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**Kirches, Grit; Paperin, Michael; Klein, Holger; Brockmann, Carsten;
Stelzer, Kerstin**

The KLIWAS Climatology for Sea Surface Temperature and Ocean Colour Fronts in the North Sea

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The KLIWAS Climatology for
Sea Surface Temperature and
Ocean Colour Fronts in the North Sea
Part C: Ocean Colour Products

Koblenz, im Oktober 2013



KLIWAS

**KLIWAS Schriftenreihe
KLIWAS-23/2013**

**The KLIWAS Climatology for
Sea Surface Temperature and
Ocean Colour Fronts in the North Sea
Part C: Ocean Colour Products**

Authors:

**Grit Kirches ¹
Michael Paperin ¹
Holger Klein ²
Carsten Brockmann ¹
Kerstin Stelzer ¹**

¹ Brockmann Consult GmbH

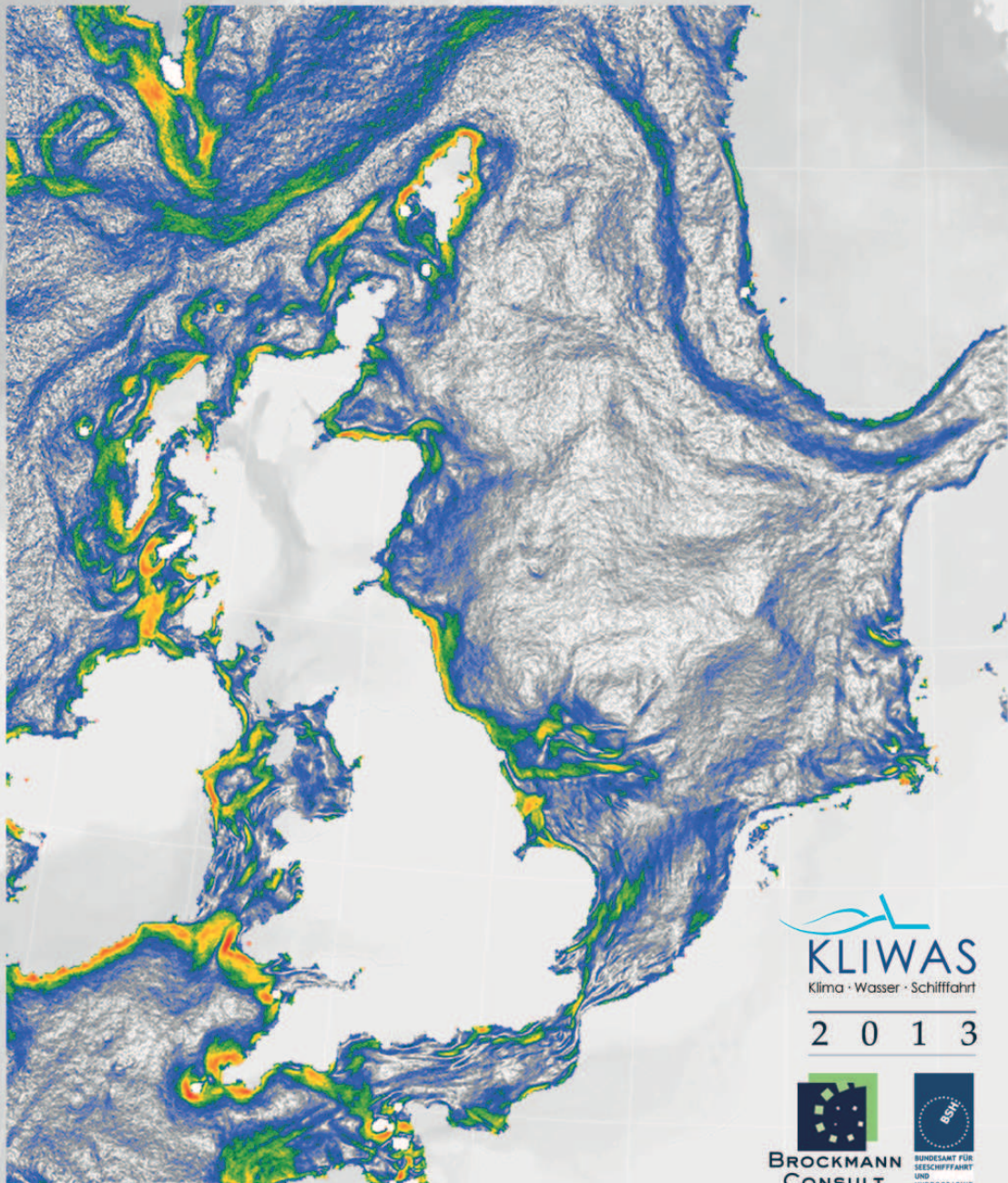
² Federal Maritime and
Hydrographic Agency

Brockmann Consult GmbH, Max-Planck-Straße 2, 21502 Geesthacht,
Germany

Federal Maritime and Hydrographic Agency, Bernhard-Nocht-Straße 78, 20359 Hamburg,
Germany

CLIMATOLOGY

of SST and Water Colours Fronts
in the North Sea




KLIWAS
Klima · Wasser · Schifffahrt

2 0 1 3


**BROCKMANN
CONSULT**


BUNDESAGENTUR FÜR
SEE-SCHIFFFAHRT
UND
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1 Abstract

The KLIWAS climatology of sea surface temperature (SST) and ocean colour (OC) fronts in the North Sea was established by a co-operation of the Federal Maritime and Hydrographic Agency (BSH) and Brockmann Consult (BC) in order to generate a reliable reference data set for the assessment of changes in frontal position, gradients, and seasonal variability due to climate change on the basis satellite data.

Frontal zones are relative sharp boundaries between different water masses and can be identified by feature extraction and classification of satellite data from different sensors providing information about the SST and OC i.e. chlorophyll or suspended matter concentration. While frontal zones can be identified directly from SST, water quality parameters such as chlorophyll concentration can be a proxy for a frontal zone, but not every strong OC gradient is mandatory an oceanic front. More than two decades of satellite data have been analysed for this climatology referring to type and location of frontal zones, horizontal scales (e.g. gradients perpendicular to the front), and sensor characteristics like spatial resolution and noise.

This report consists of three parts:

Part A describes background, methods, data, the new algorithms, and the data access via ftp. The data are freely available for everyone.

Part B presents a selection of SST products, and

Part C (this document) presents a selection of OC products.

2 OC time series

2.1 Total suspended matter (TSM) time series based on the data of the MERIS-sensor on ENVISAT

2.1.1 Time period 2002-2010, annual means

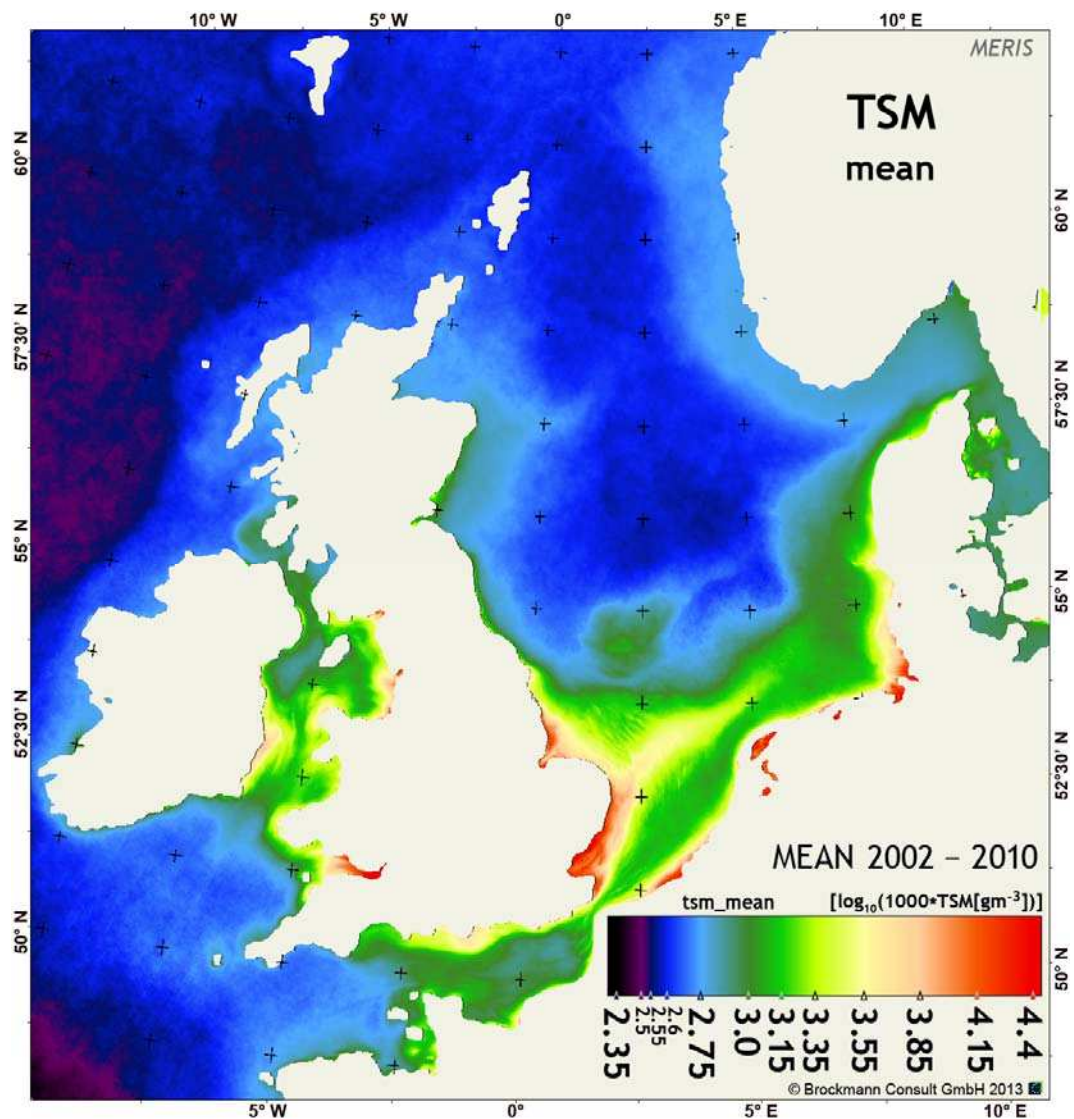


Fig. 1: TSM mean field based on the data of the MERIS sensor on ENVISAT 2002 - 2010

