS AQUA



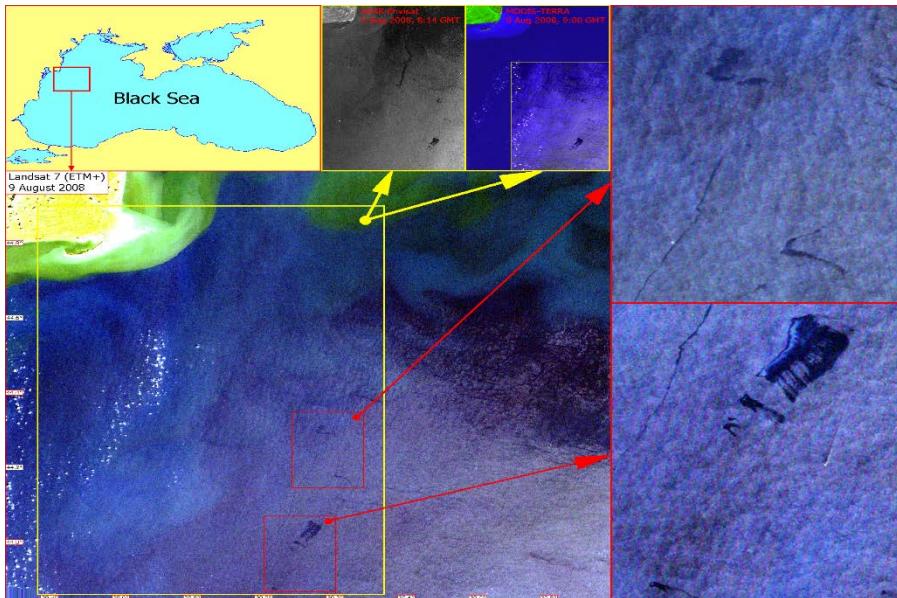
9-40 MODIS TERRA



Day168,2008



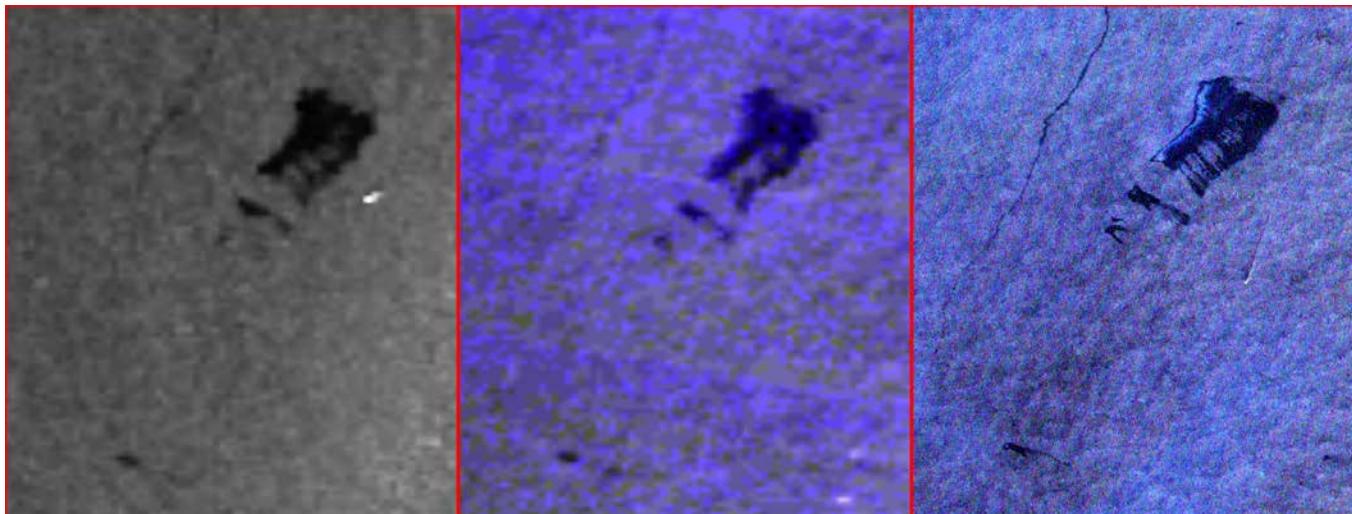
Oil spill appearance in optical data



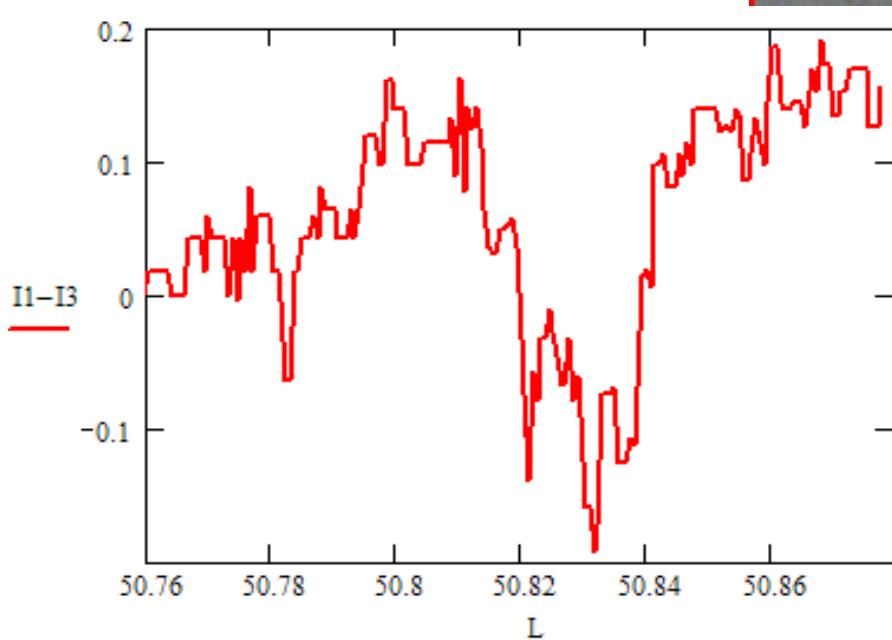
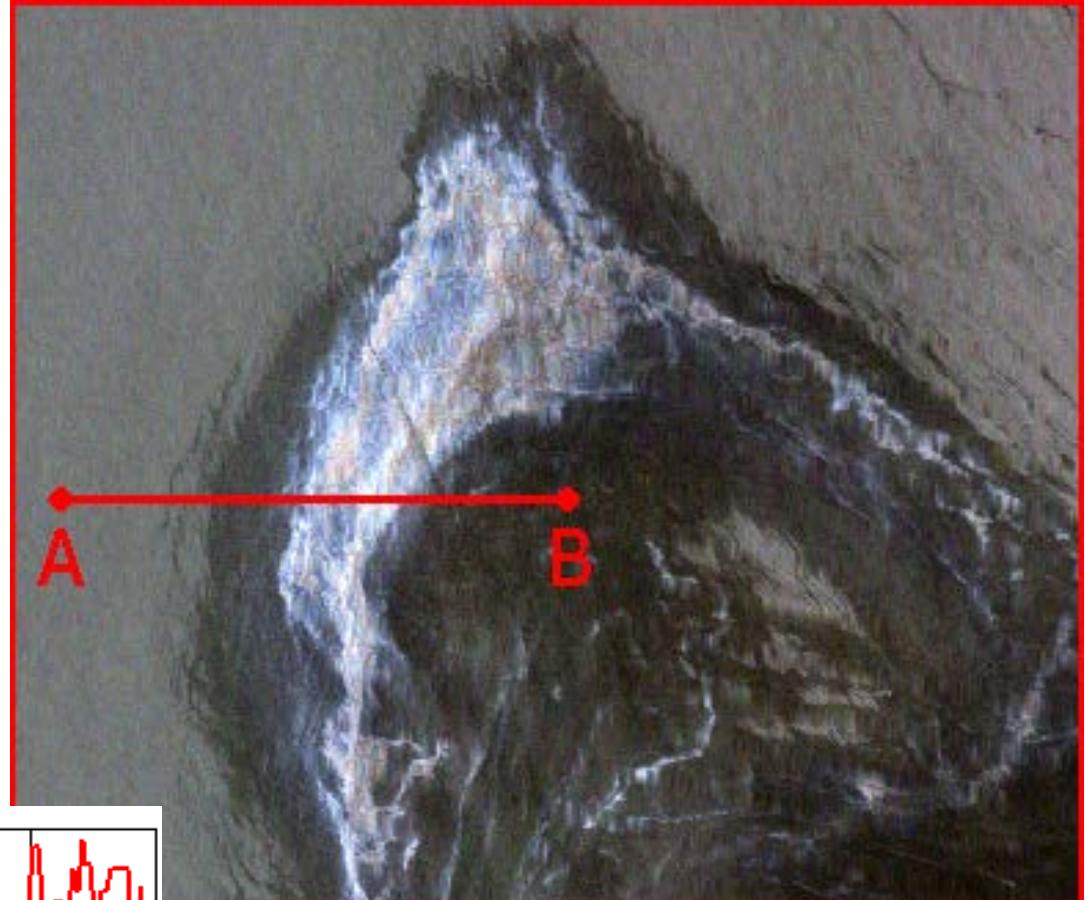
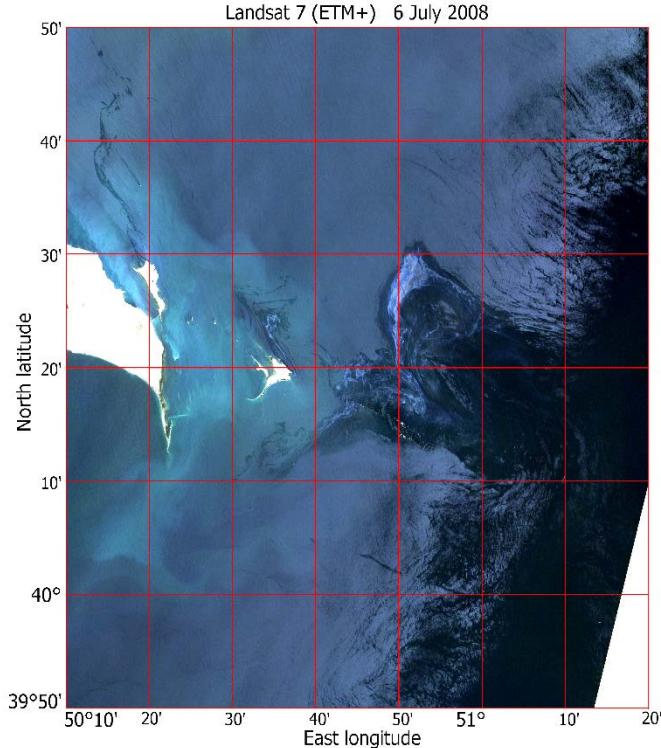
ASAR