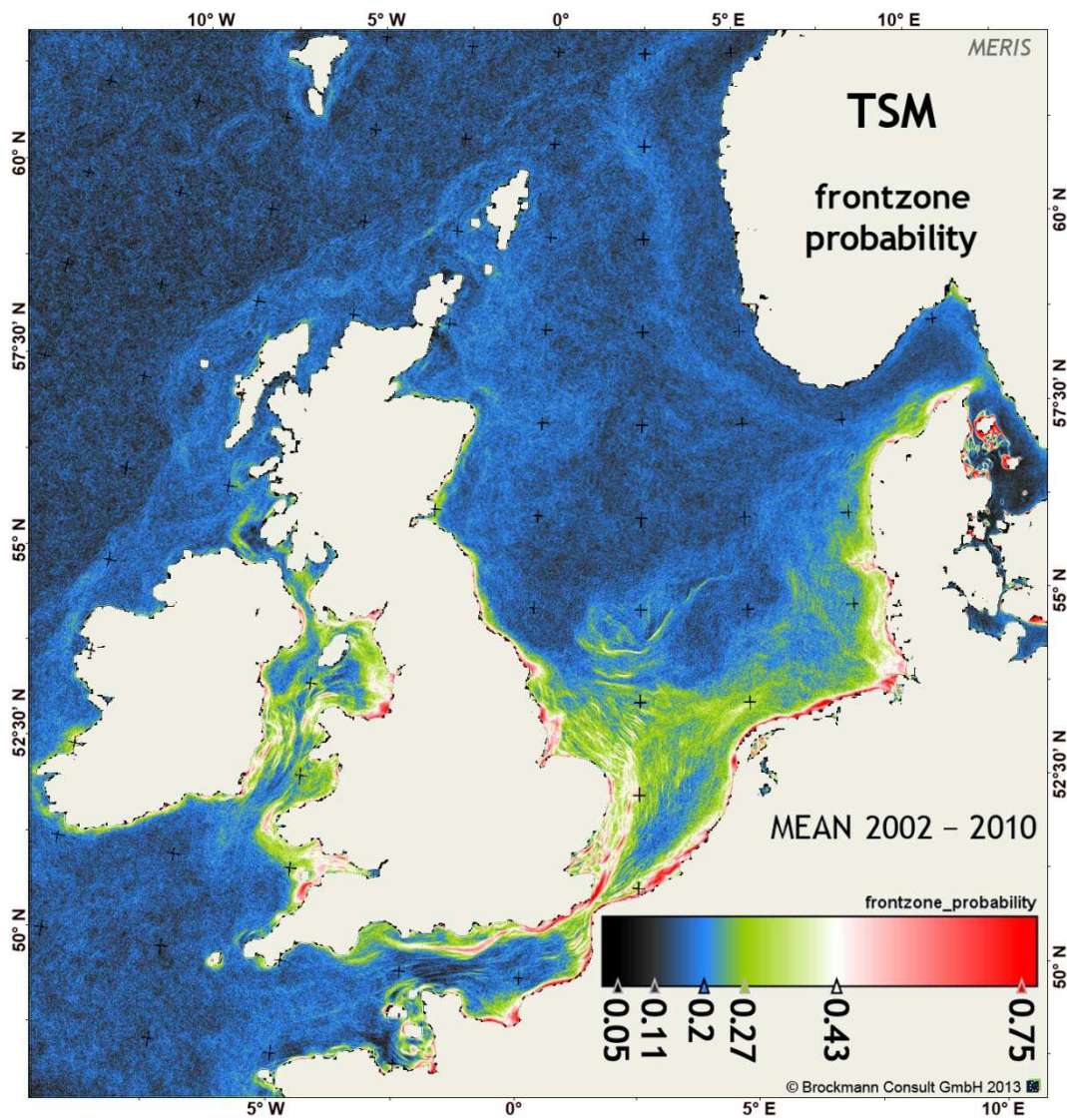


Fig. 2: TSM front probability based on the data of the MERIS sensor on ENVISAT 2002 - 2010

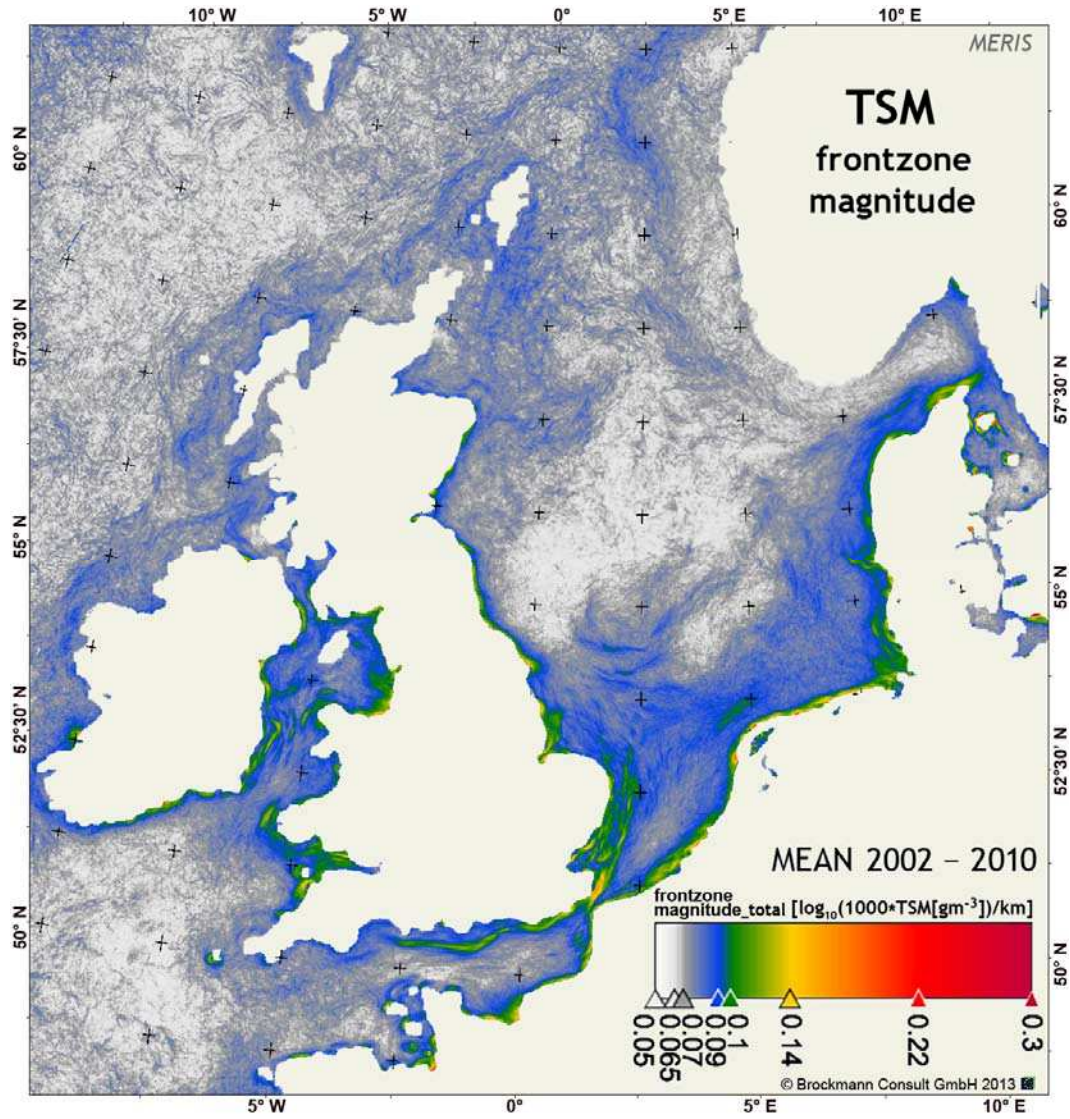


Fig. 3: TSM: mean of gradient magnitude for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