MODIS

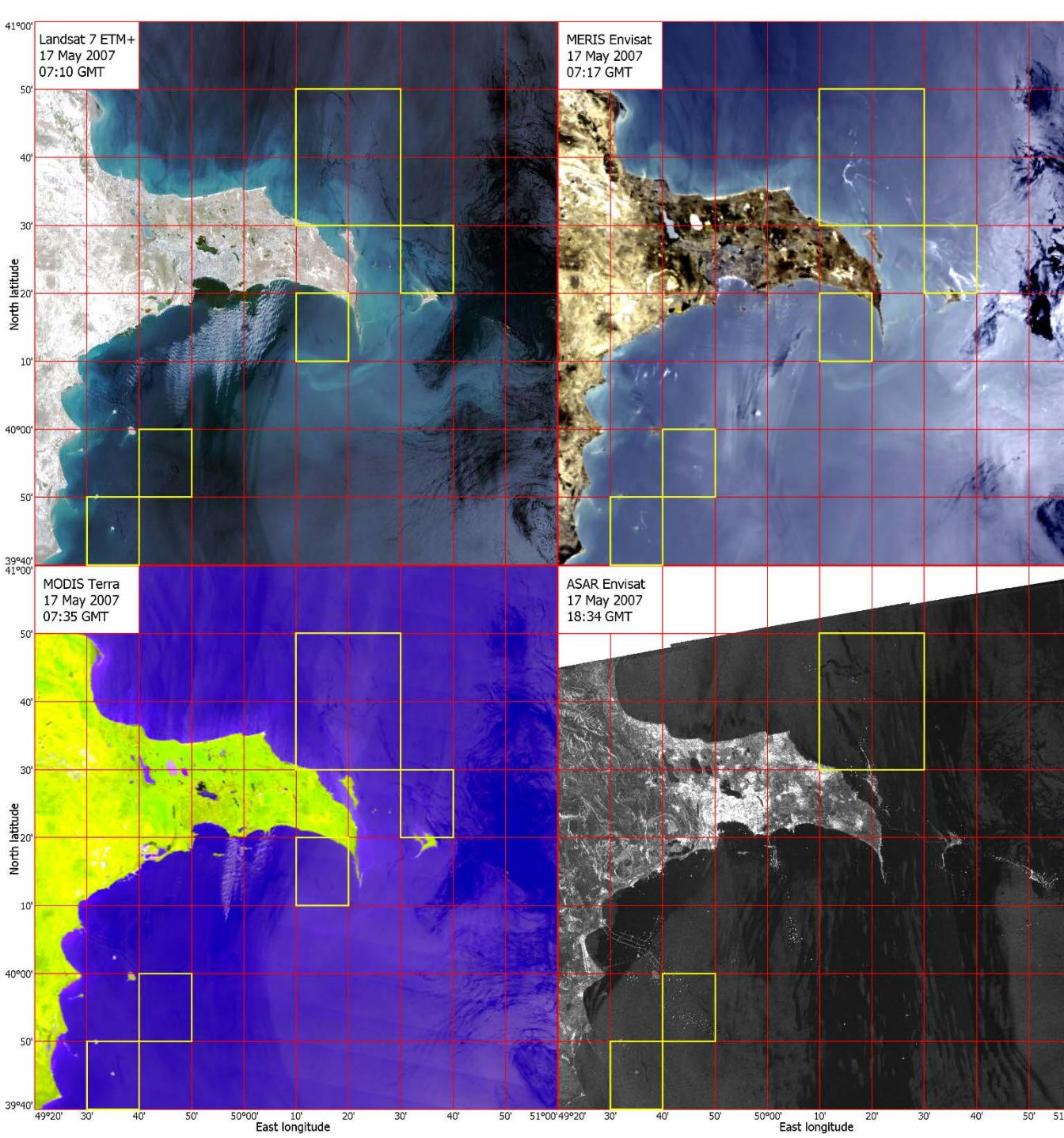
Landsat

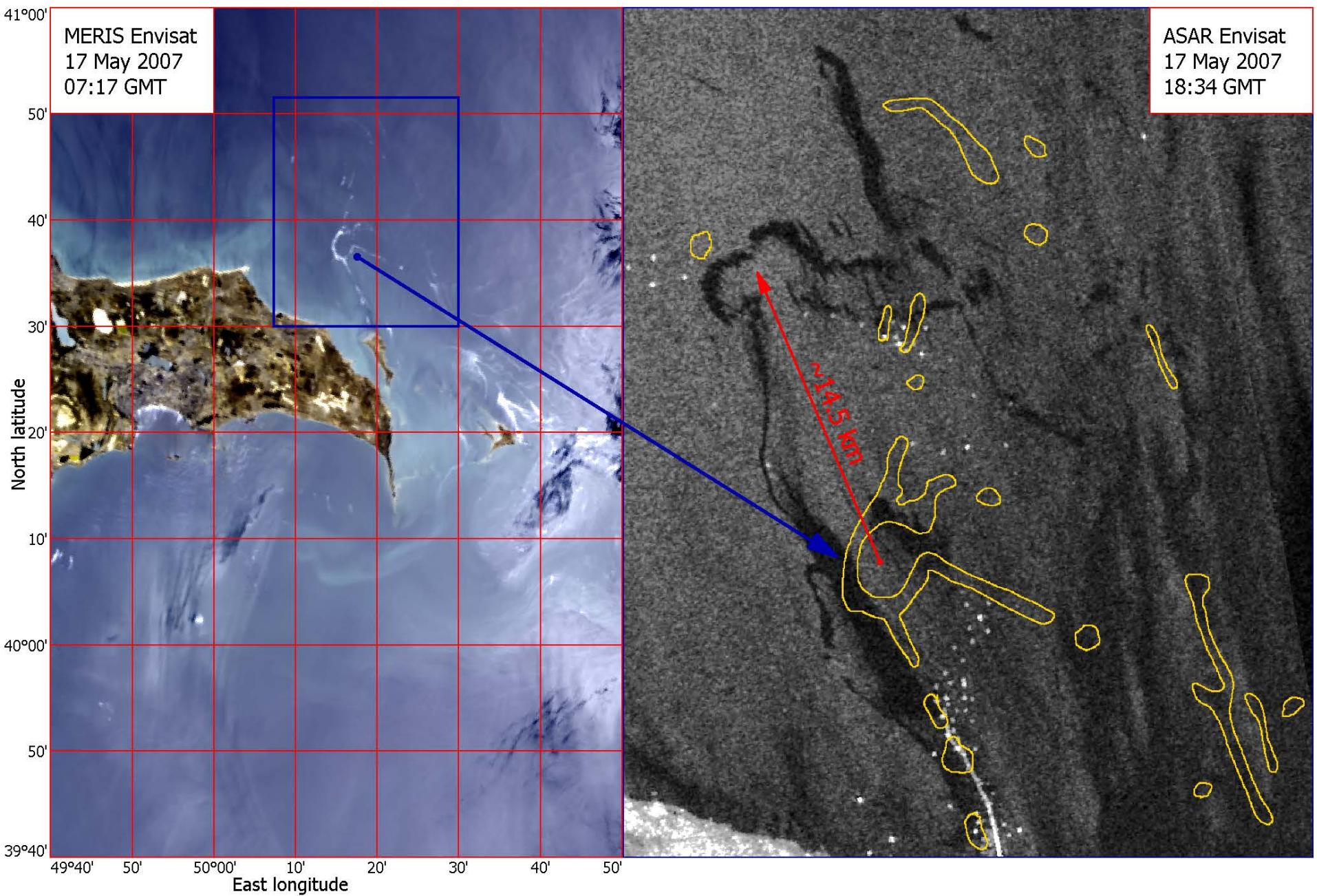


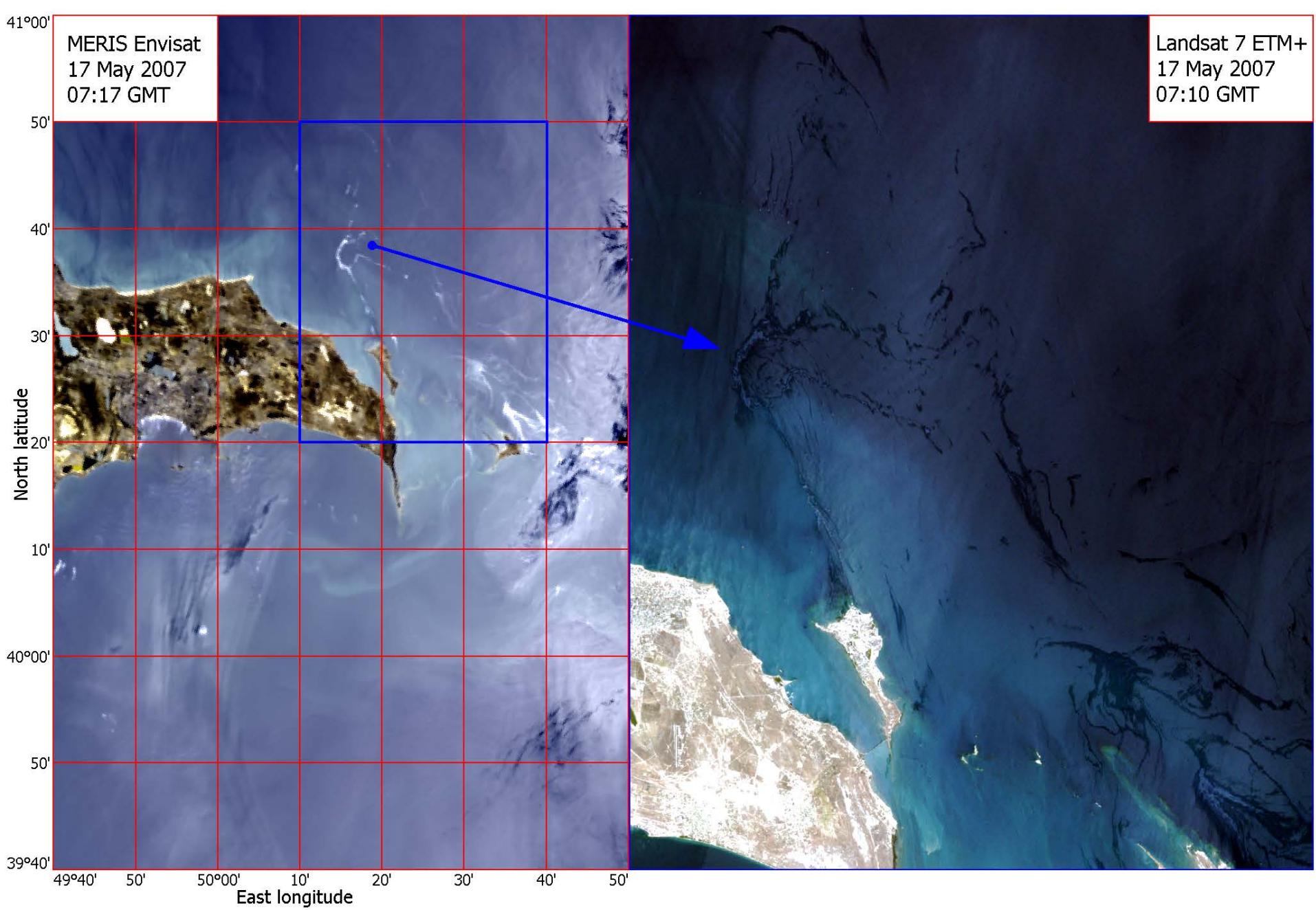
На данных Landsat
видна область толстой пленки
с увеличенным отражением

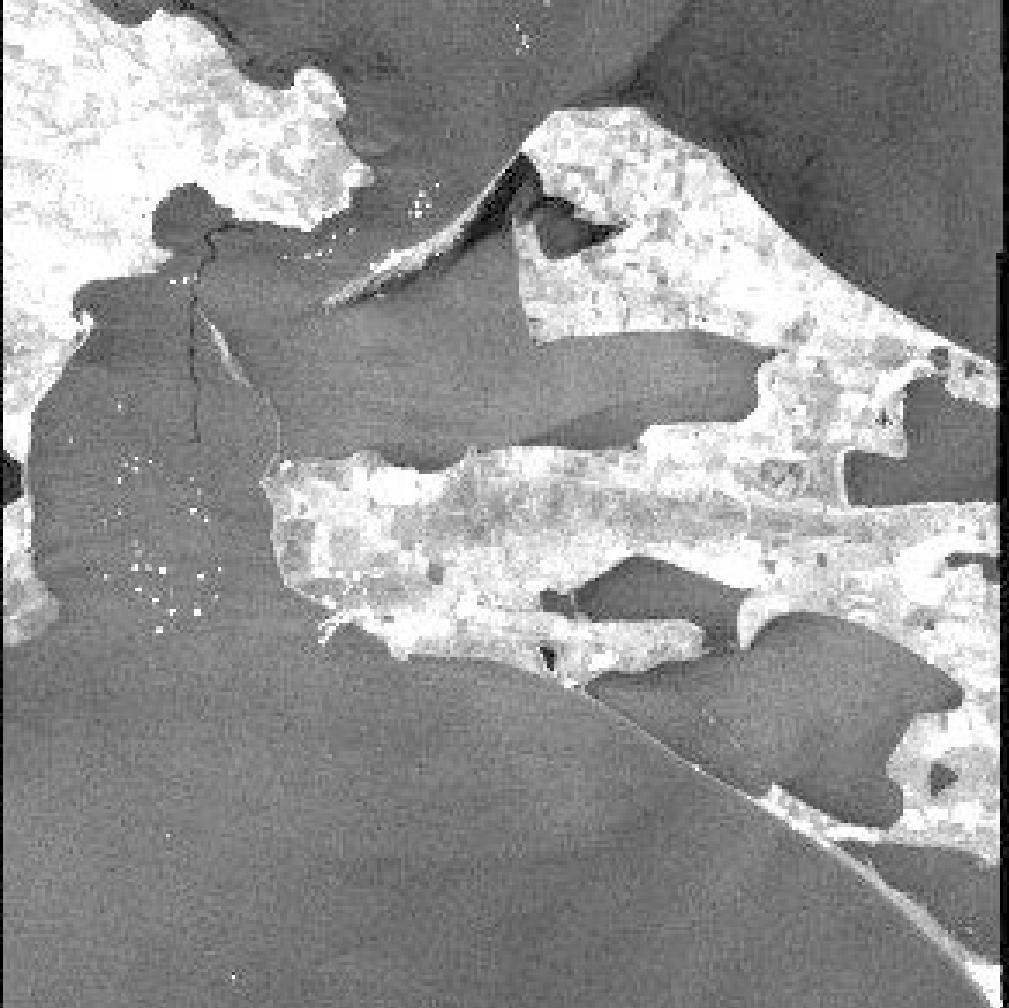


Разность спектральных контрастов
В 1 и 3м каналах сканера
0.45-0.51 мкм
0.63-0.69 мкм



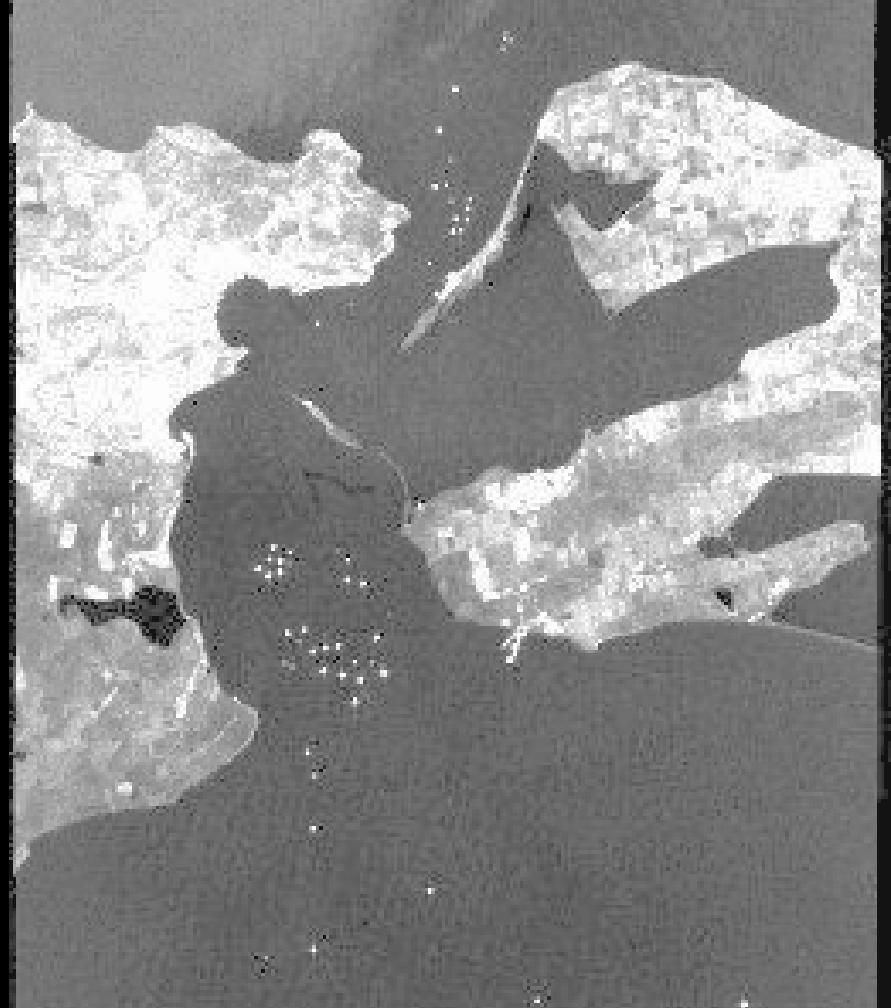






18 07 2008

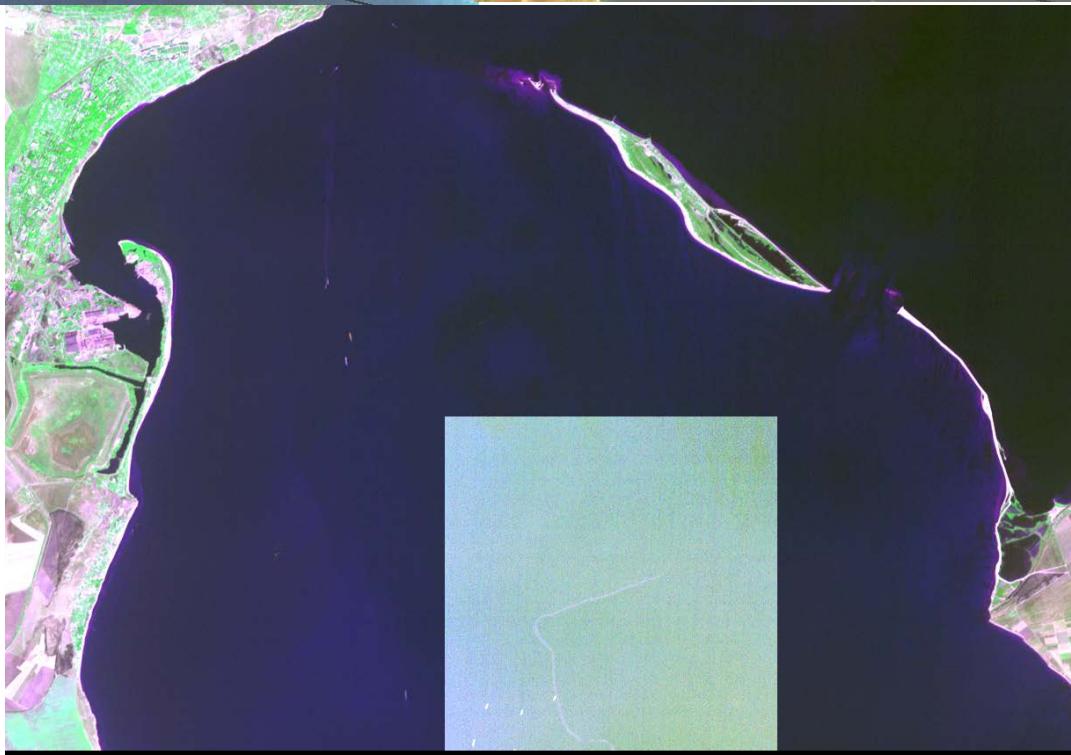
ASAR

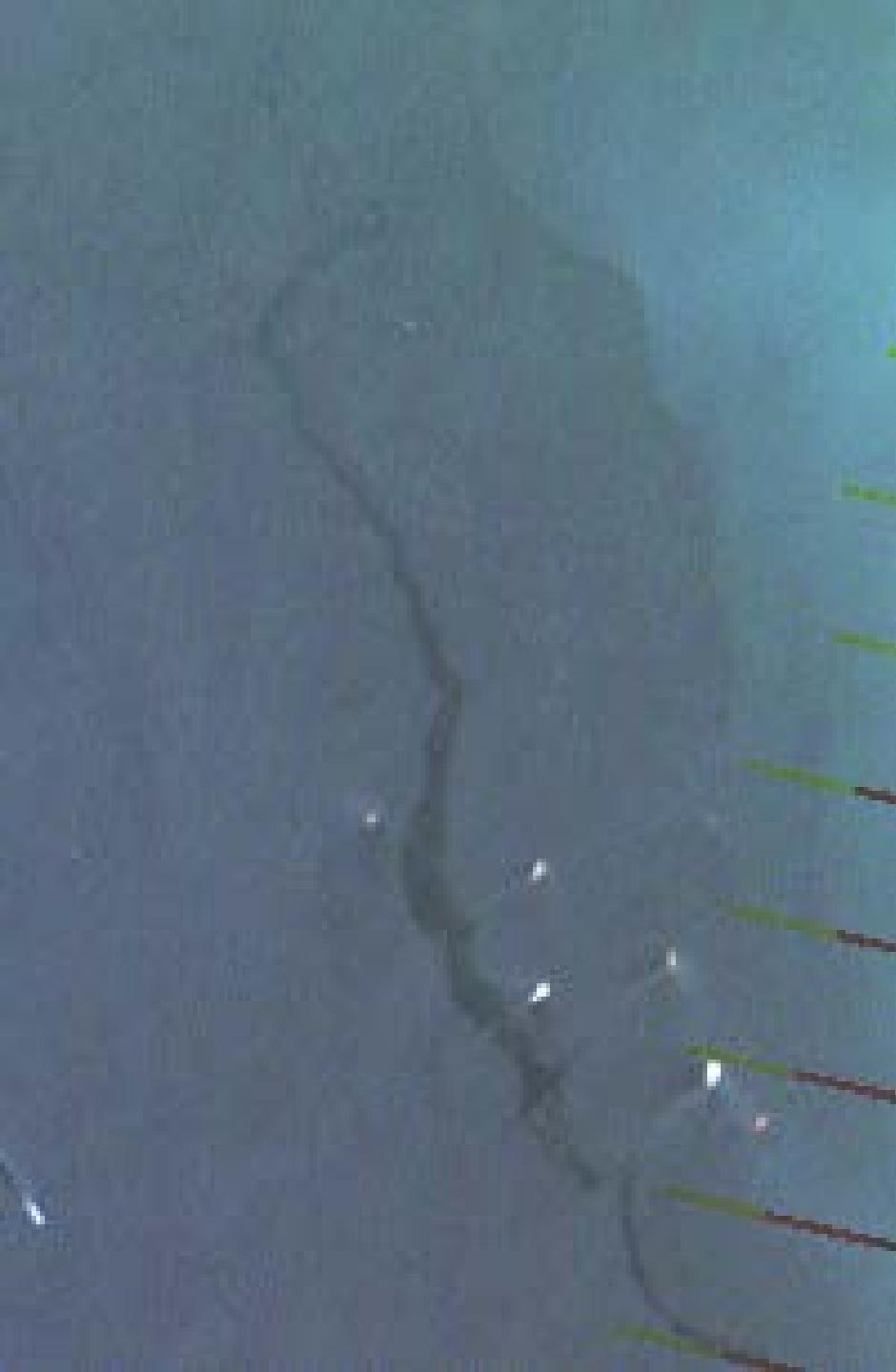


19 07 2008 7-35



Landsat ETM+
и ASTER

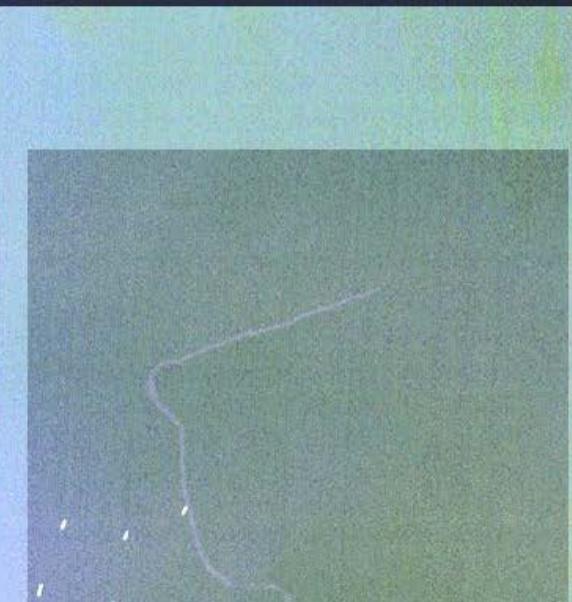
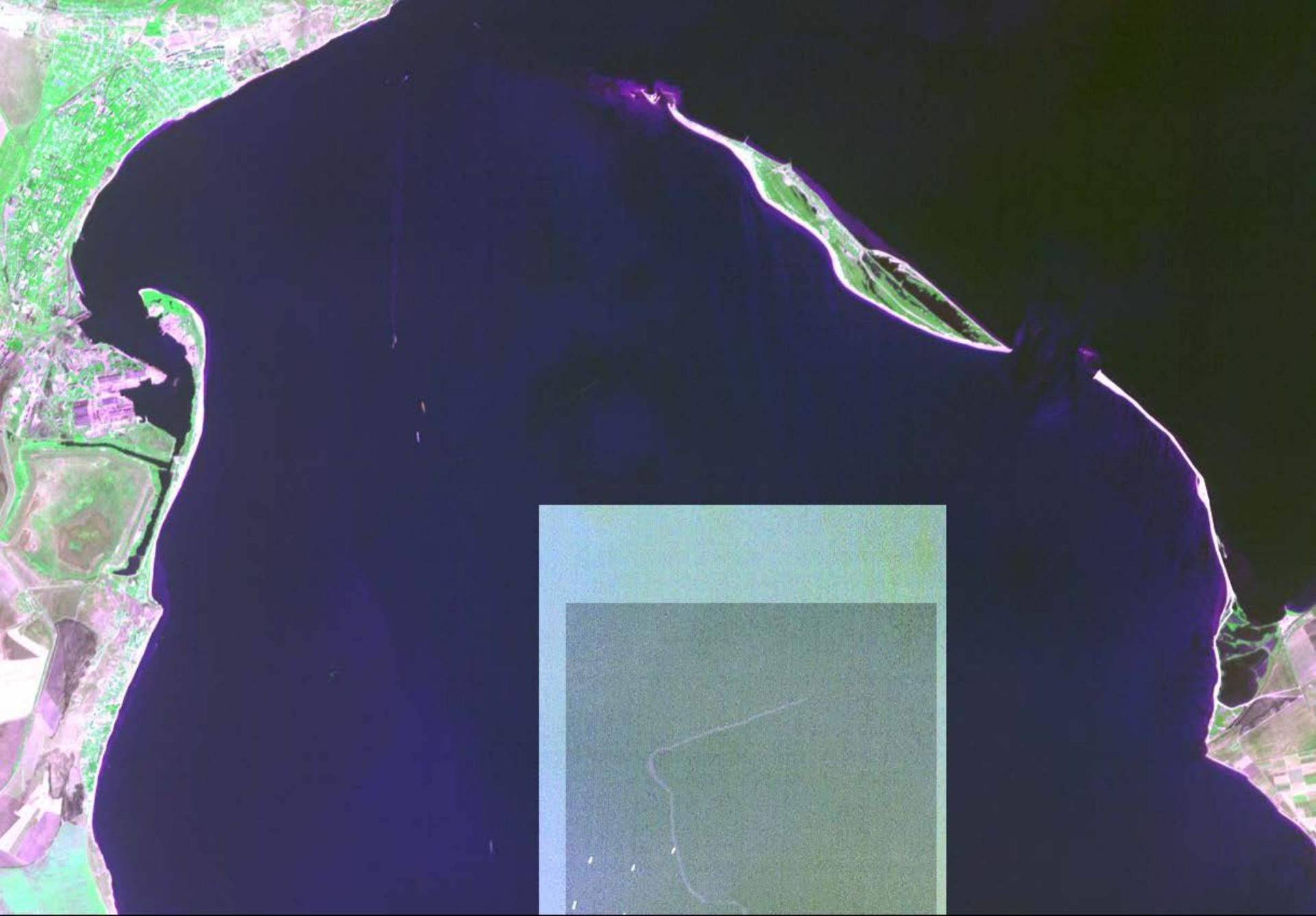



$$C(t) = C_0 \exp(-kt)$$
$$C_{\text{пор}}$$

$$t_{\text{пор}} = L/V$$

L - длина полосы
V – скорость

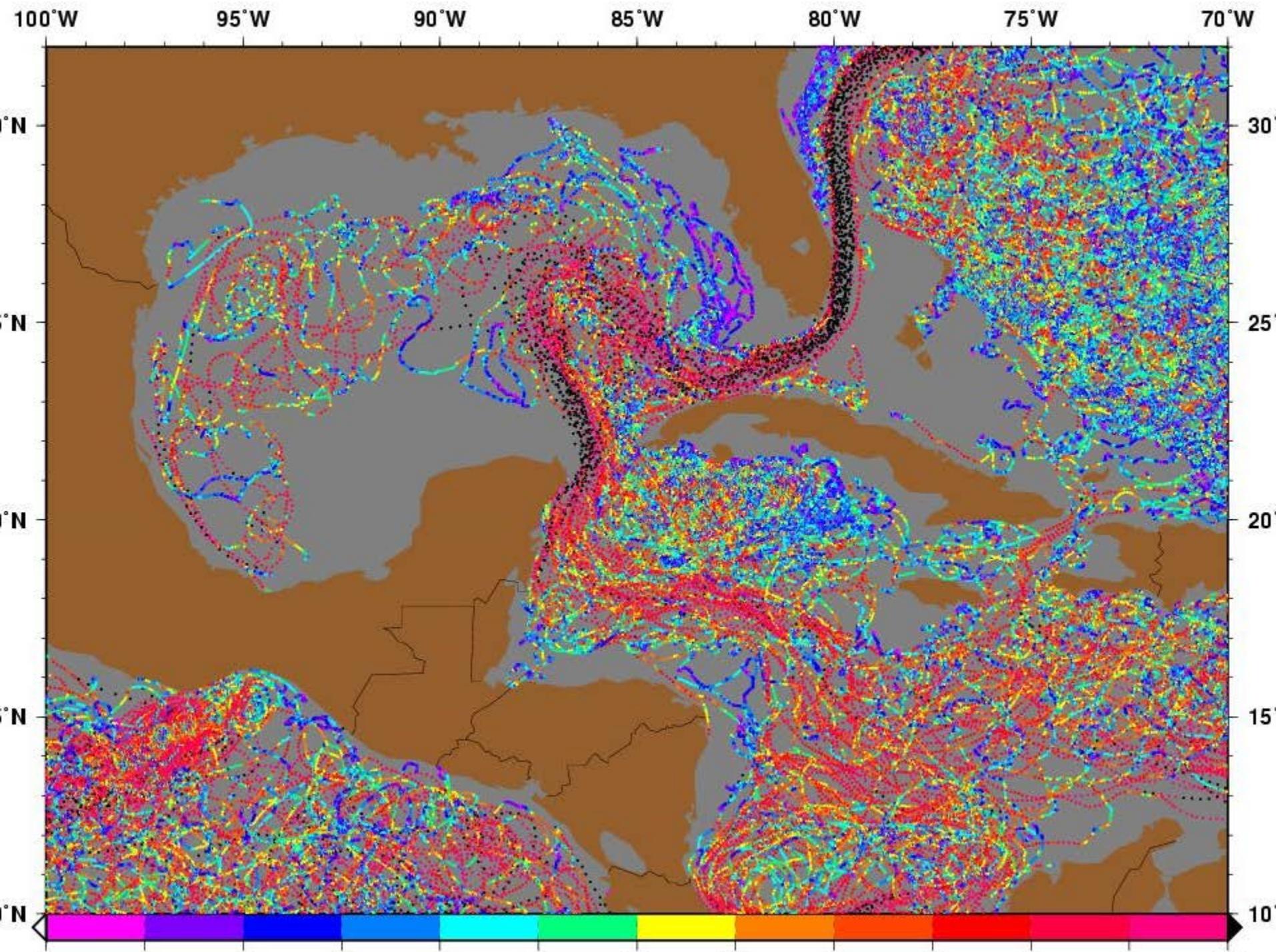


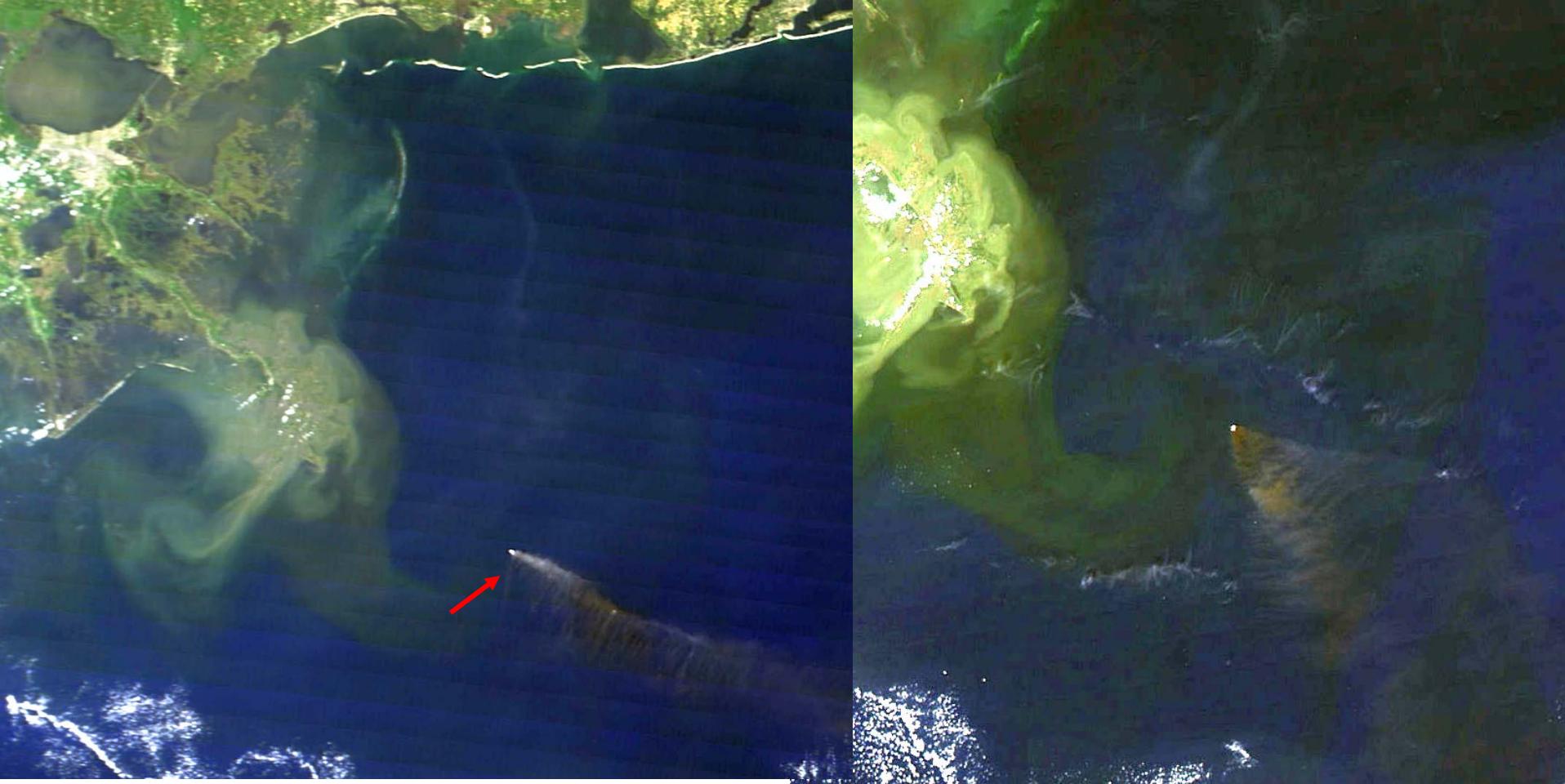




«Deepwater Horizon»