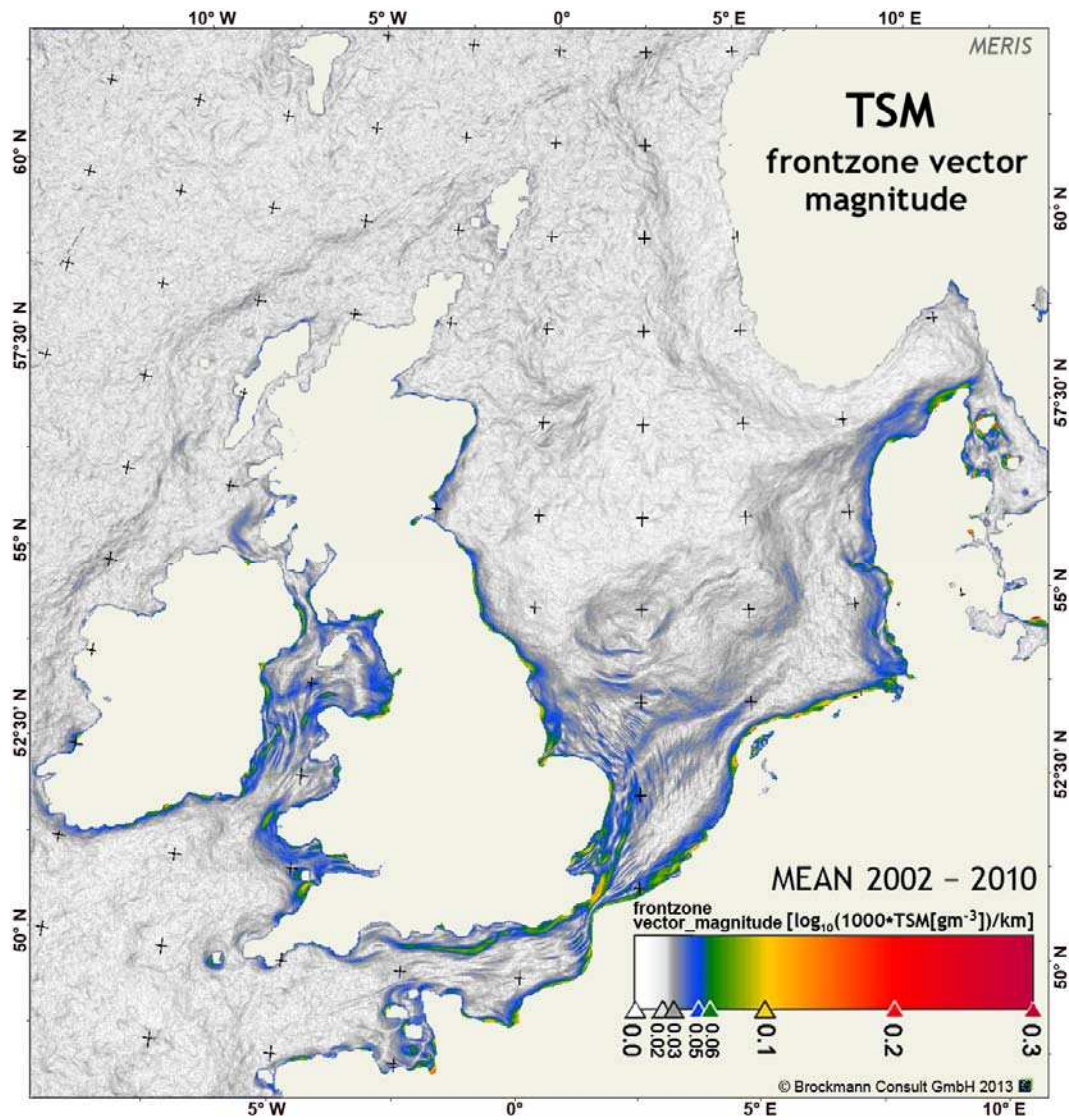


Fig. 4: TSM: magnitude of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

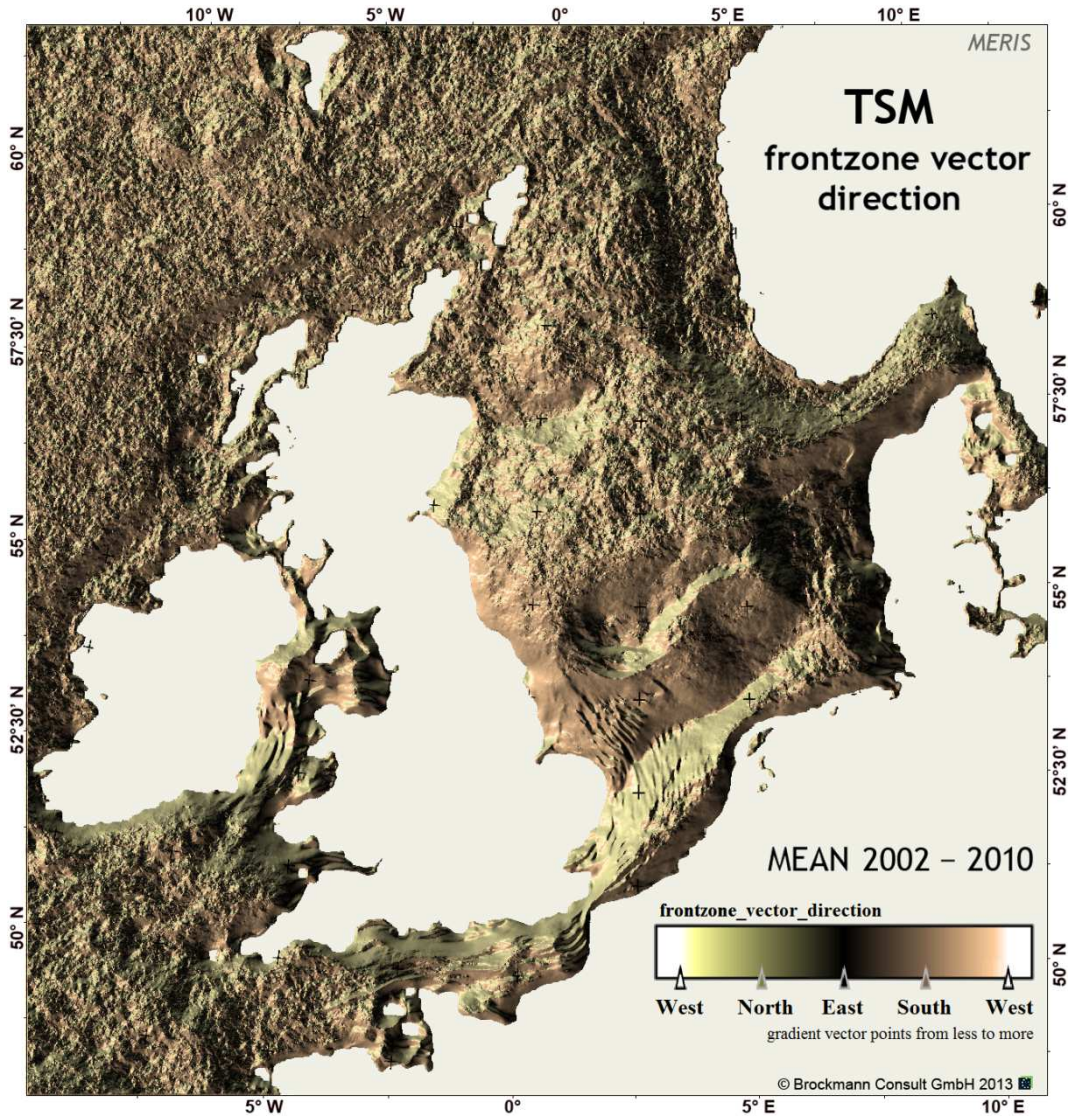


Fig. 5: TSM: direction of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

2.1.2 Time period 2002-2010, seasonal means

MERIS TSM - Mean

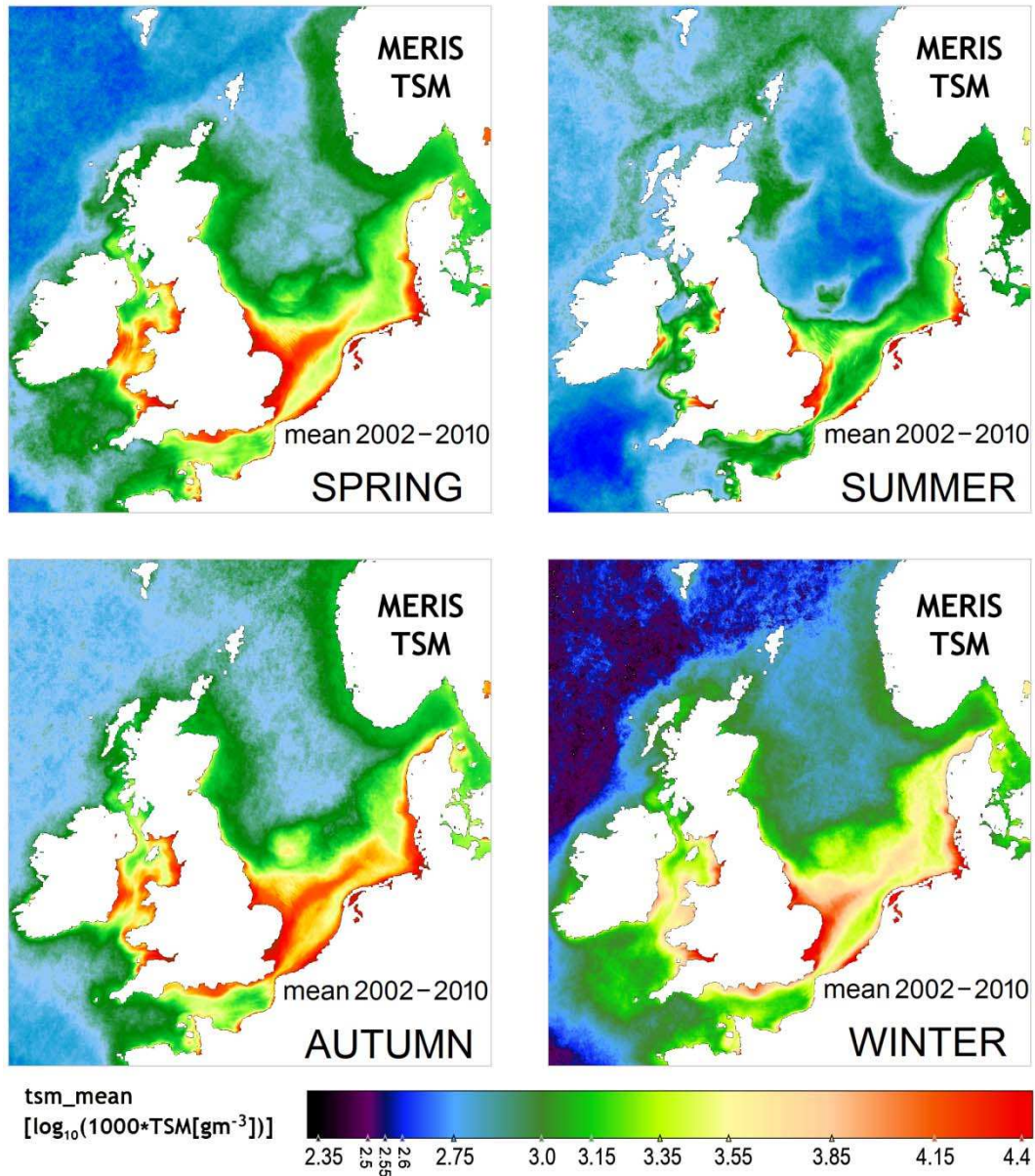


Fig. 6: TSM mean field based on the data of the MERIS sensor on ENVISAT 2002 - 2010

MERIS TSM - Front Zone Probability

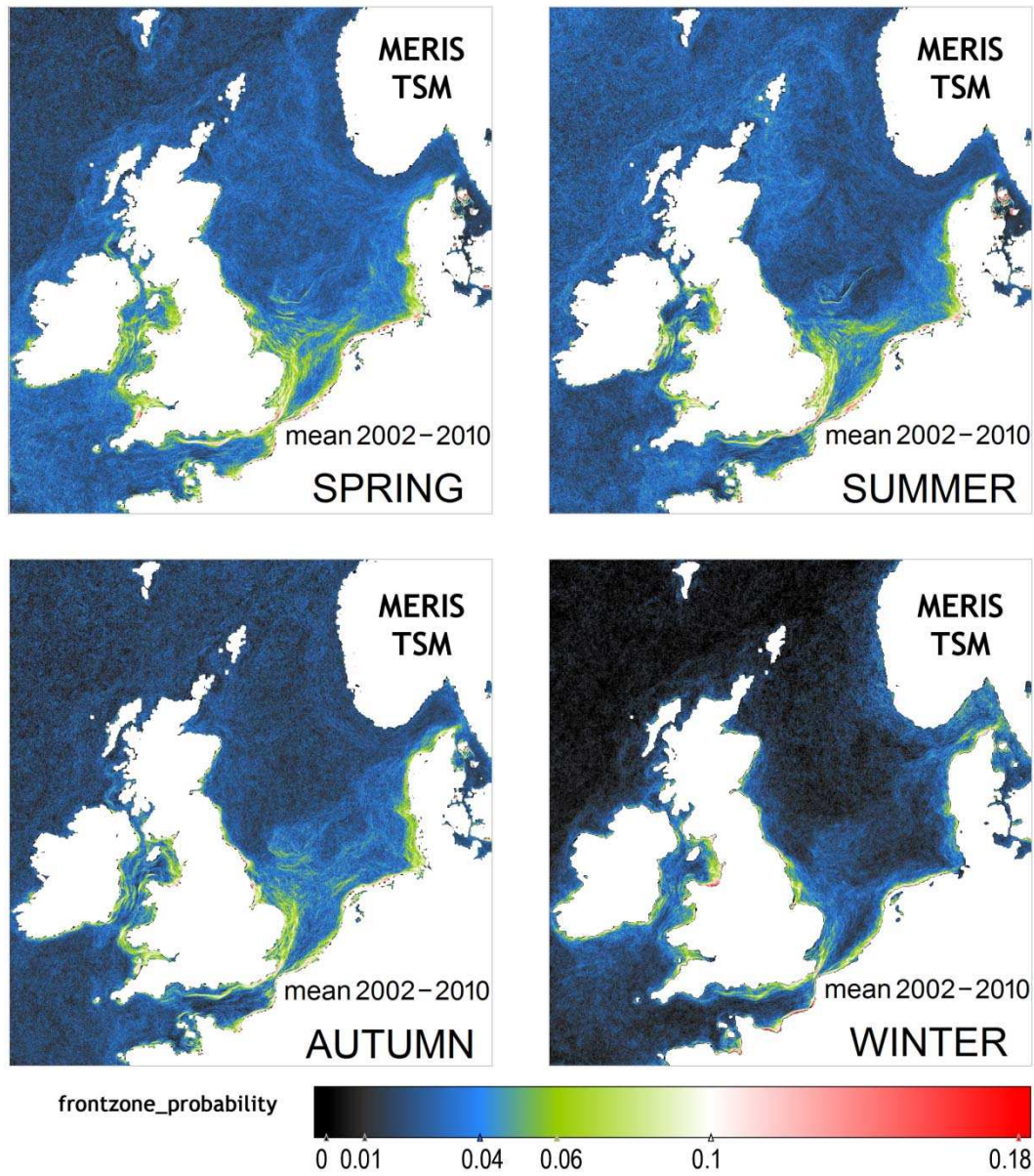


Fig. 7: TSM: front probability based on the data of the MERIS sensor on ENVISAT 2002 - 2010