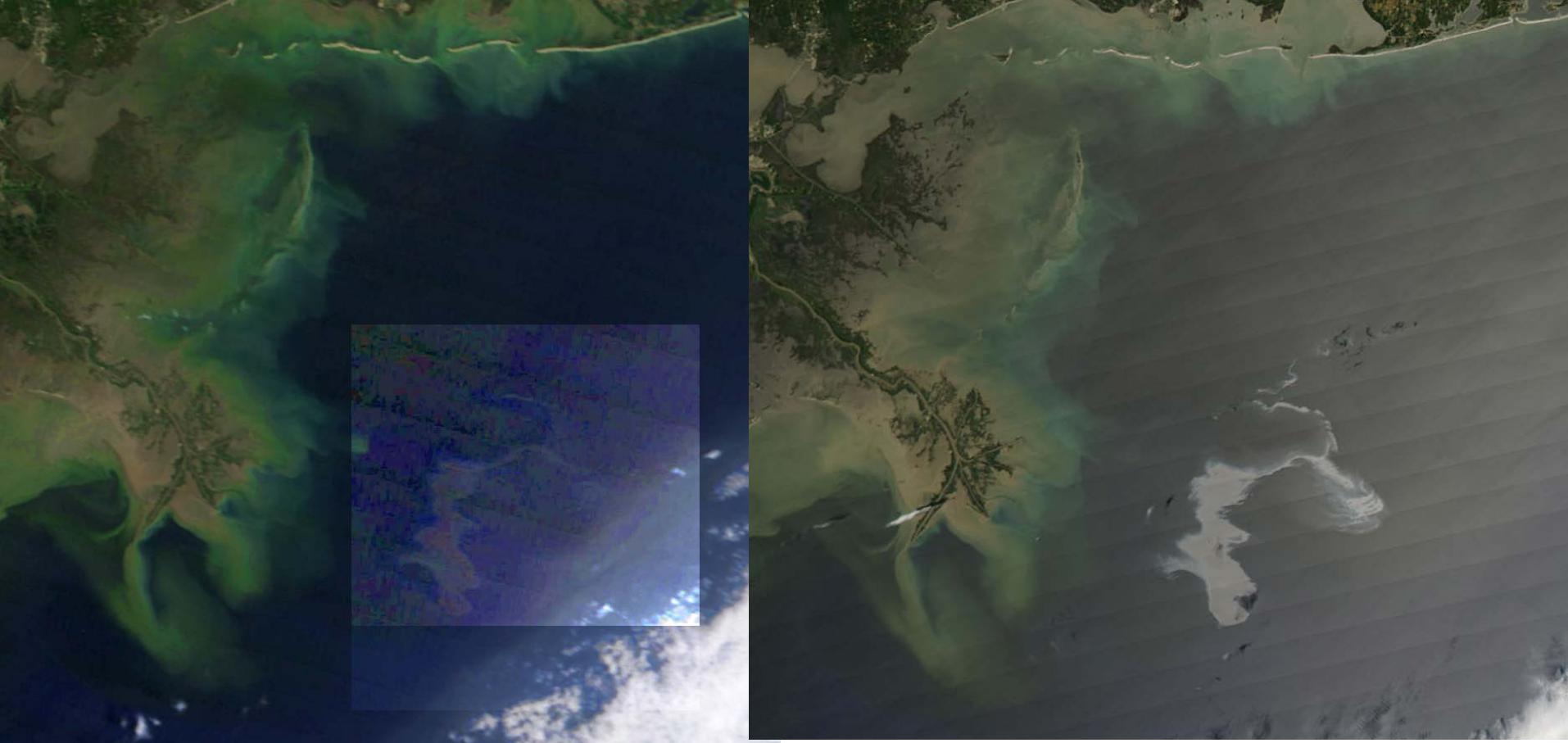




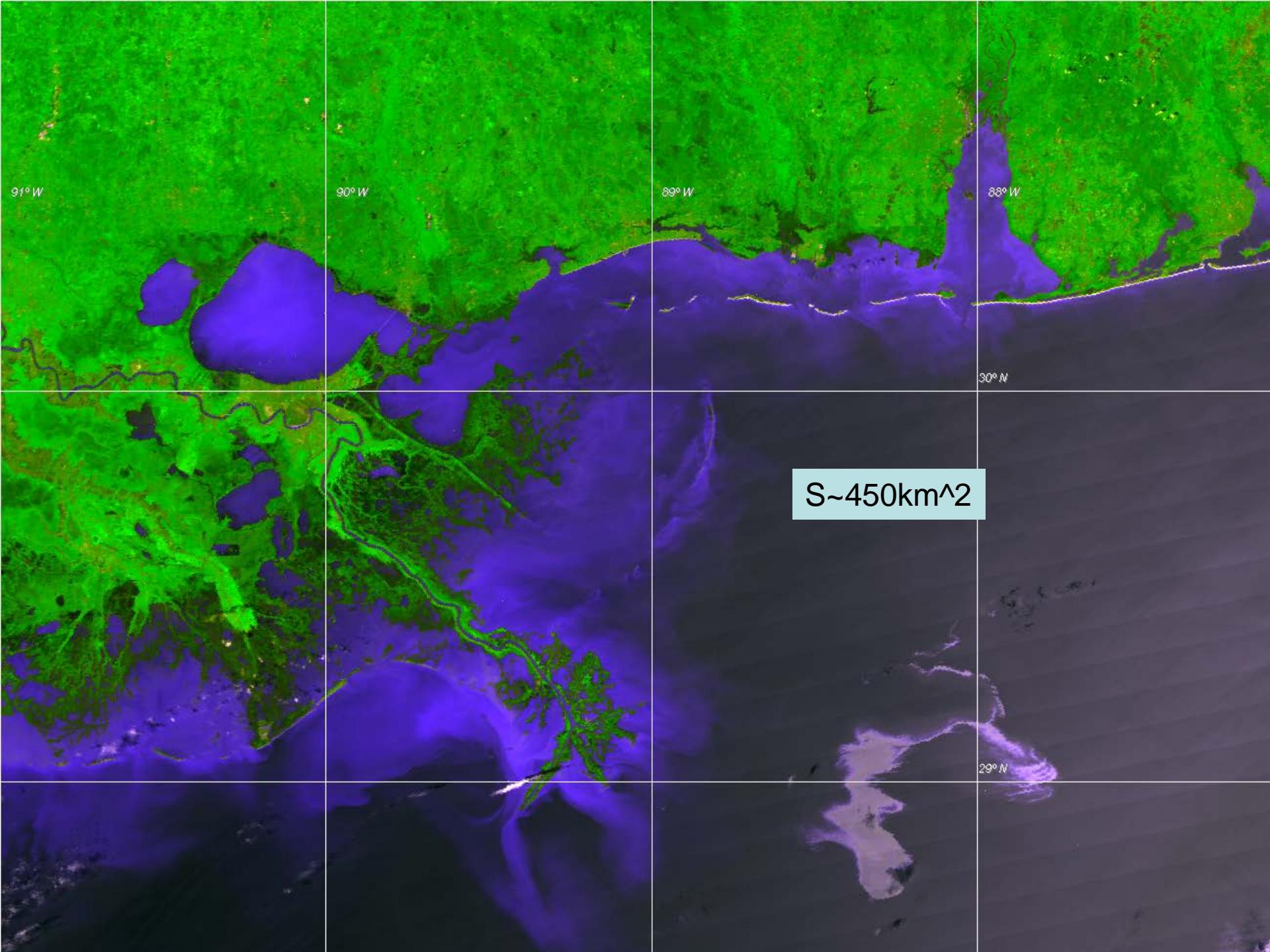


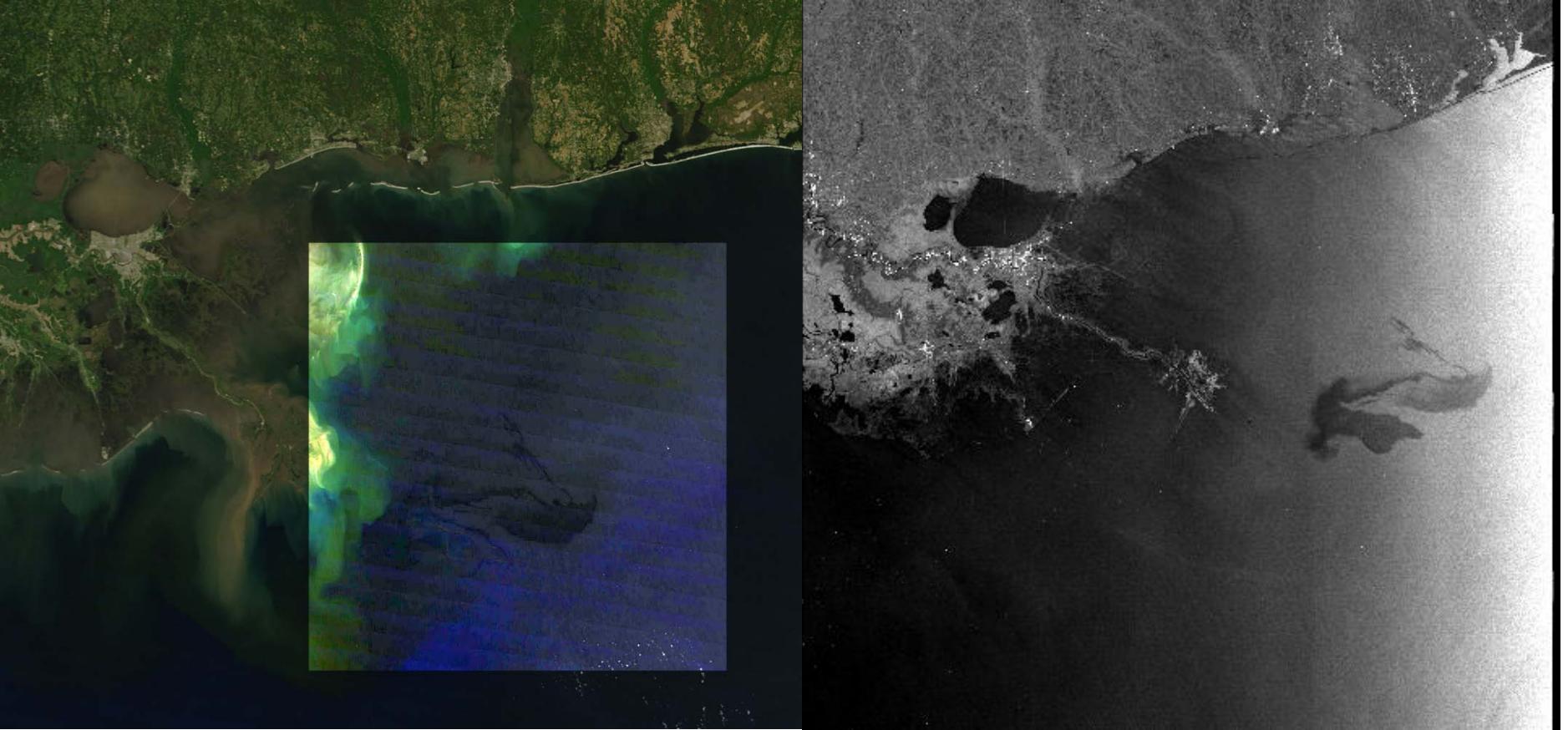
April 21

Damaged Well in Gulf of Mexico



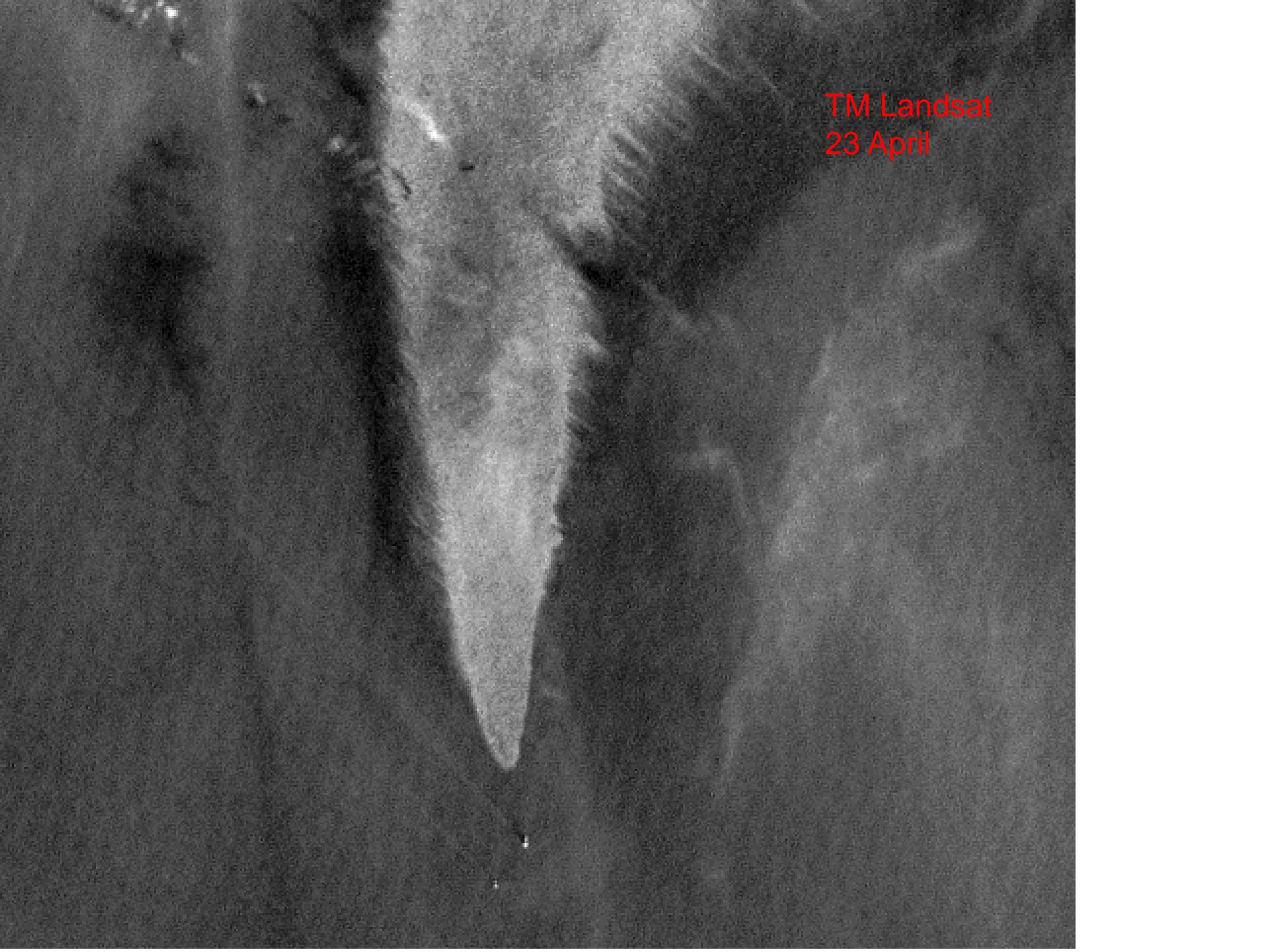
April 25





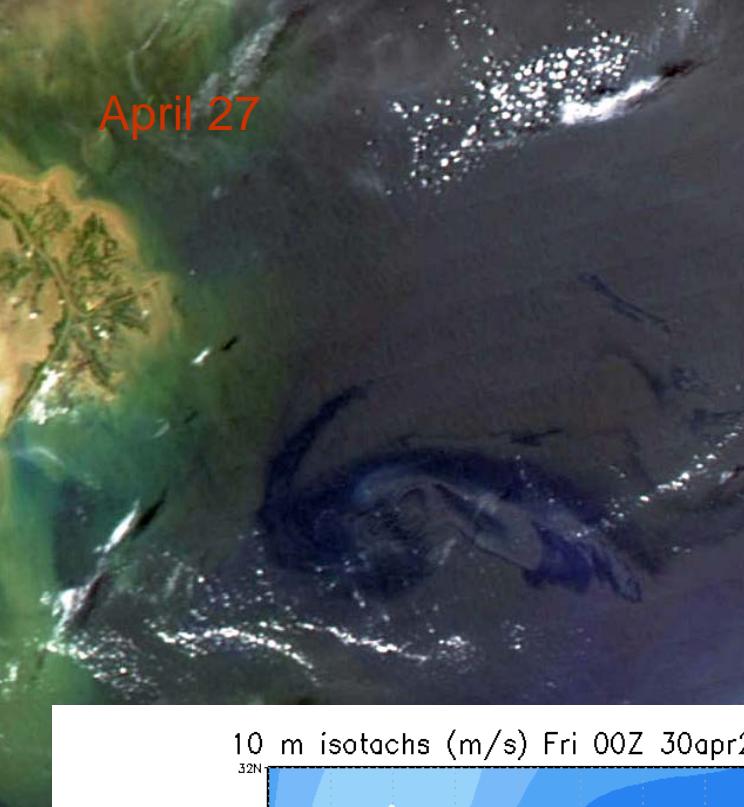
April 26

ASAR ESA 26 April

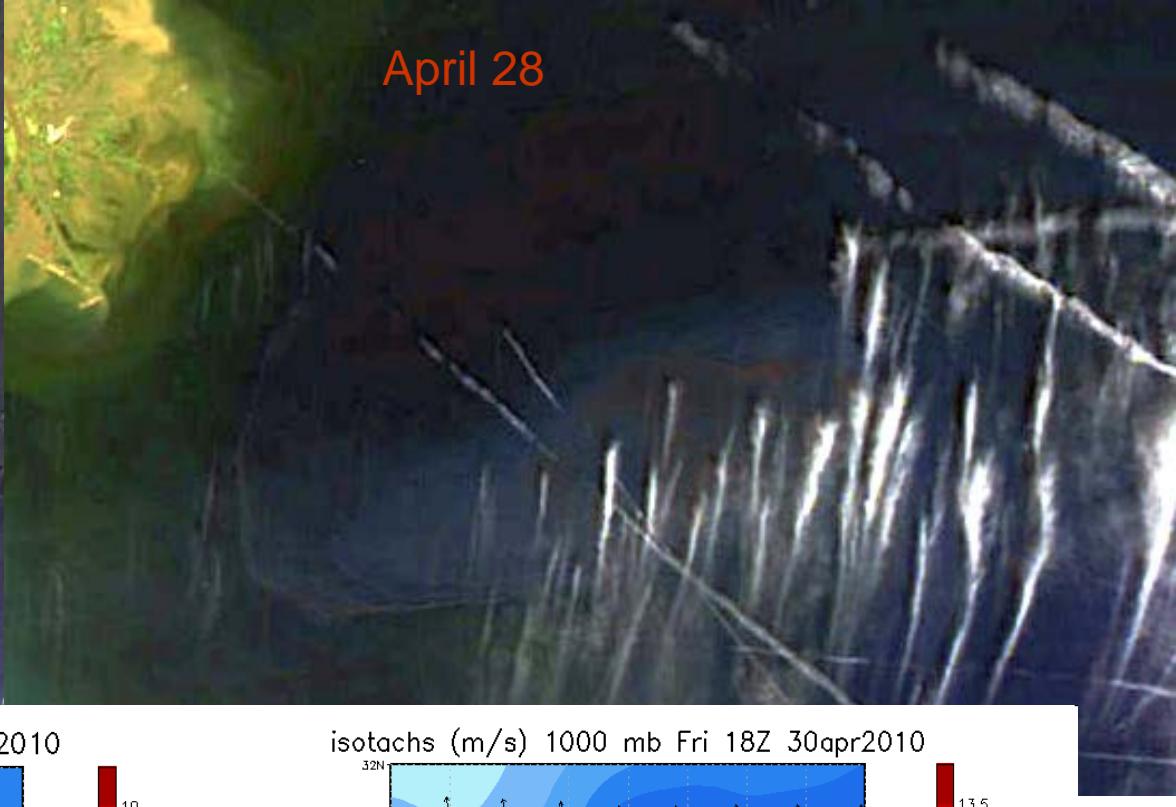


TM Landsat
23 April

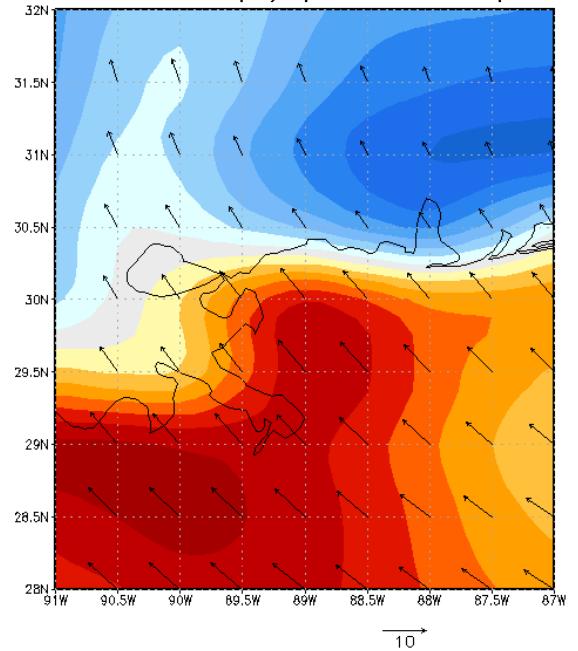
April 27



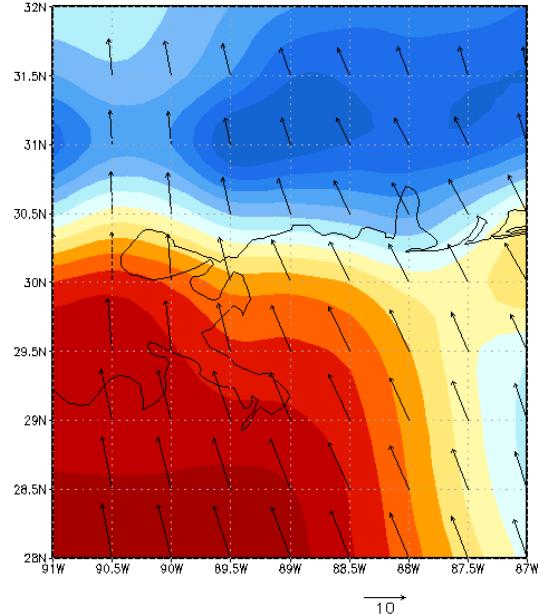
April 28



10 m isotachs (m/s) Fri 00Z 30apr2010



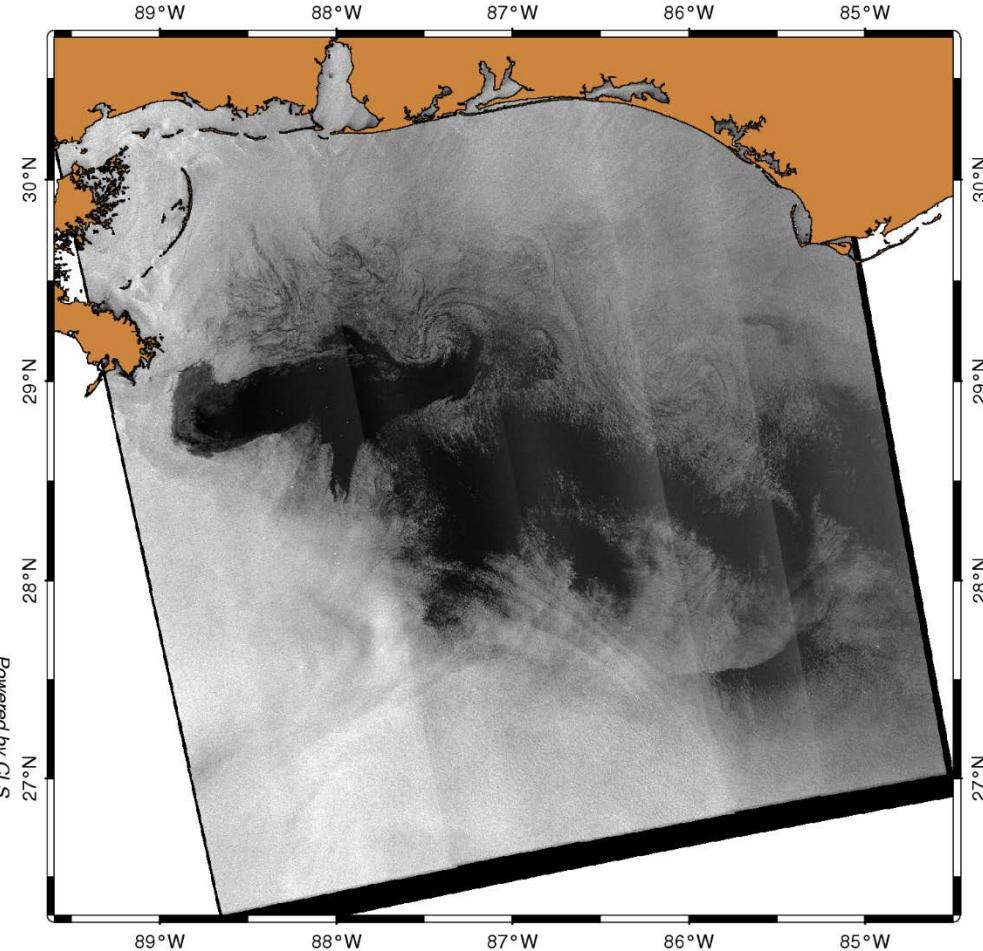
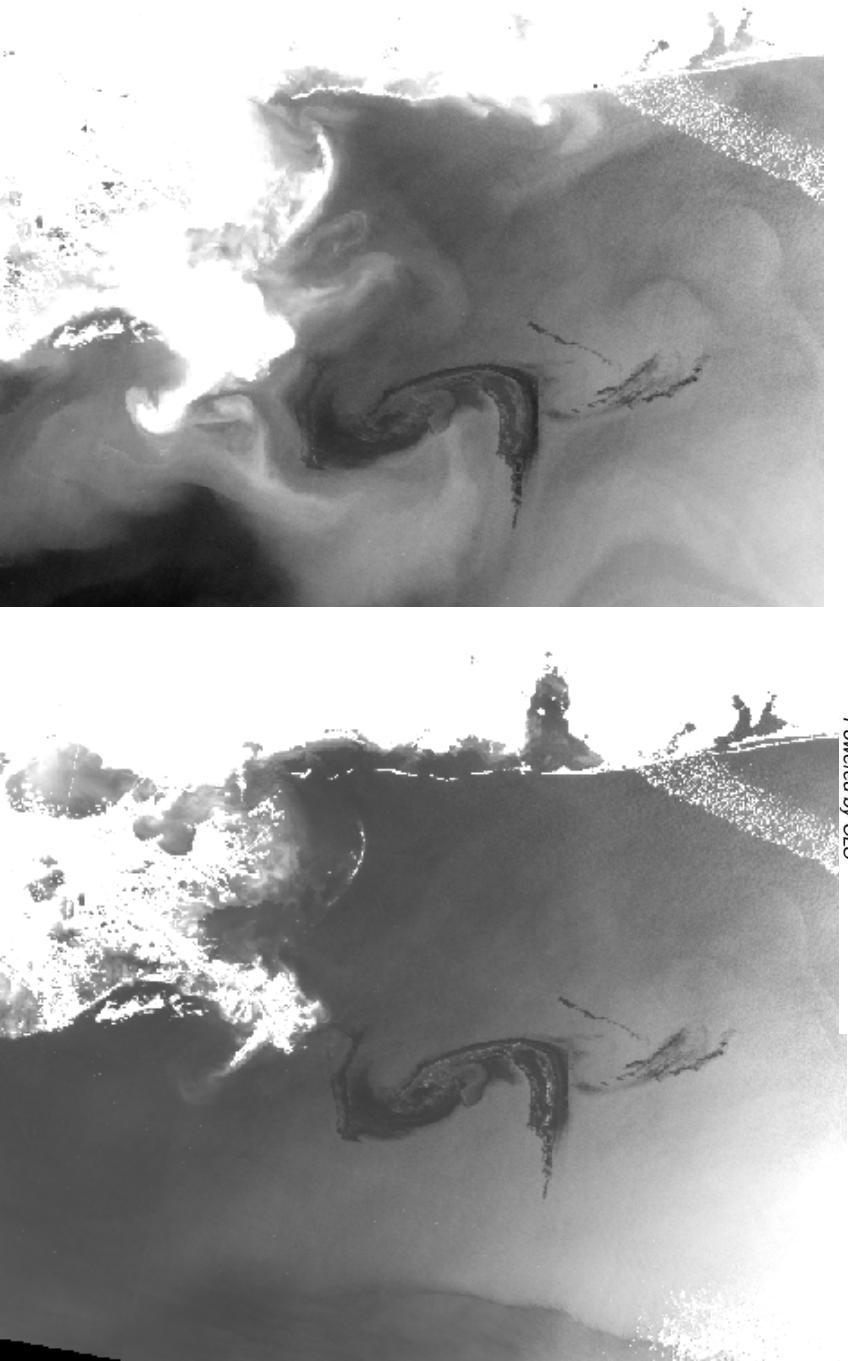
isotachs (m/s) 1000 mb Fri 18Z 30apr2010



29-April-2010 03:46:25 (UTC)

ENVISAT WSM Product

SOPRANO
CLS™
esa



Проявление нефтяного загрязнения
В данных MERIS и ASAR



MODIS

MERIS

29 04 2010

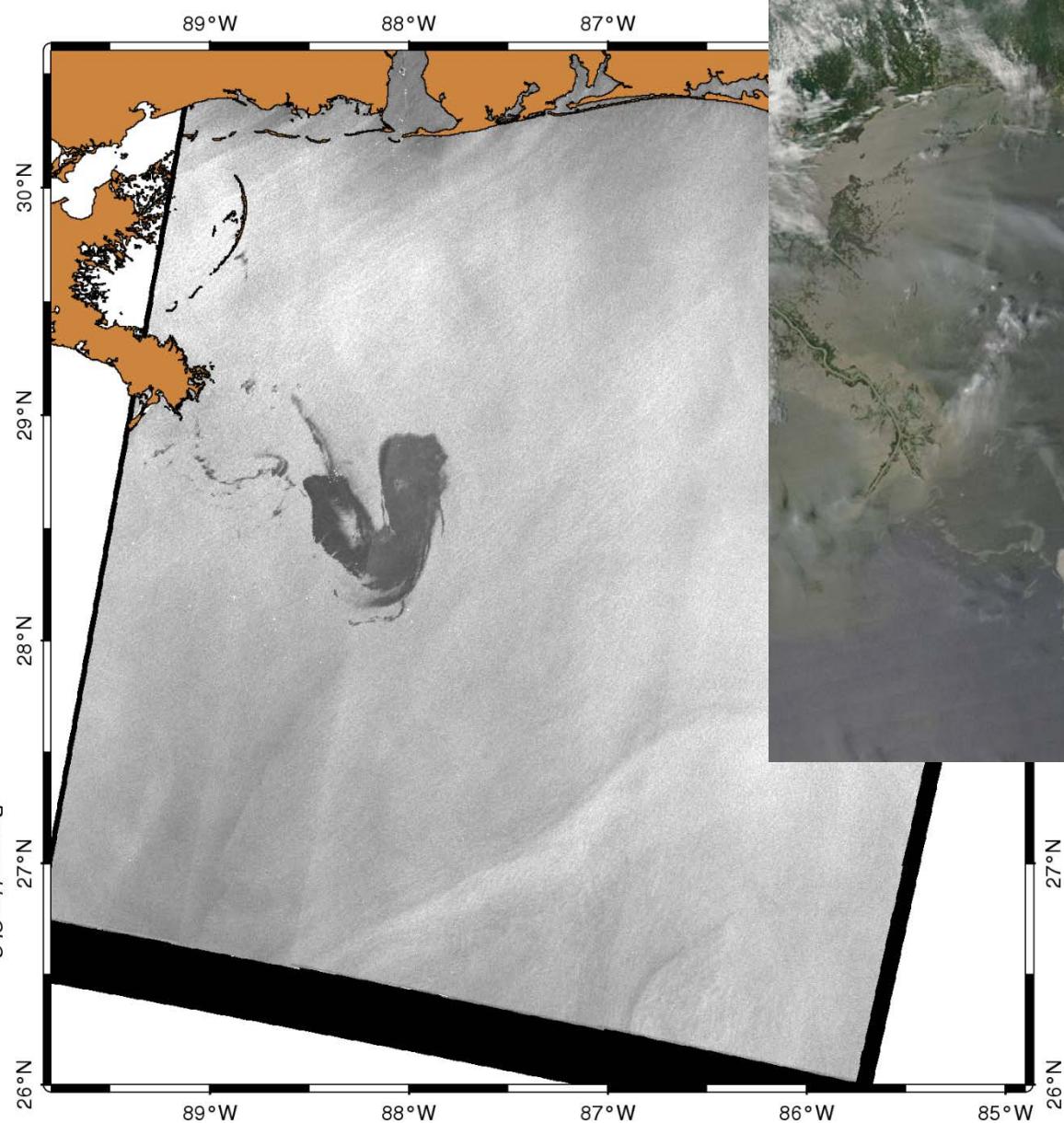


Вне зоны блика MODIS

09-May-2010 15:49:53 (UTC)