MERIS TSM - Front Zone Magnitude

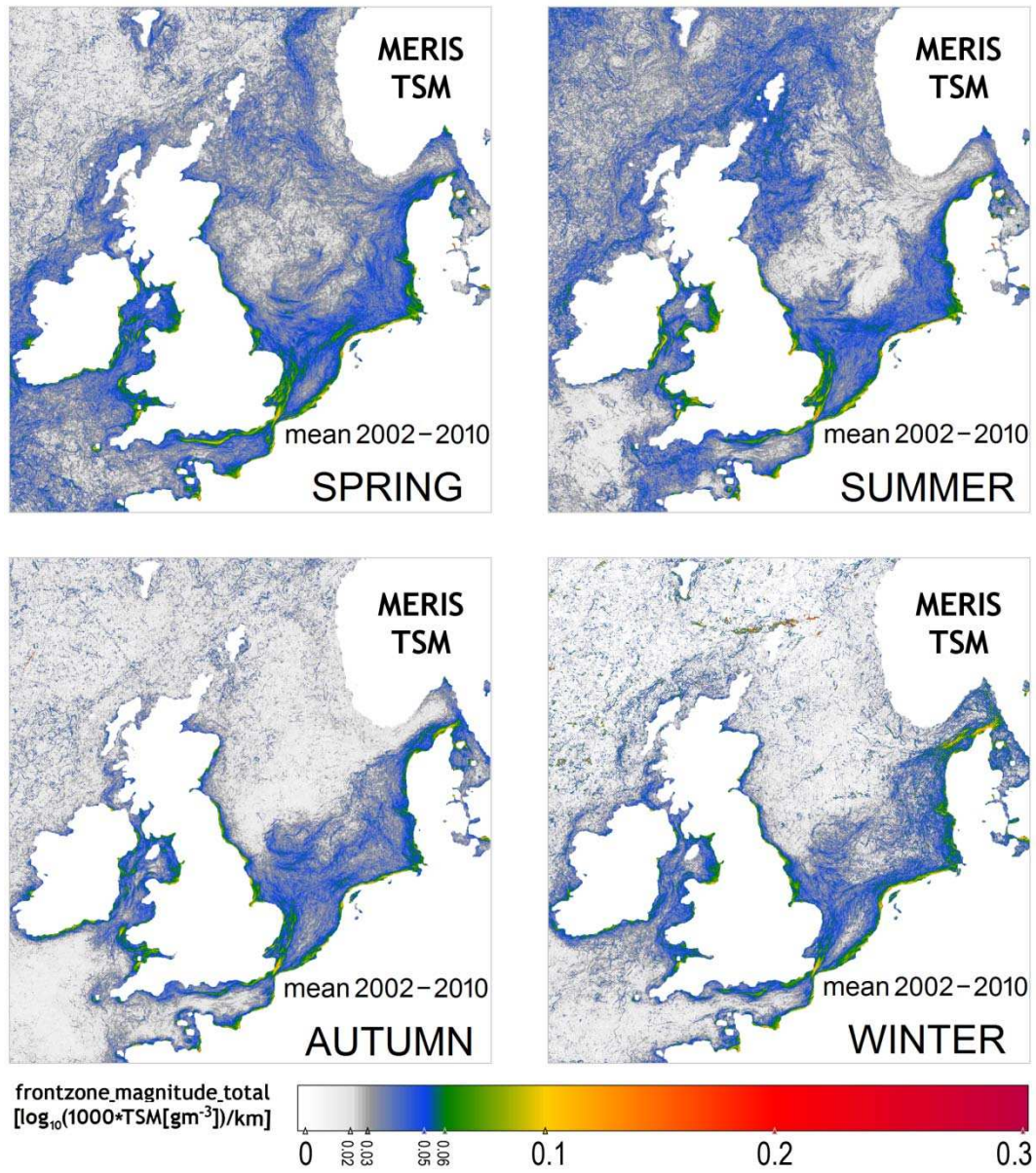


Fig. 8: TSM: mean of gradient magnitude for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

MERIS TSM - Front Zone Vector Magnitude

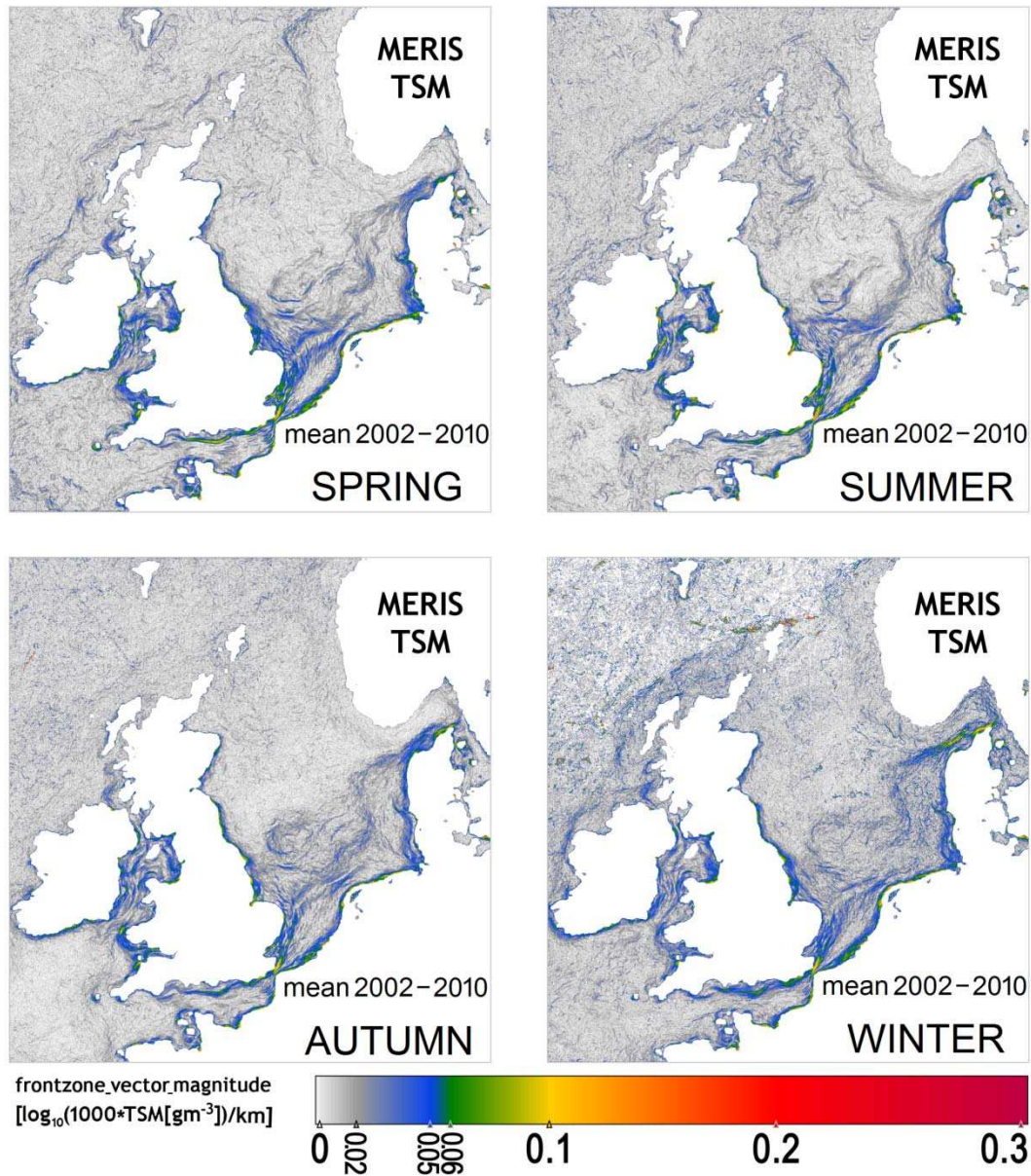


Fig. 9: TSM: magnitude of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

MERIS TSM - Front Zone Vector Direction

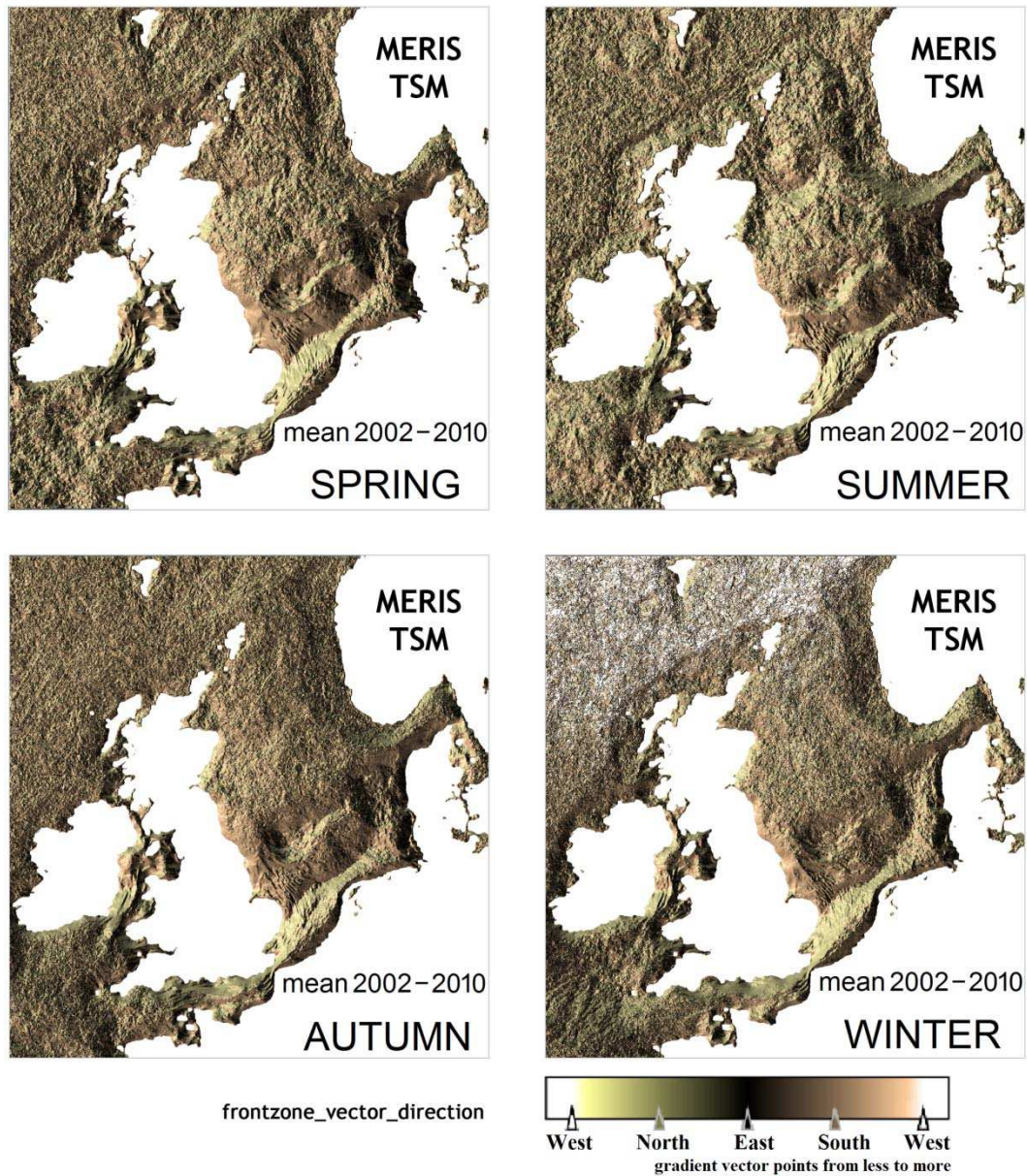


Fig. 10: TSM: direction of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

2.2 Chlorophyll time series based on the data of the MERIS sensor on ENVISAT

In case of chlorophyll concentration, the statistical measurements could have only calculated both for spring and summer time and for growing season which is here defined as the period from March 16th to October 15th. The cause of this is to be found in the restrictions of the algorithms for deviation of the chlorophyll concentration for MERIS data.