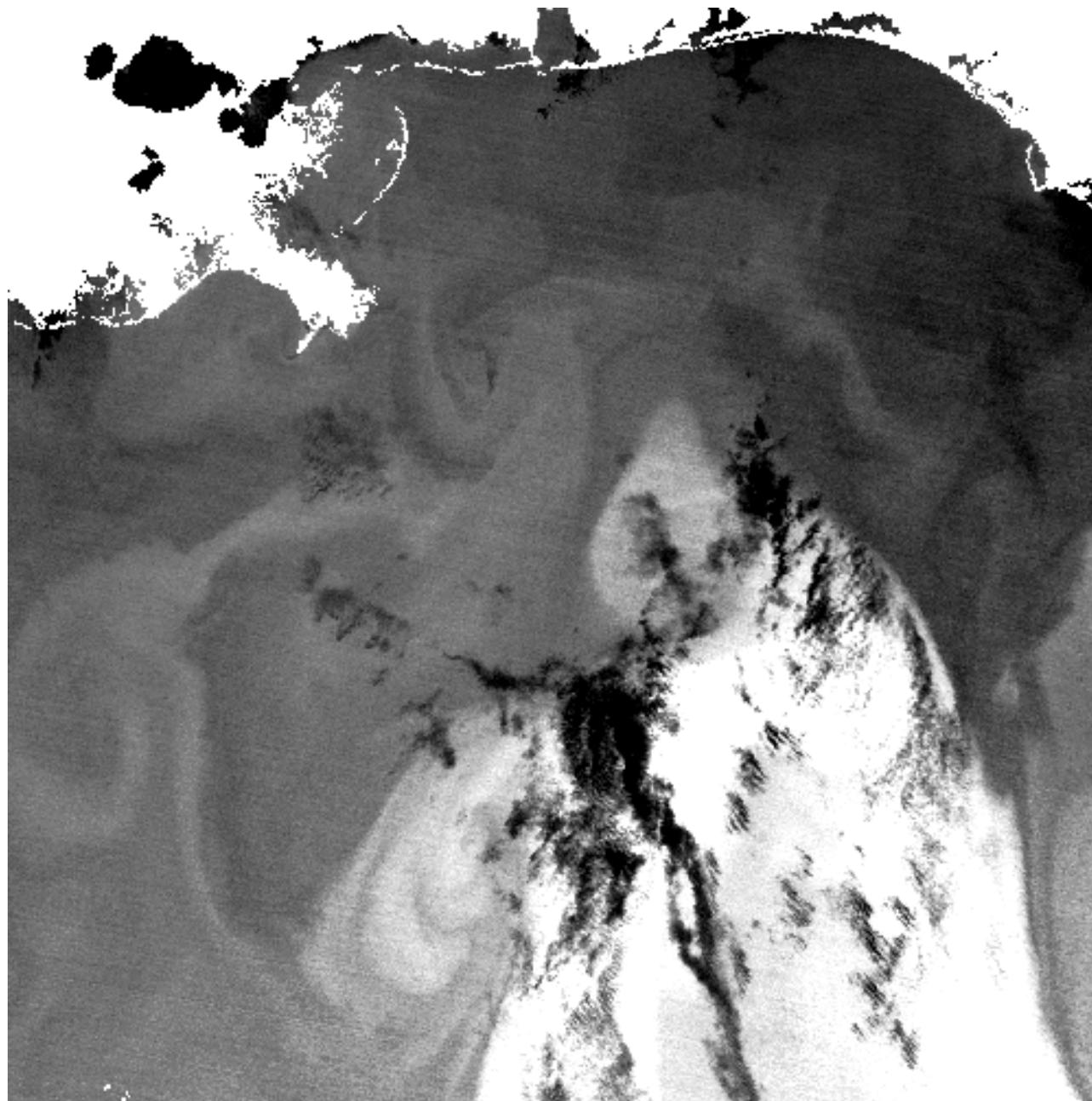
ENVISAT WSM Product

SOPRANO
cls™ esa

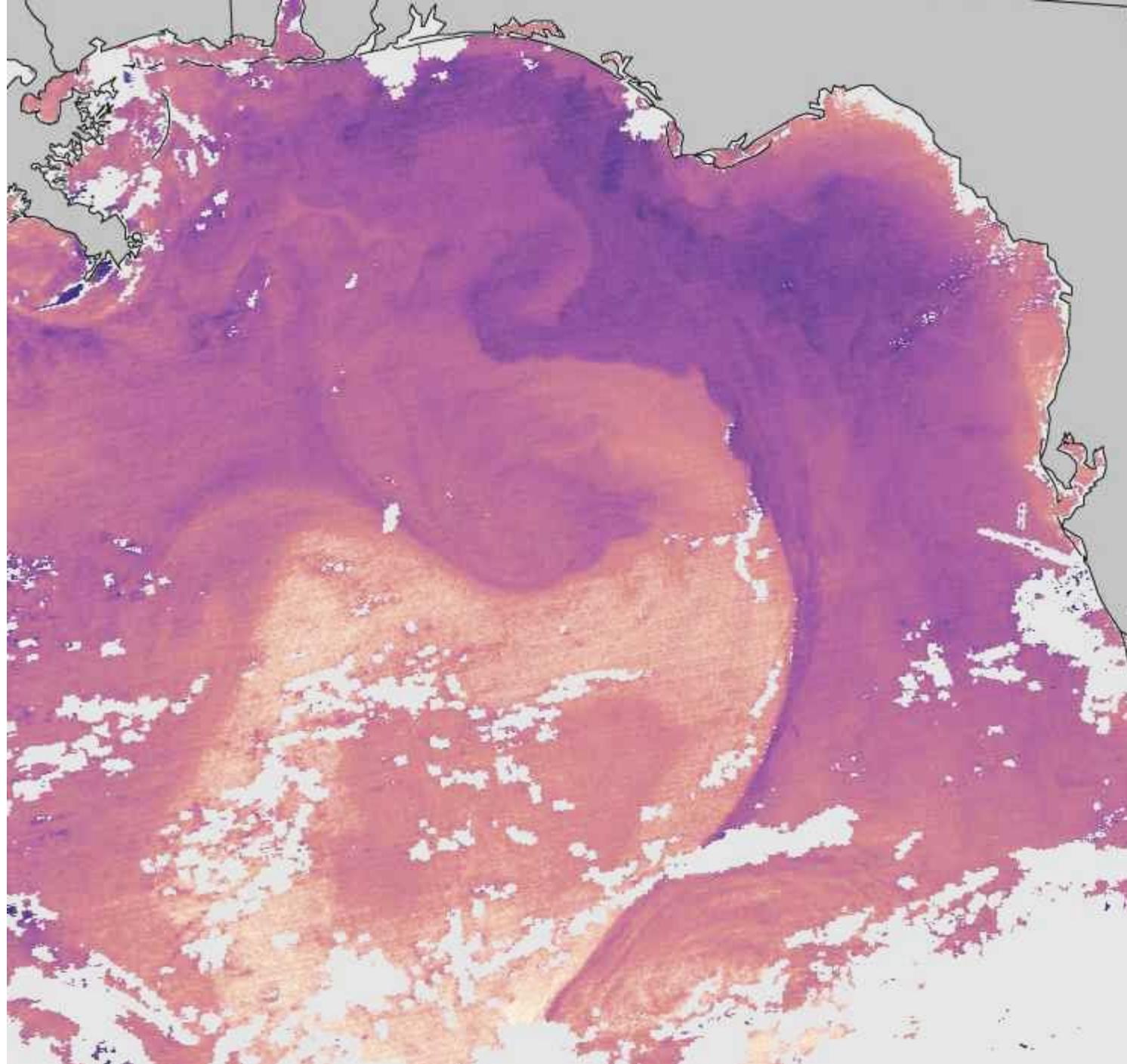


MODIS, ASAR 09 05 2010

SST



SST 18 MAY





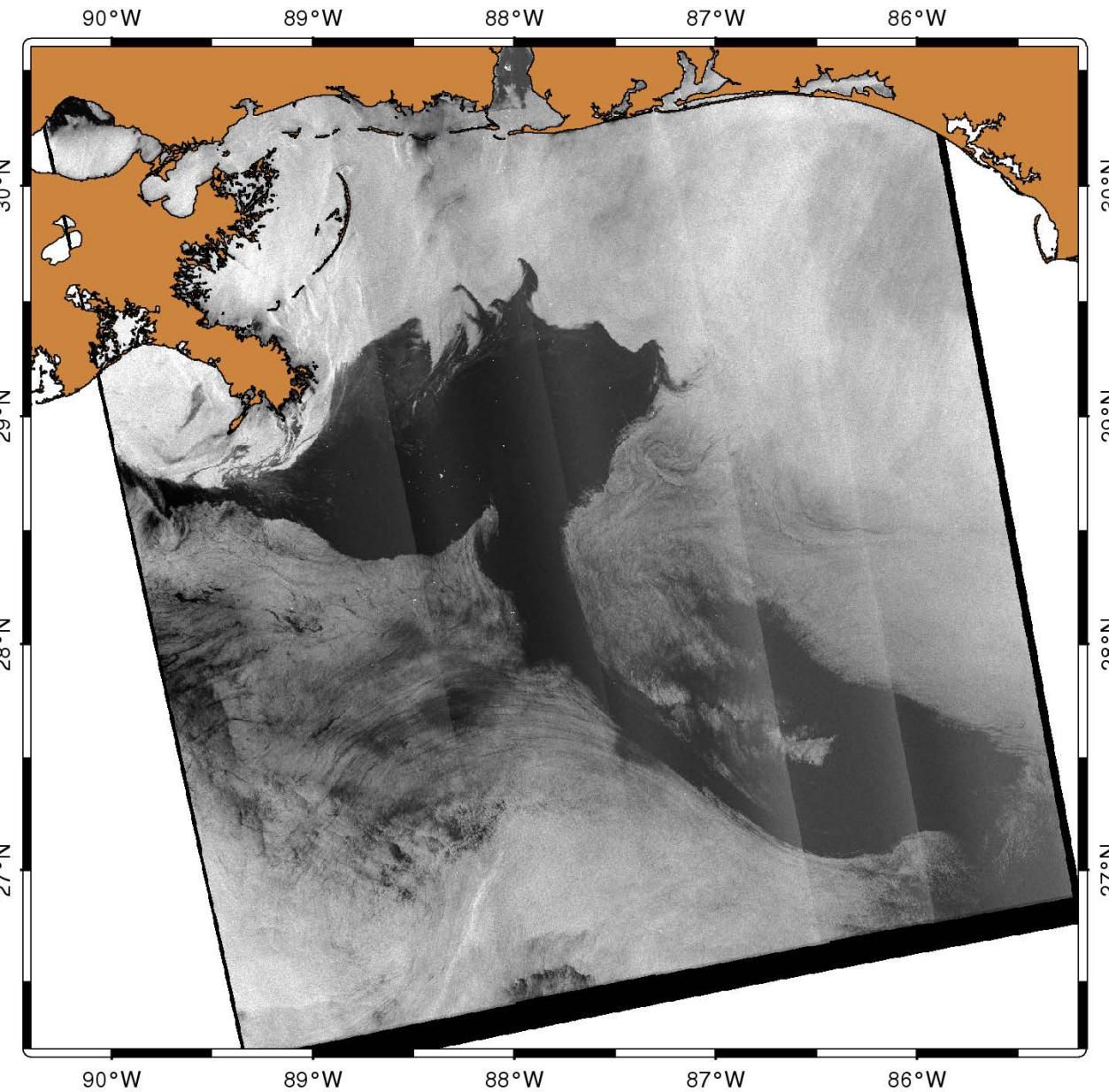
May 17



May 24

18-May-2010 03:49:18 (UTC)

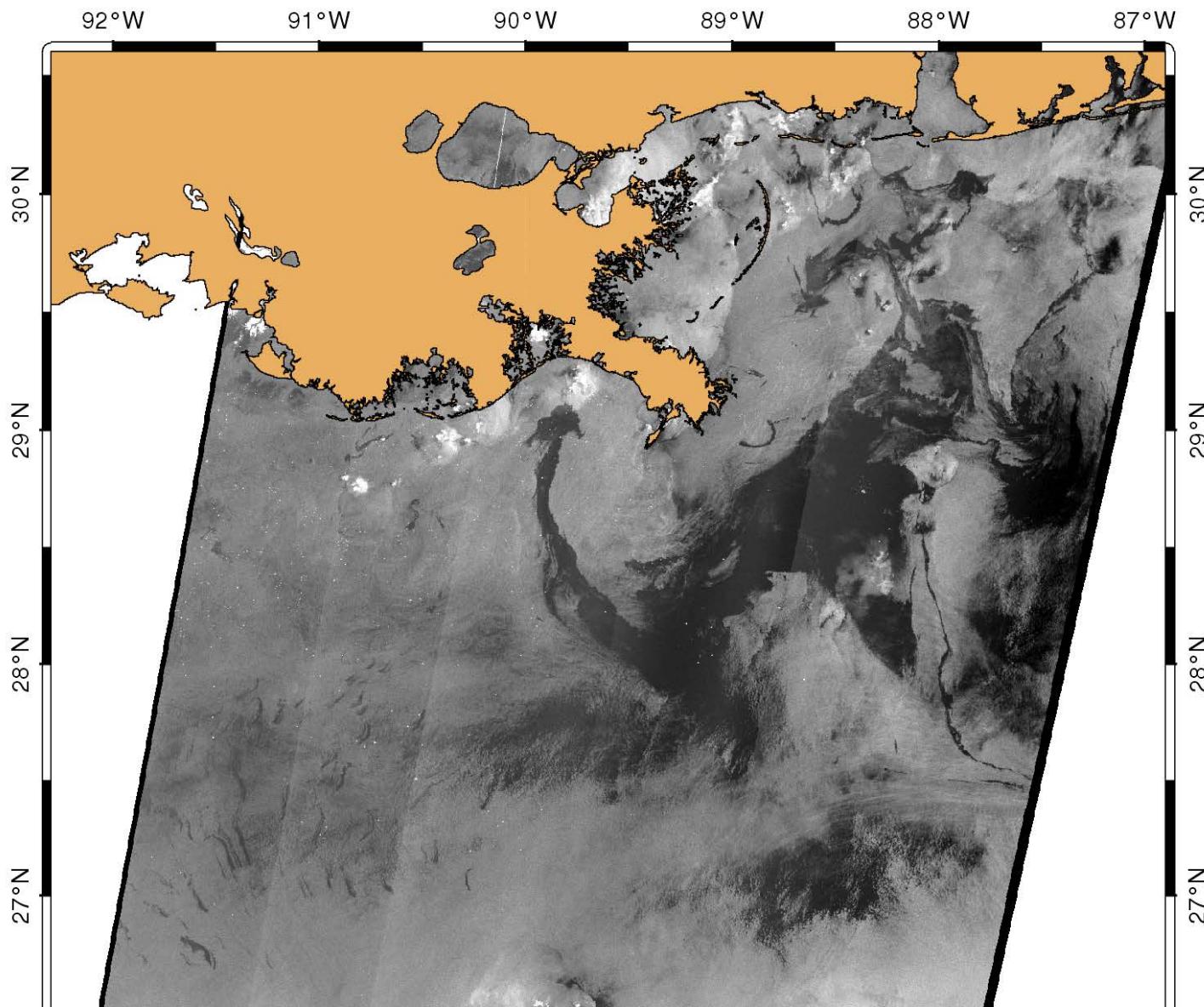
ENVISAT WSM Product

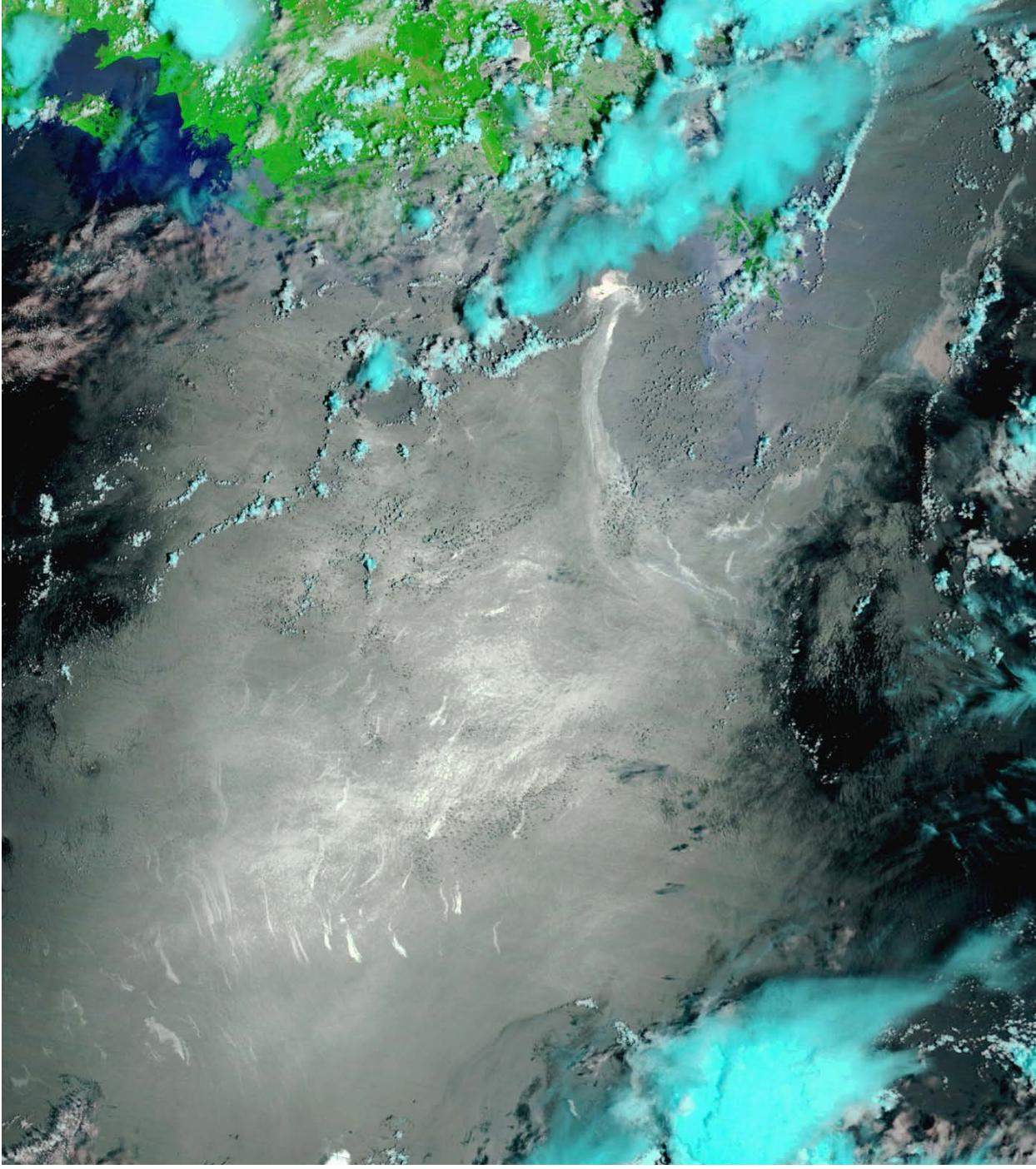


$$S=20\,000 \text{ km}^2$$
$$D=10^{-6} \text{ m}$$
$$V=20\,000 \text{ m}^3$$

31-May-2010 15:59:26 (UTC)
ENVISAT WSM Product

SOPRANO
••• CLS™ esa

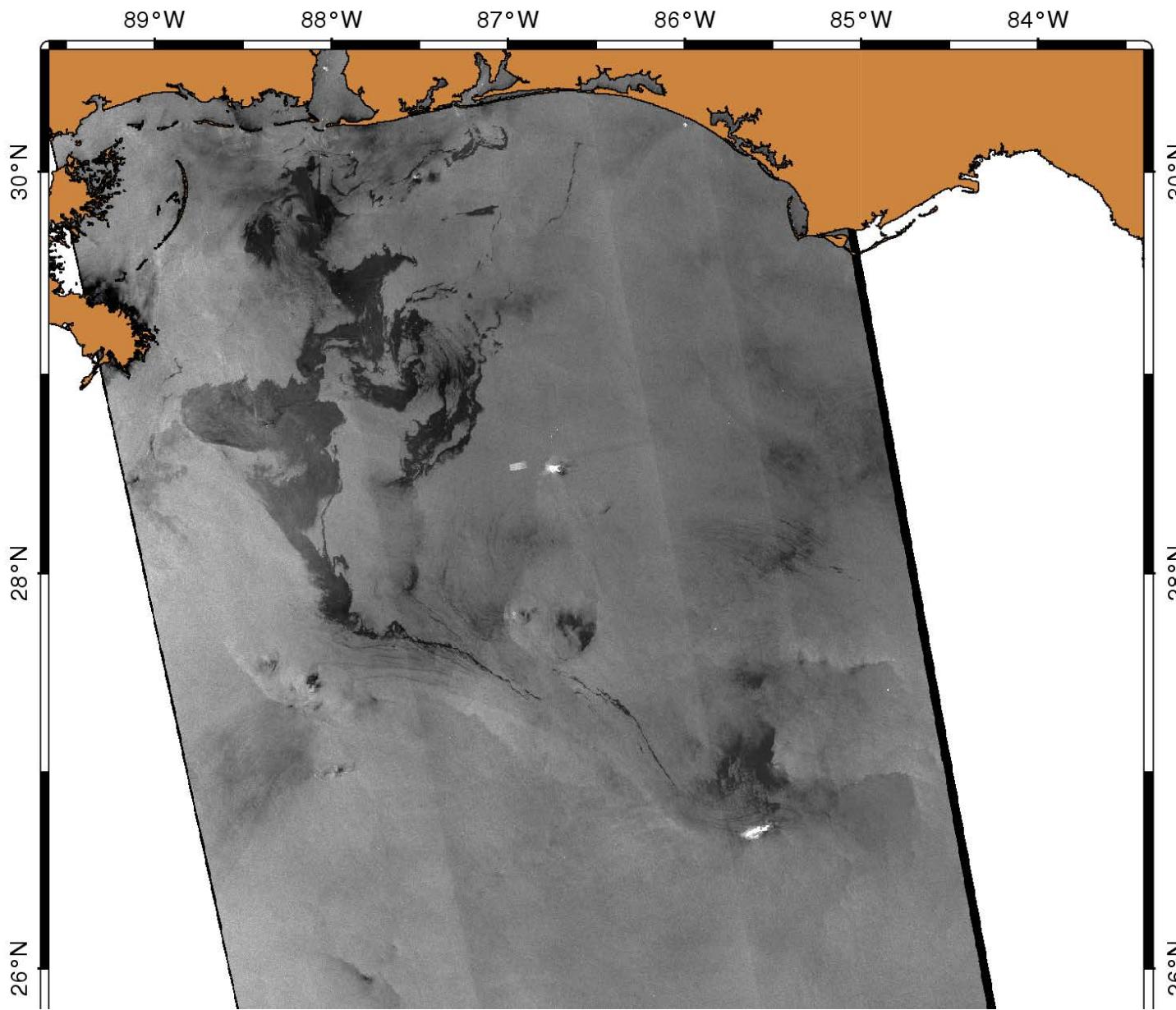


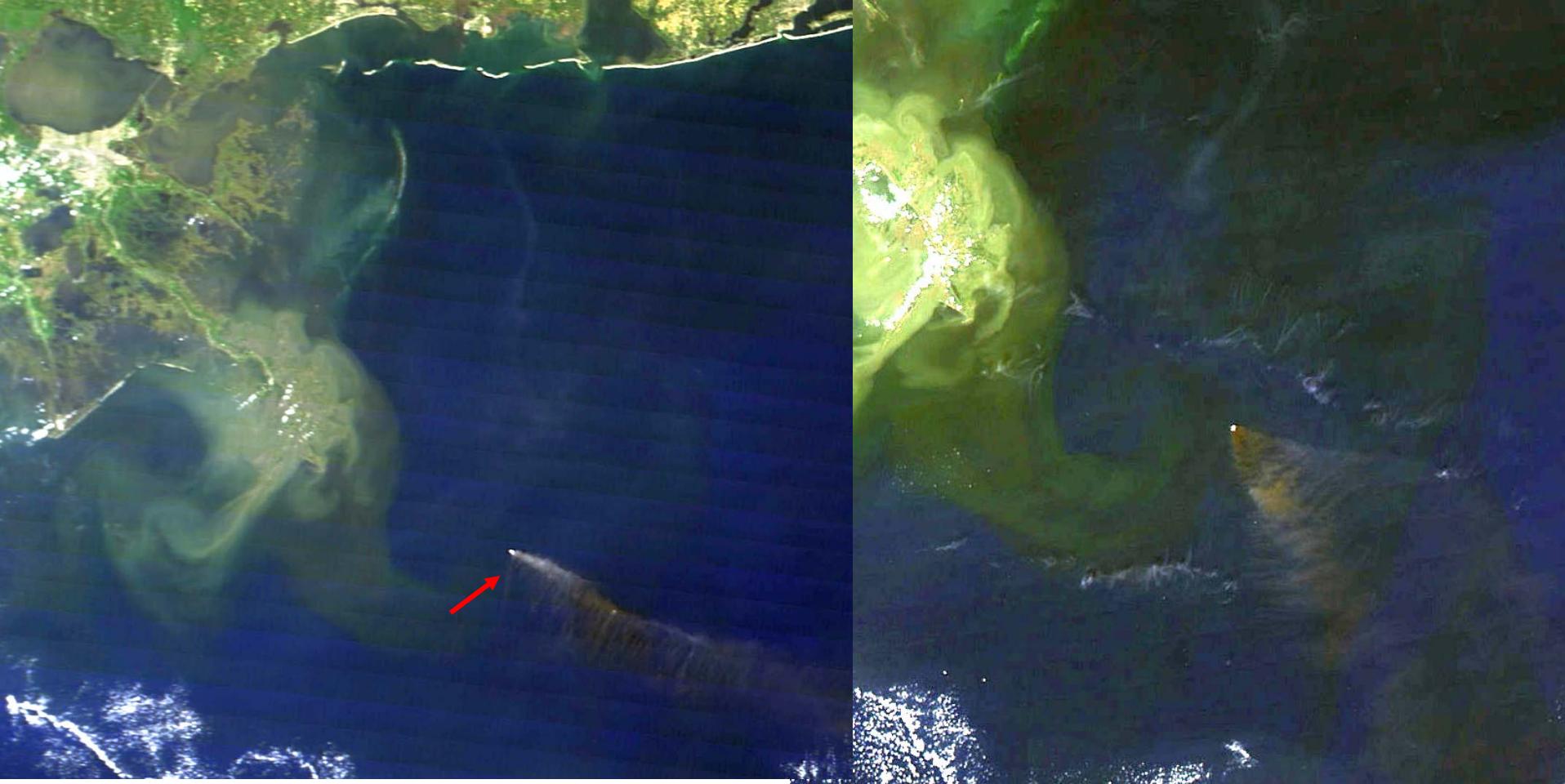


03–June–2010 03:45:45 (UTC)

ENVISAT WSM Product

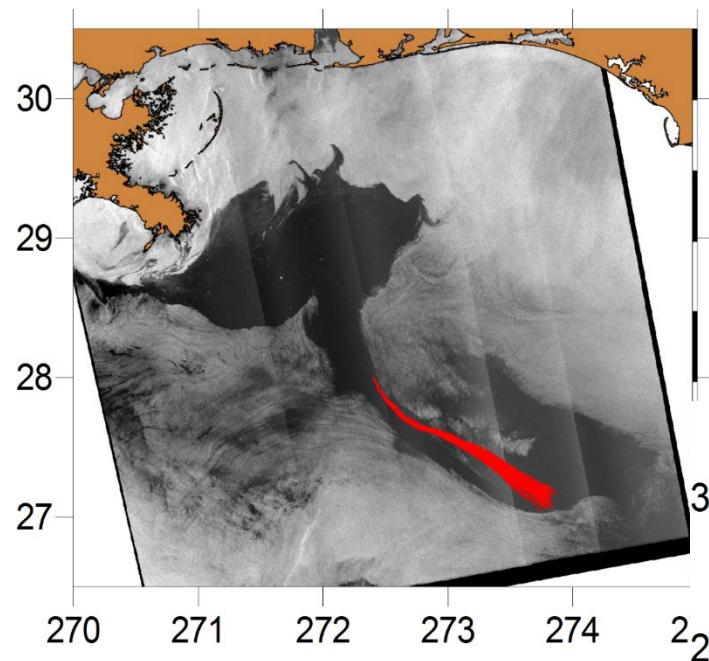
SOPRANO
••• CLS™
e esa



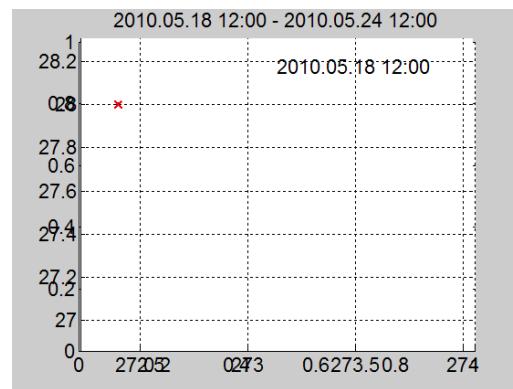


April 21

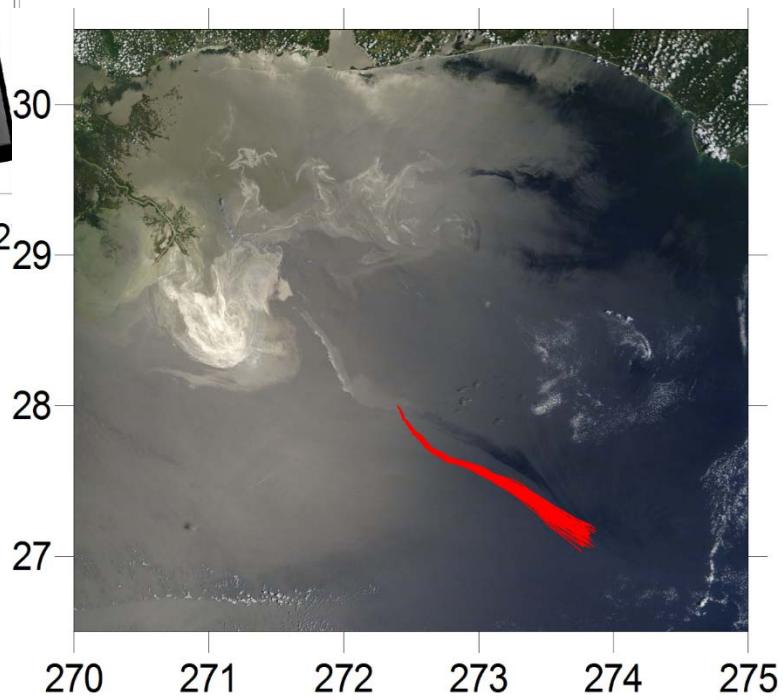
Damaged Well in Gulf of Mexico



ASAR
ESA May18

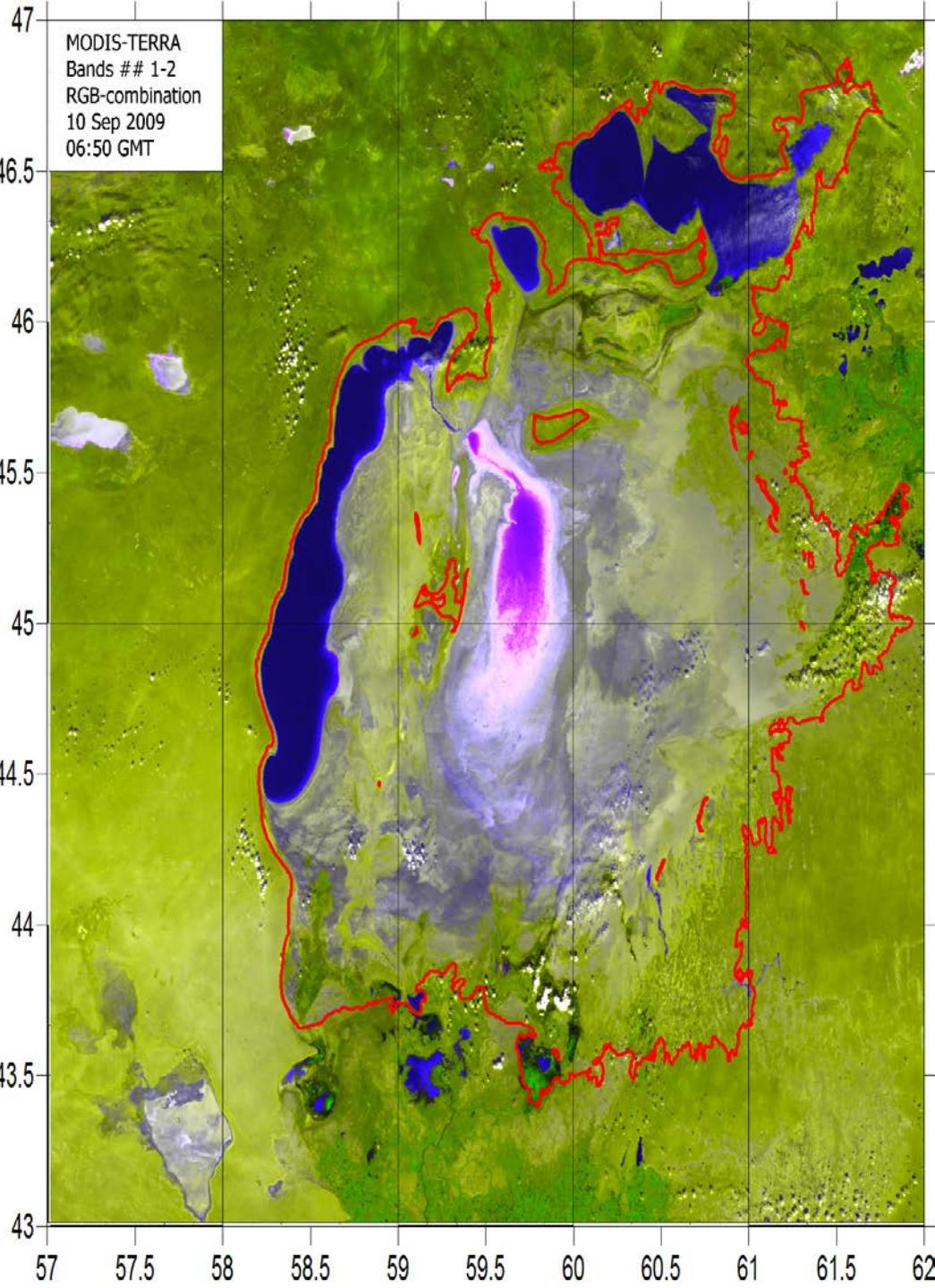
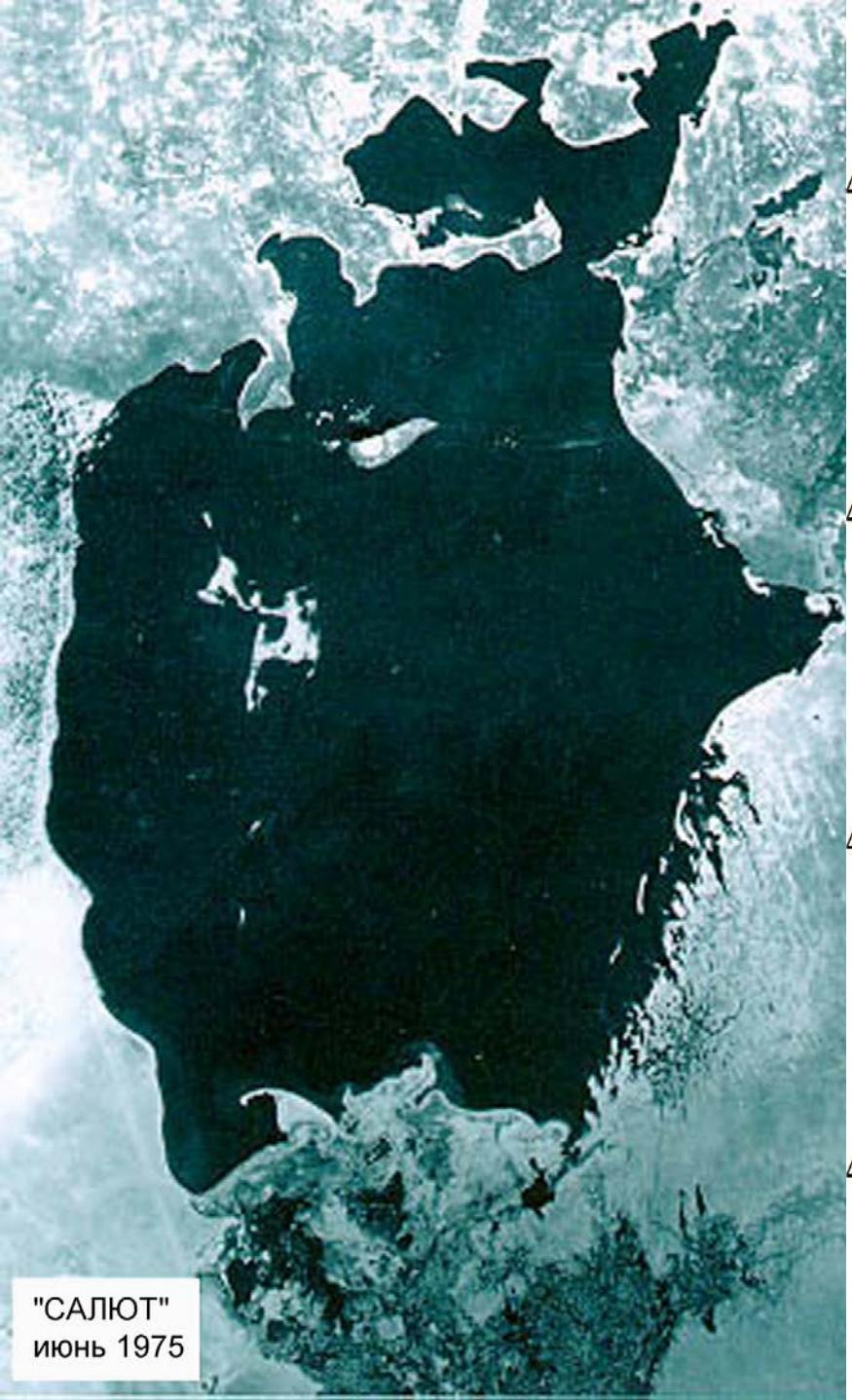