2.2.1 Time period 2002-2010, growing season

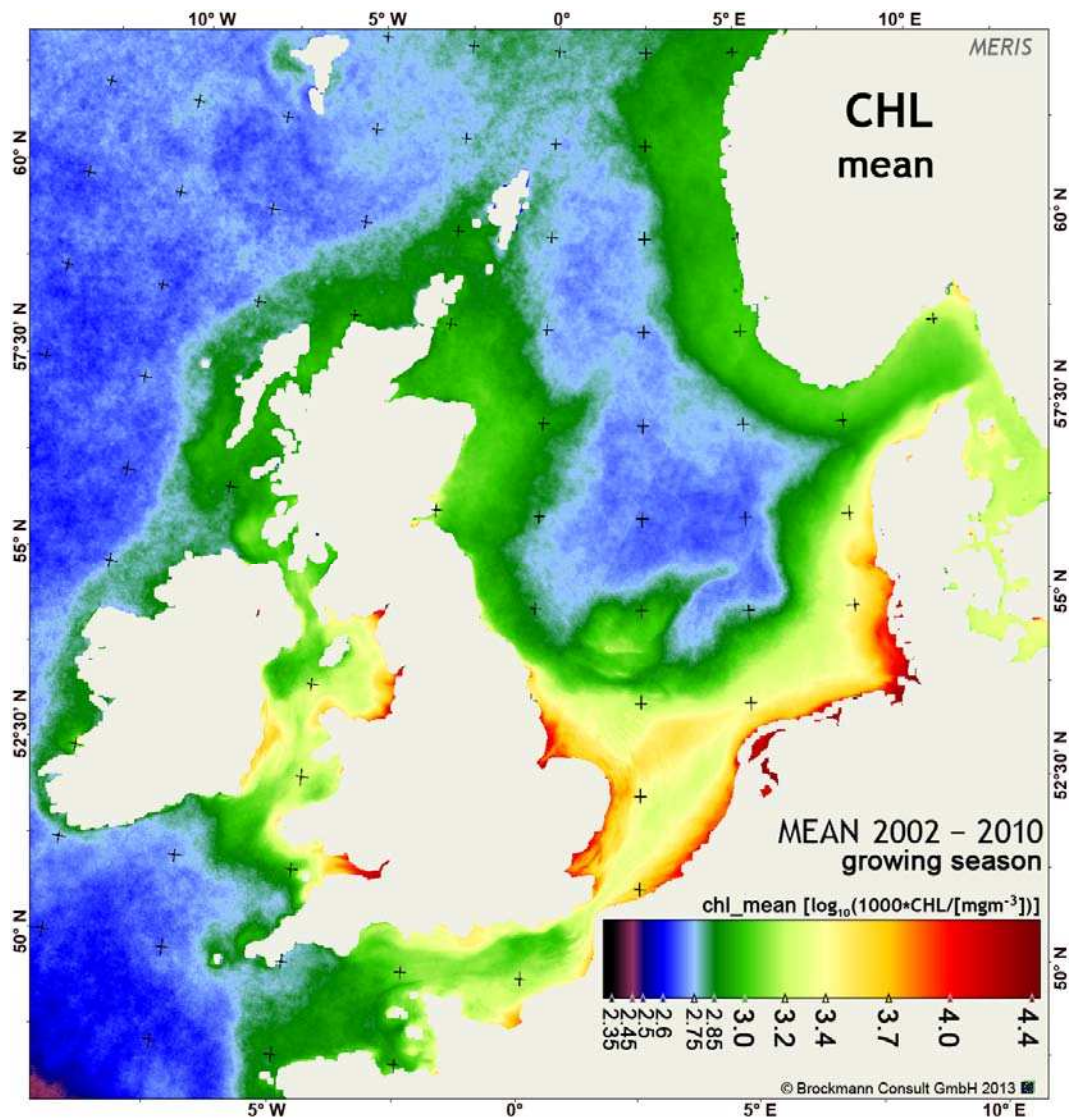


Fig. 11: Mean chlorophyll field based on the data of the MERIS sensor on ENVISAT 2002 - 2010

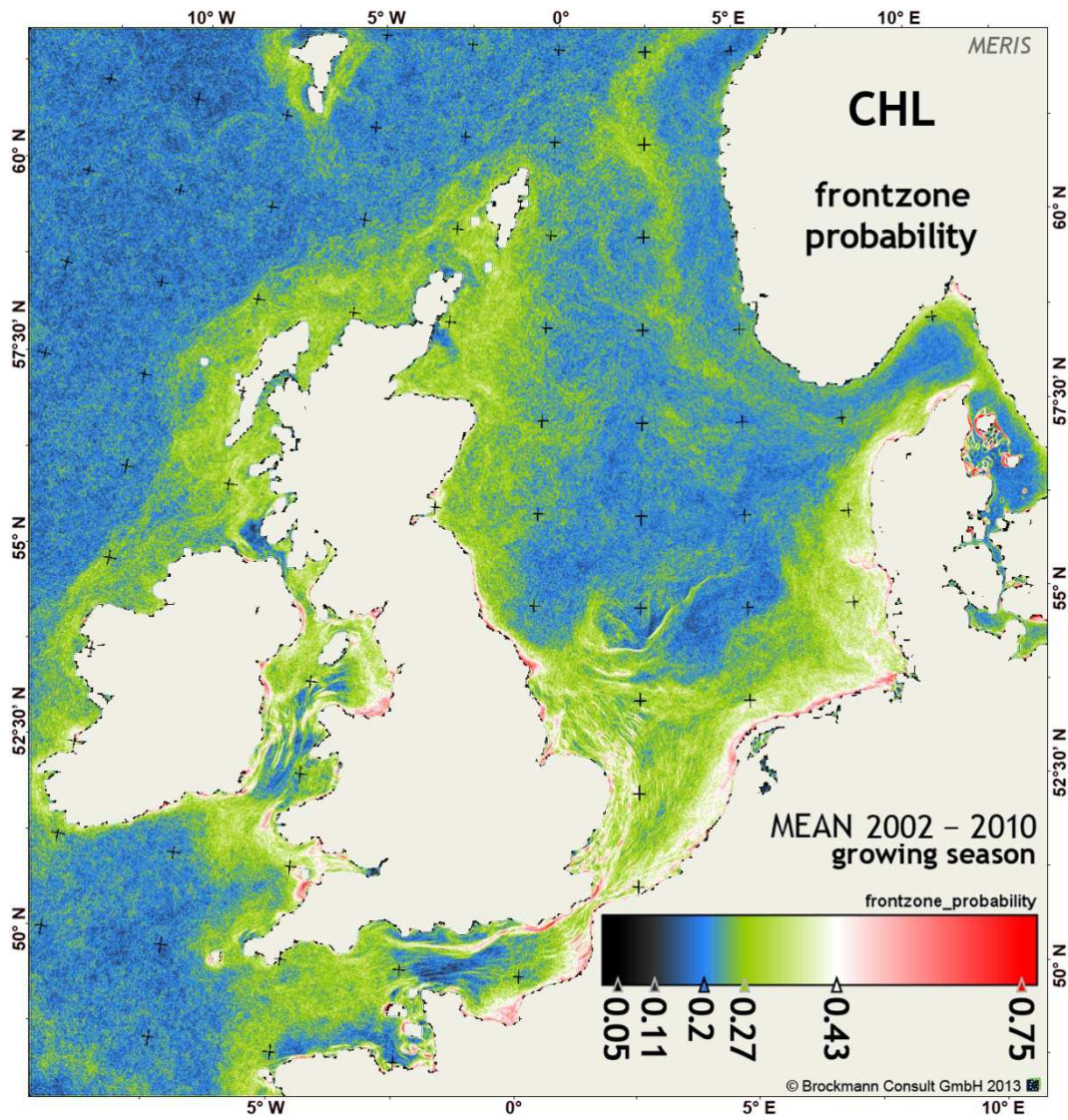


Fig. 12: Chlorophyll: front probability based on the data of the MERIS sensor on ENVISAT 2002 - 2010