MODIS Terra May24



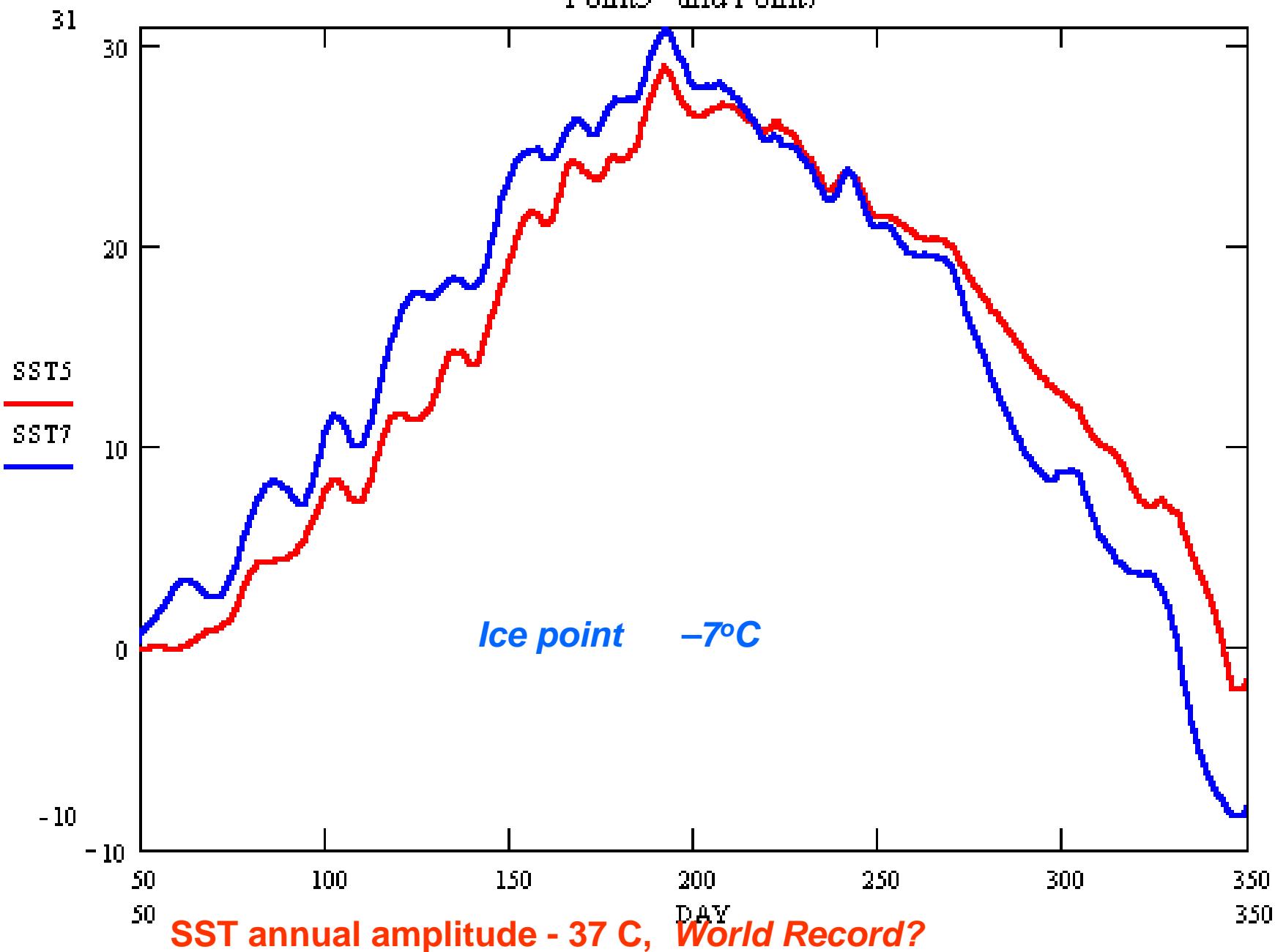
Aral Sea –

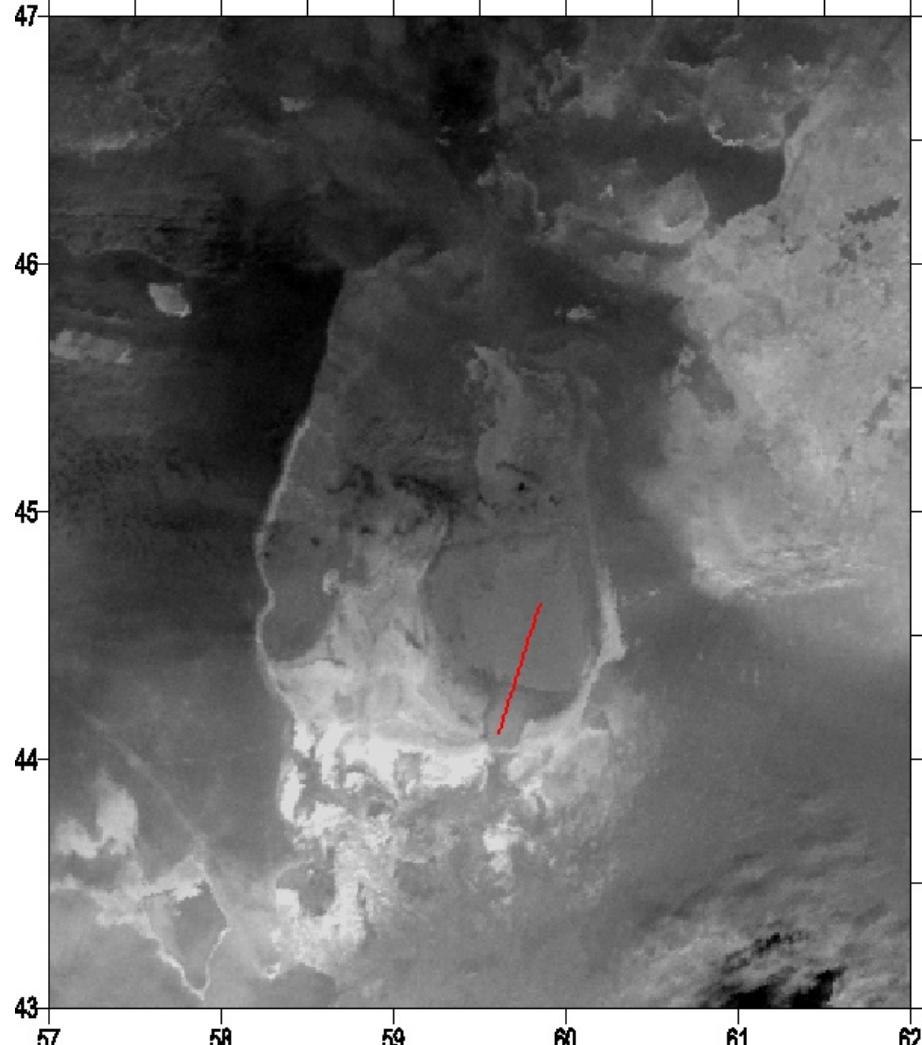
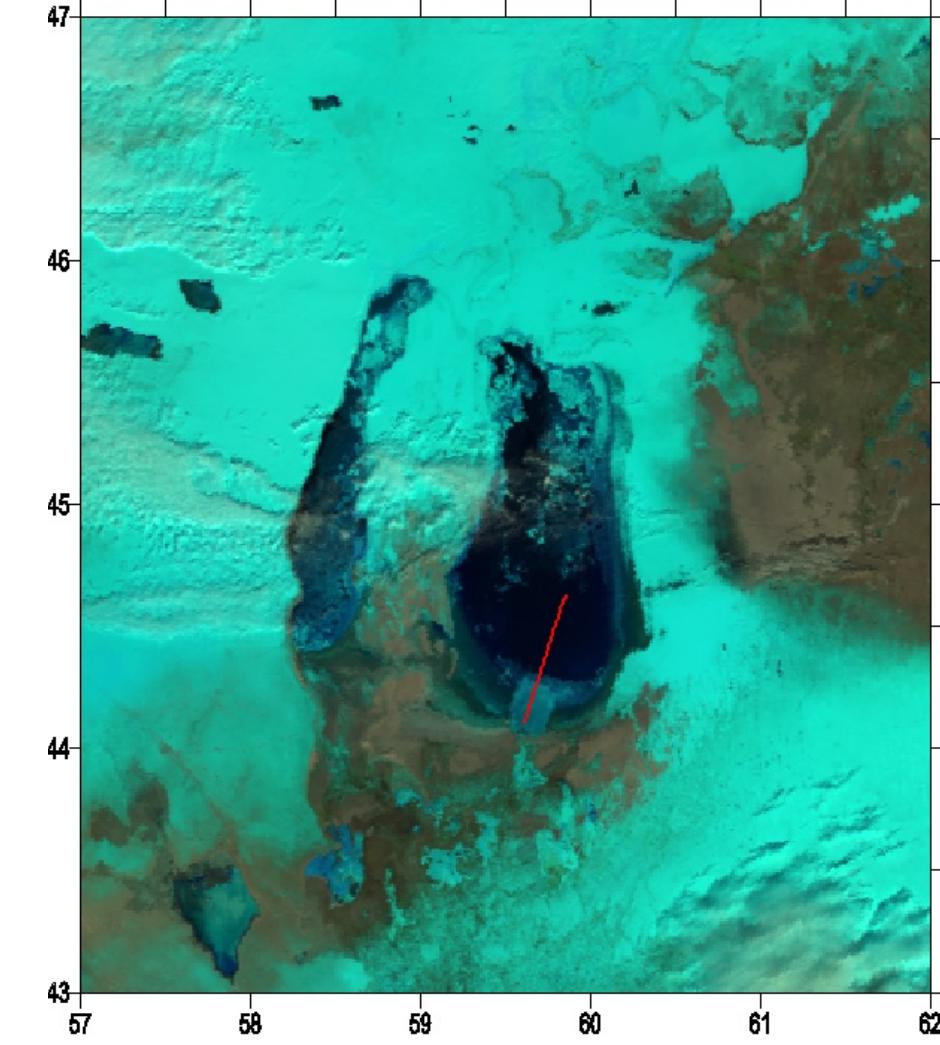
The Aral Sea disaster is one of the most significant examples of a man made ecological catastrophe caused by mismanagement of water resources. Uncontrolled water withdrawal lead to the Aral sea's level drop of up to 30 meters for the last 40 years.



"САЛЮТ"
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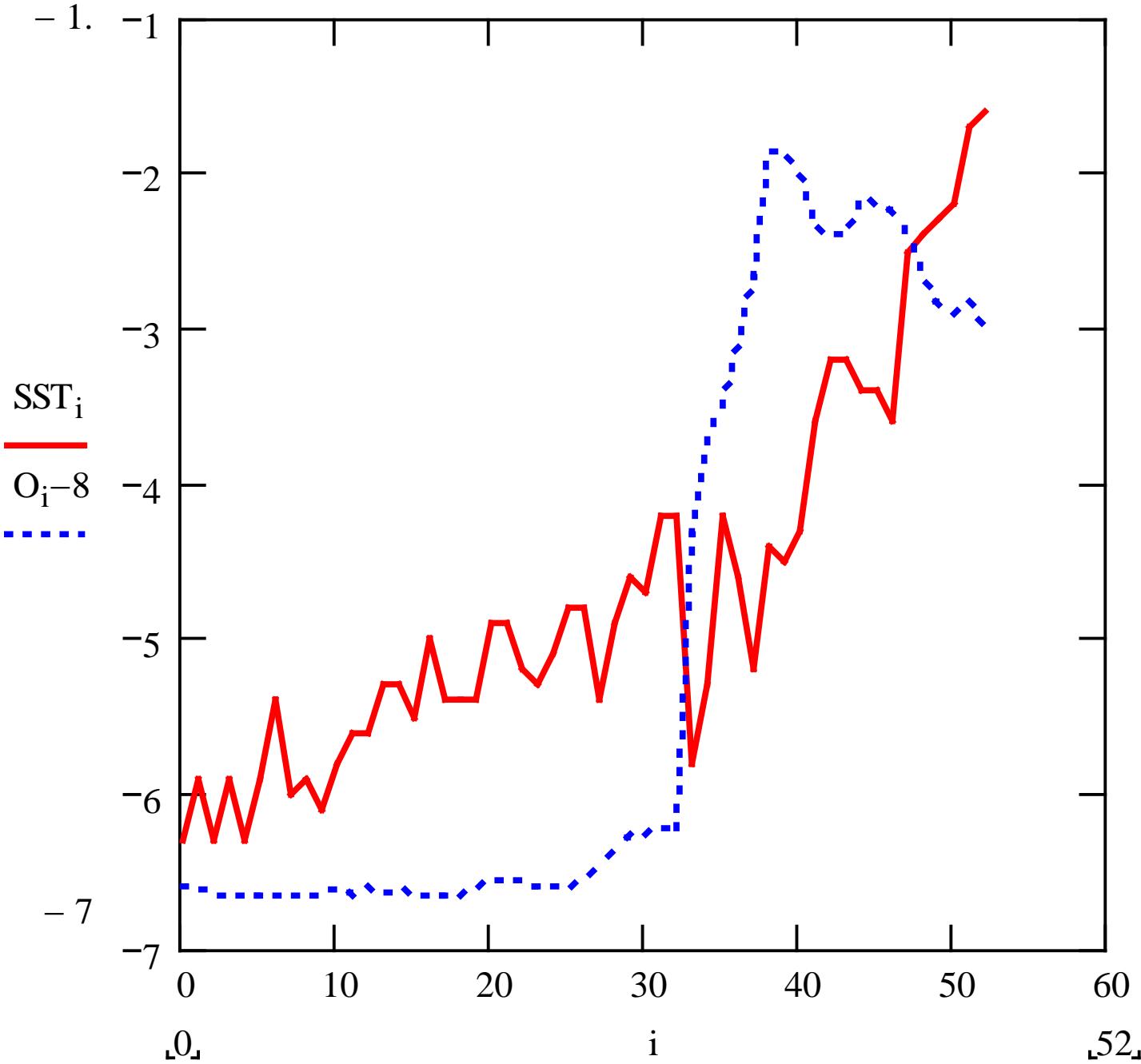
Point5 and Point7

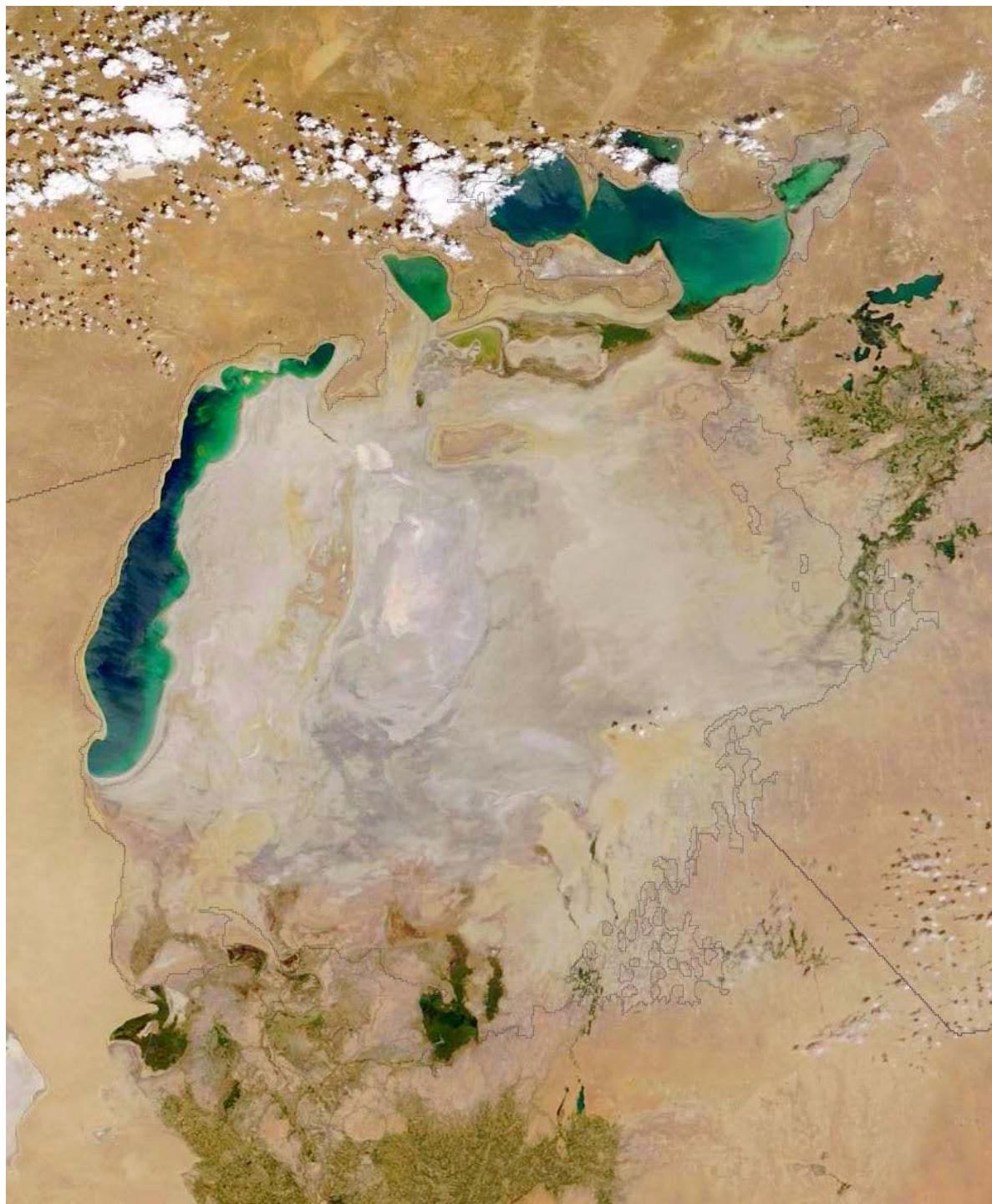




WARM ICE

SST and CH₂ alb

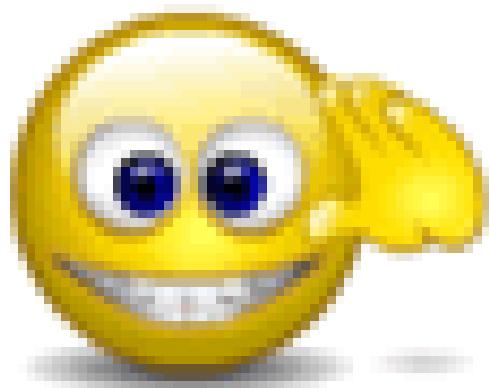




RECENT STATE

RECENT archives for satellite and meteo data

MY RECOMENDATIONS



2014



Thank you

SSTANICHNY@MAIL.RU