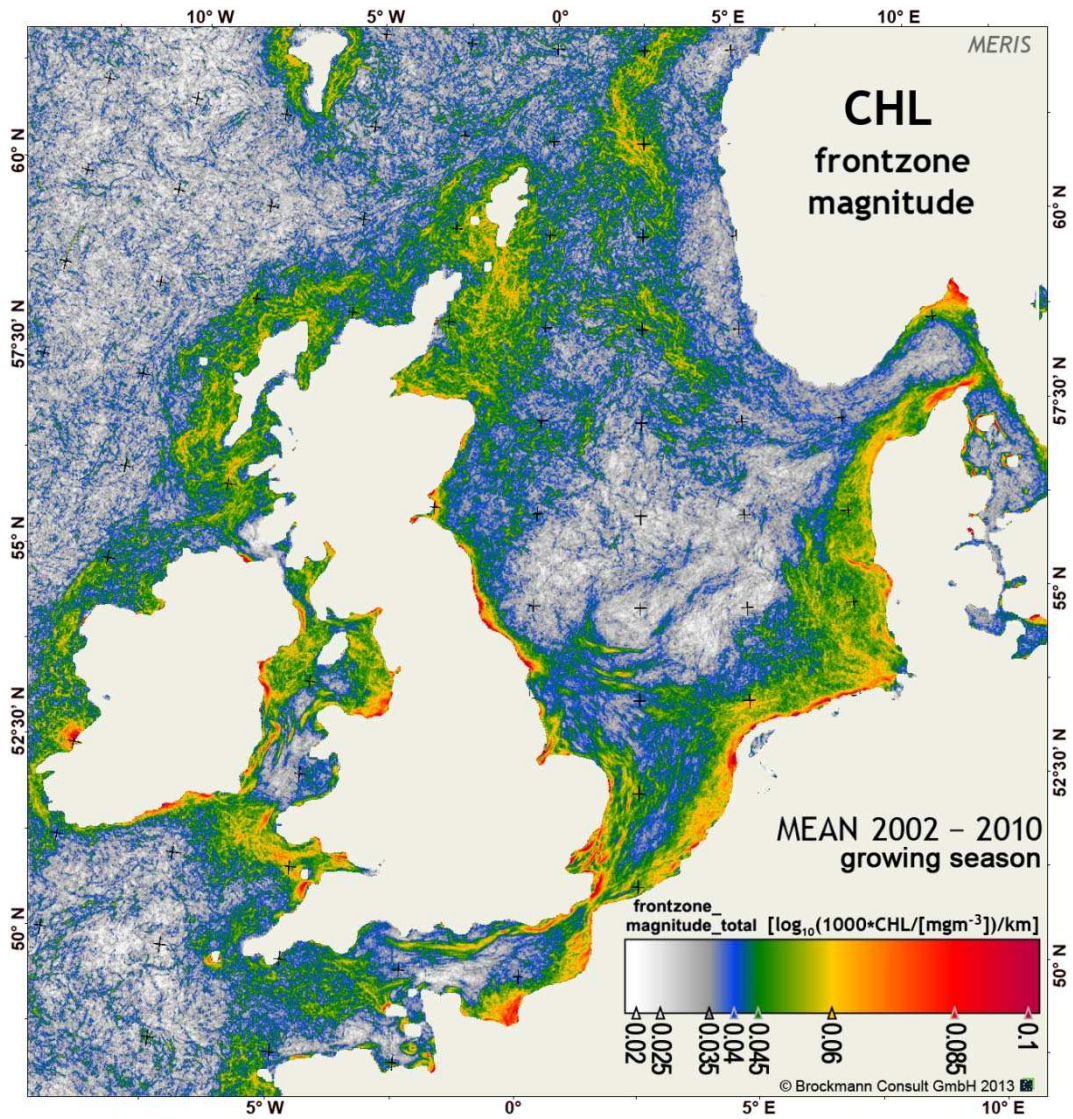


Fig. 13: Chlorophyll: mean of gradient magnitude for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

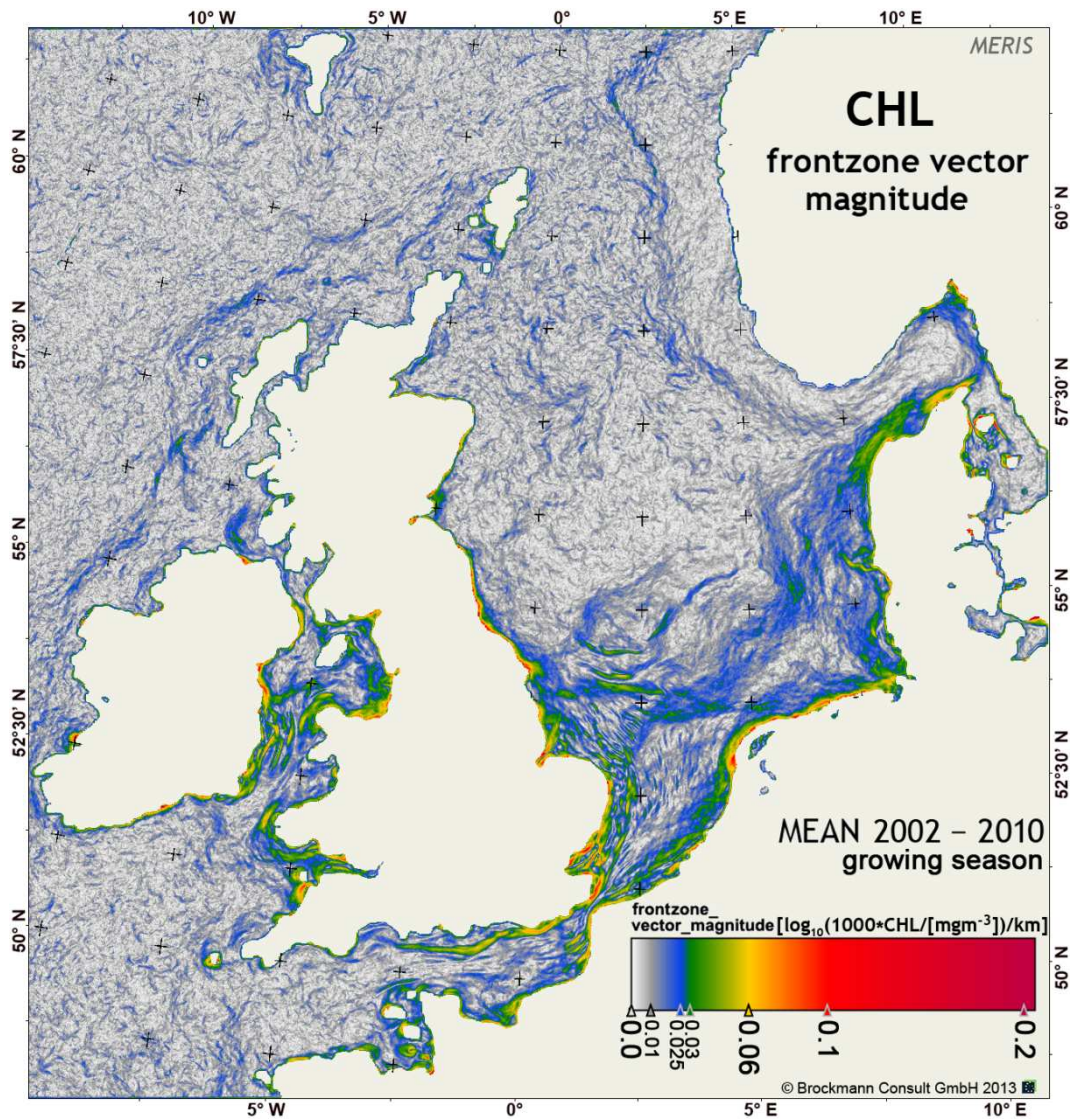


Fig. 14: Chlorophyll: magnitude of mean front gradient vector based on the data of the MERIS sensor on ENVISAT 2002 - 2010

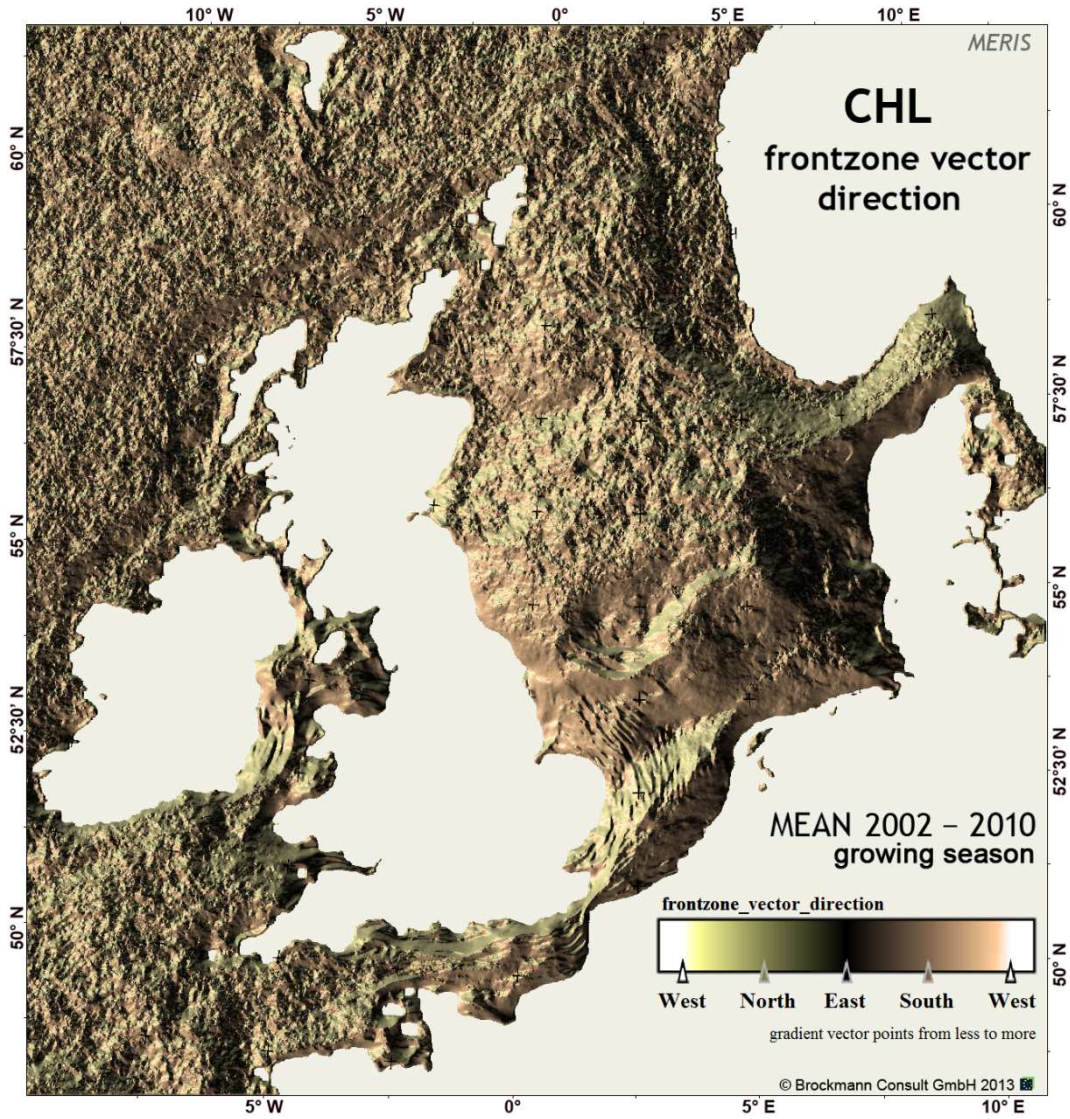


Fig. 15: Chlorophyll: direction of mean front gradient vector based on the data of the MERIS sensor on ENVISAT 2002 - 2010

2.3 Yellow substance (YS) time series based on the data of the MERIS-sensor on ENVISAT, 2002 - 2010

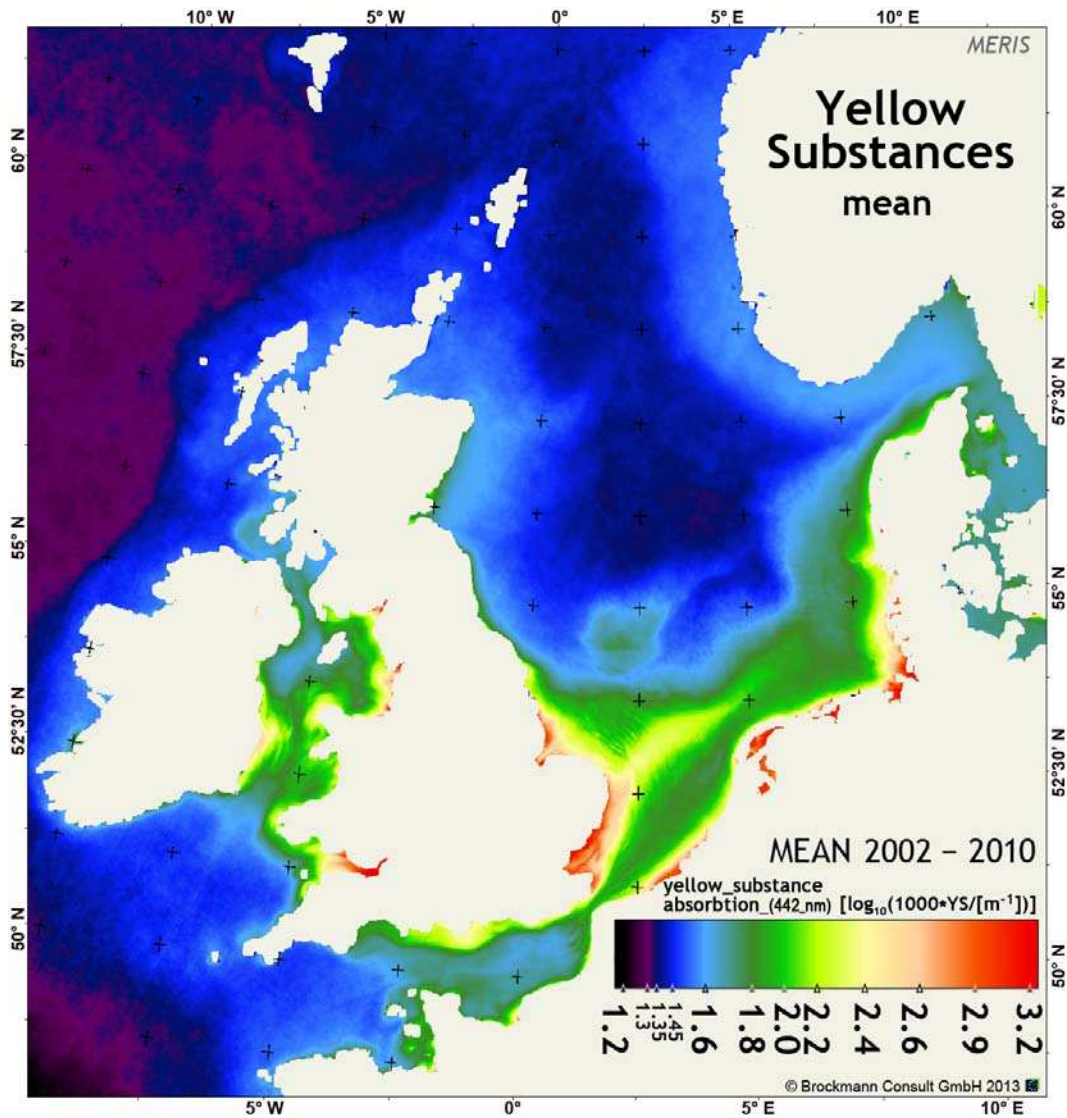


Fig. 16: Mean YS field based on the data of the MERIS sensor on ENVISAT 2002 - 2010

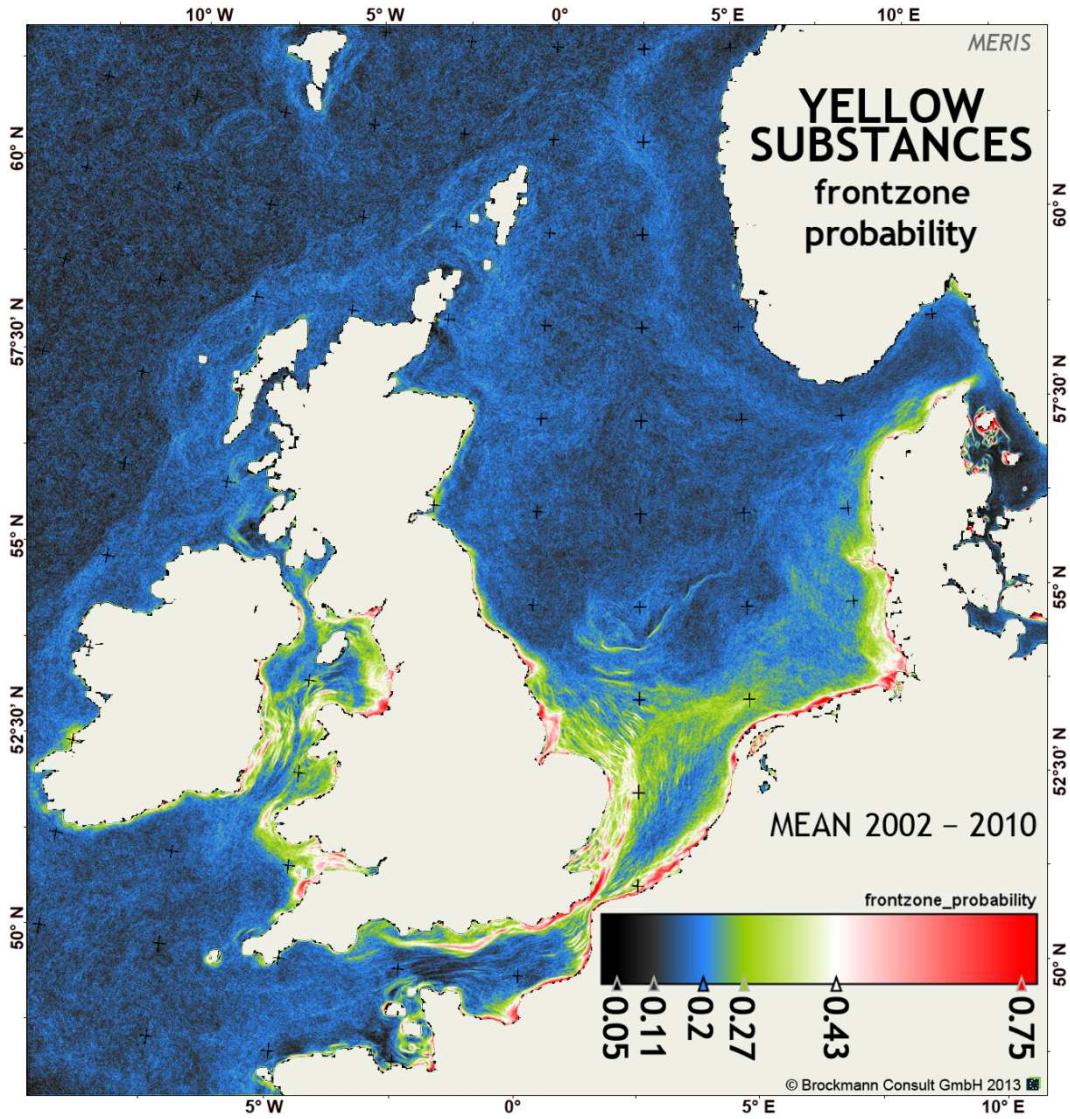


Fig. 17: YS: front probability based on the data of the MERIS sensor on ENVISAT 2002 - 2010

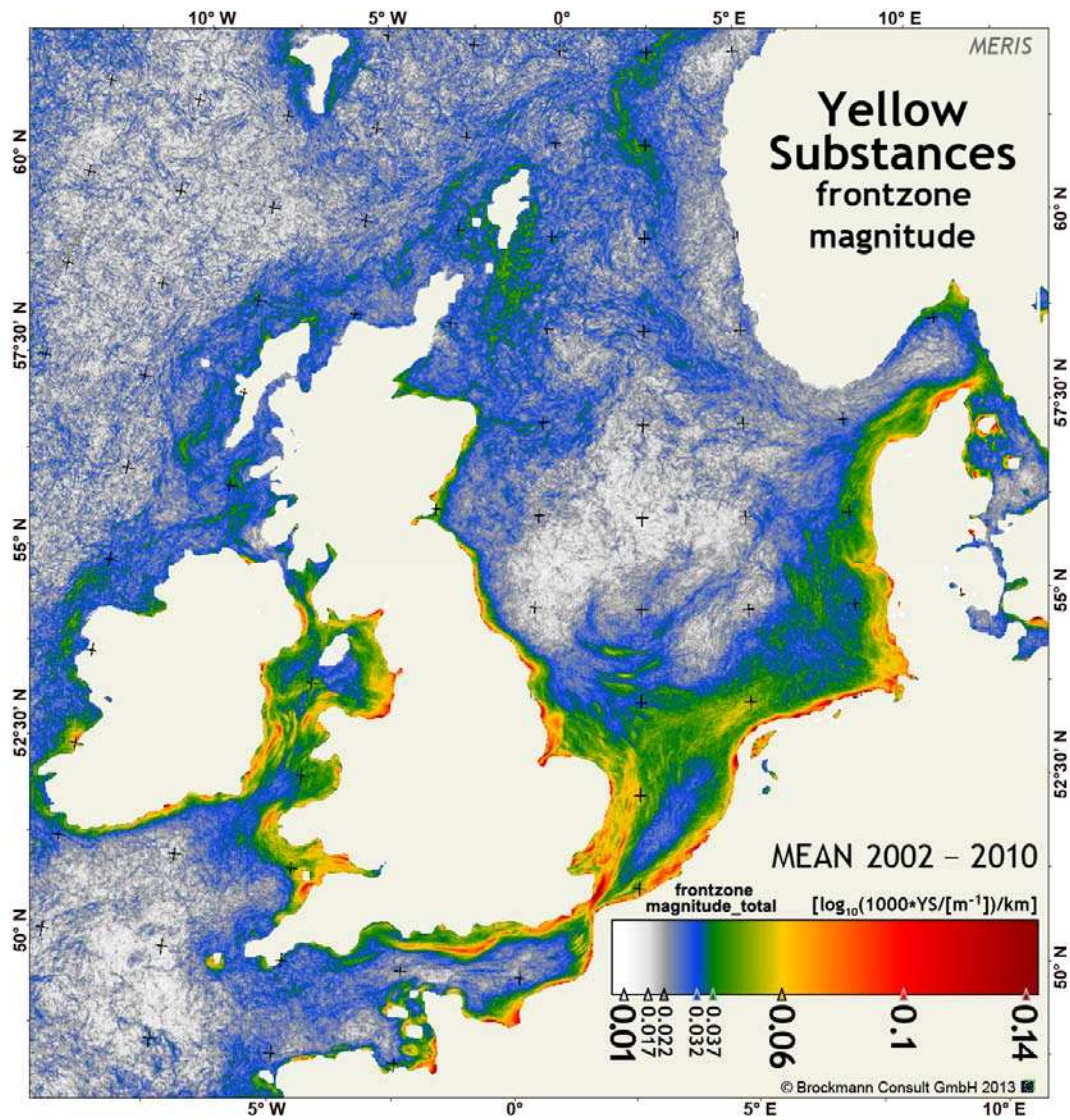


Fig. 18: YS: mean of gradient magnitude for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

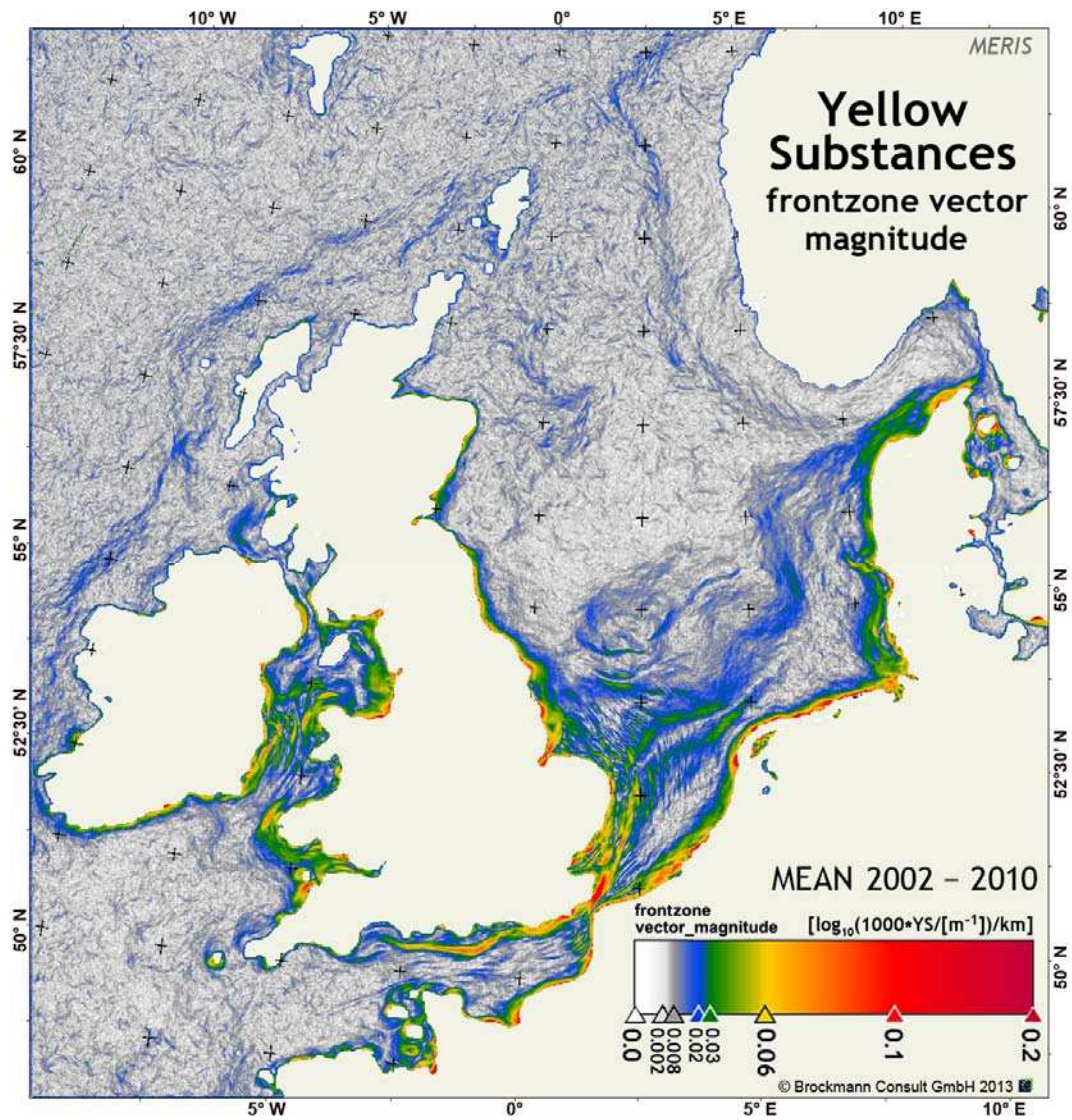


Fig. 19: YS: magnitude of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

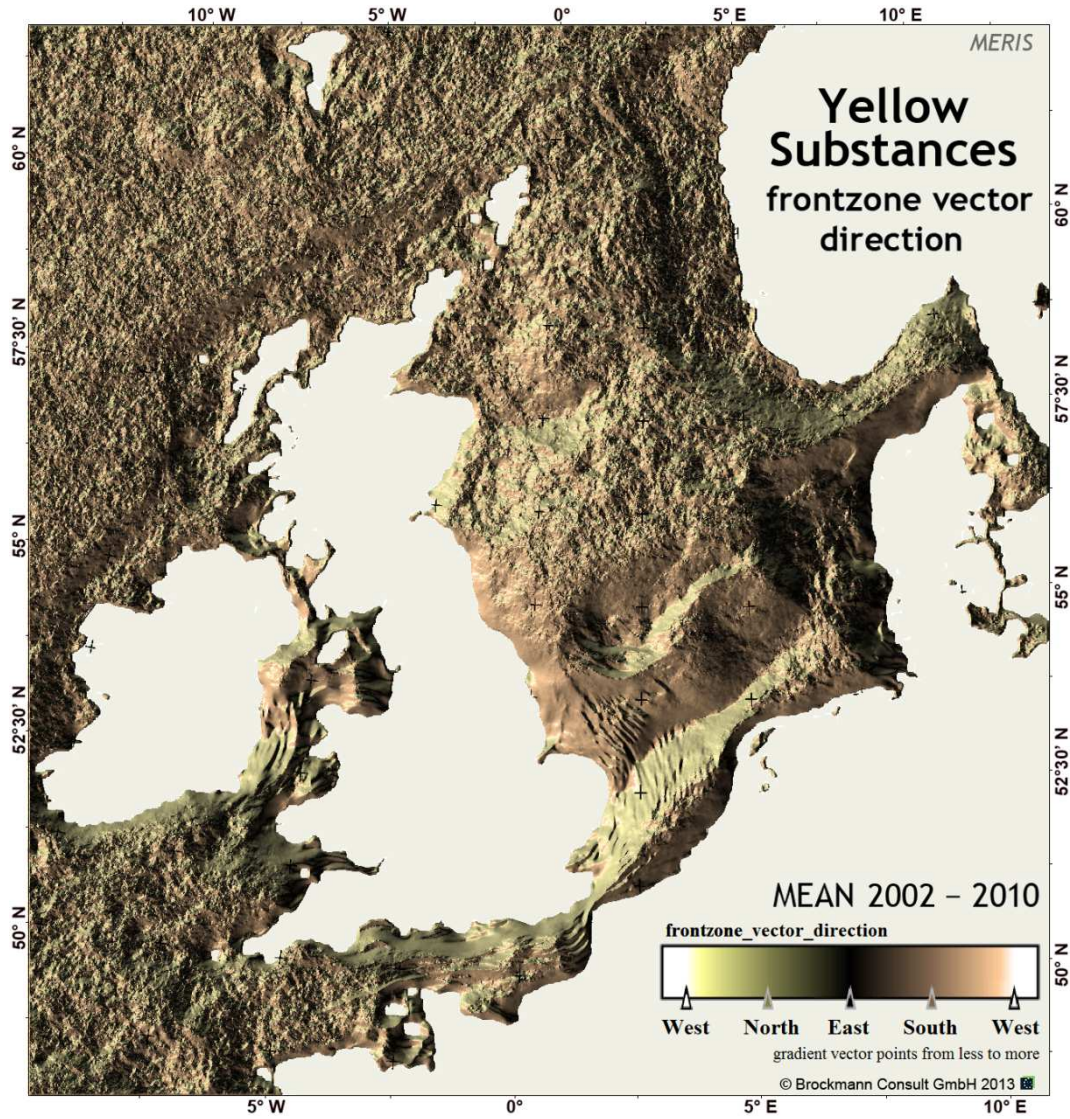


Fig. 20: YS: direction of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

2.4 Turbidity time series based on the data of the MERIS-sensor on ENVISAT, 2002 – 2010

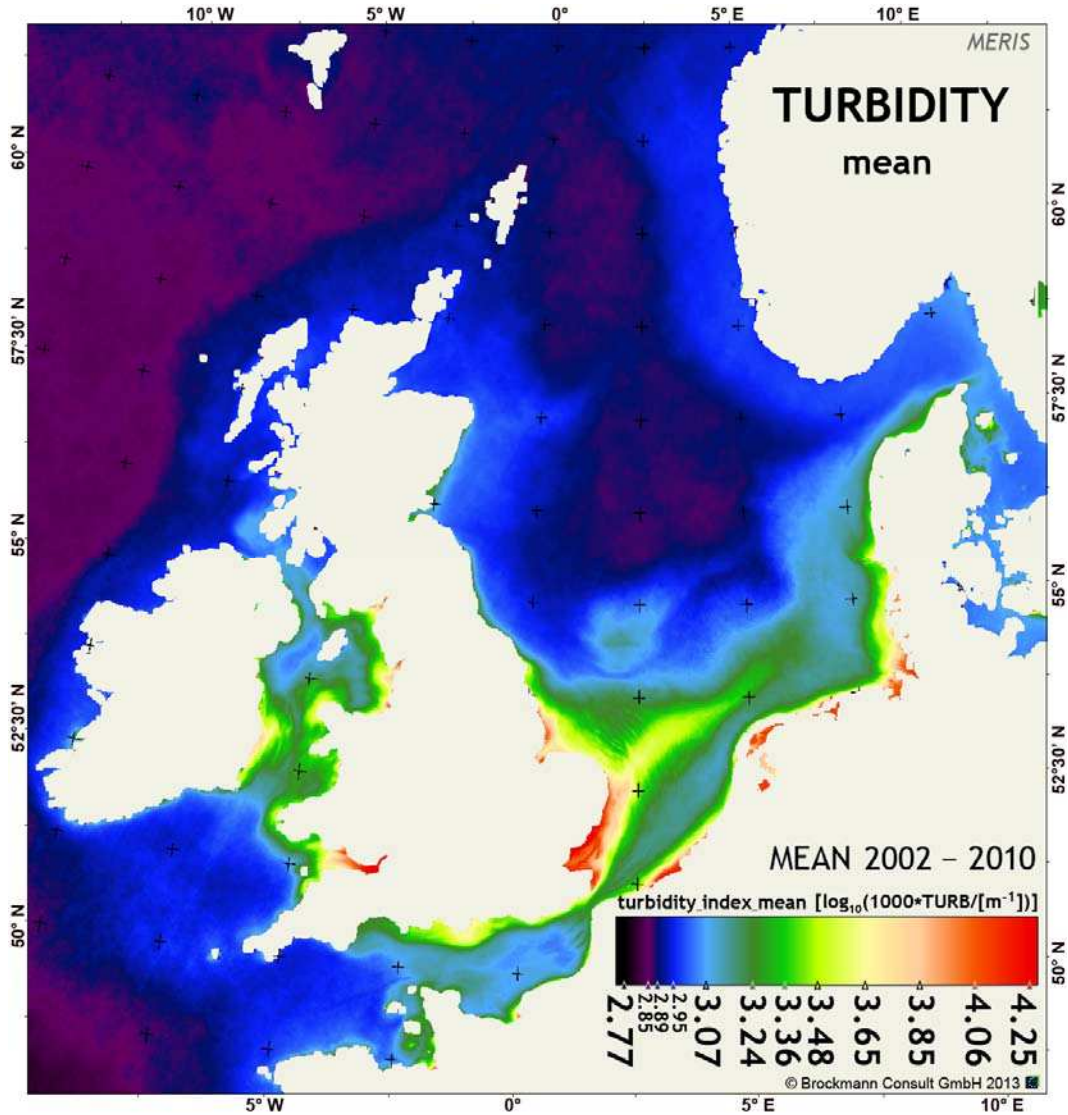


Fig. 21: Mean turbidity field based on the data of the MERIS sensor on ENVISAT 2002 - 2010

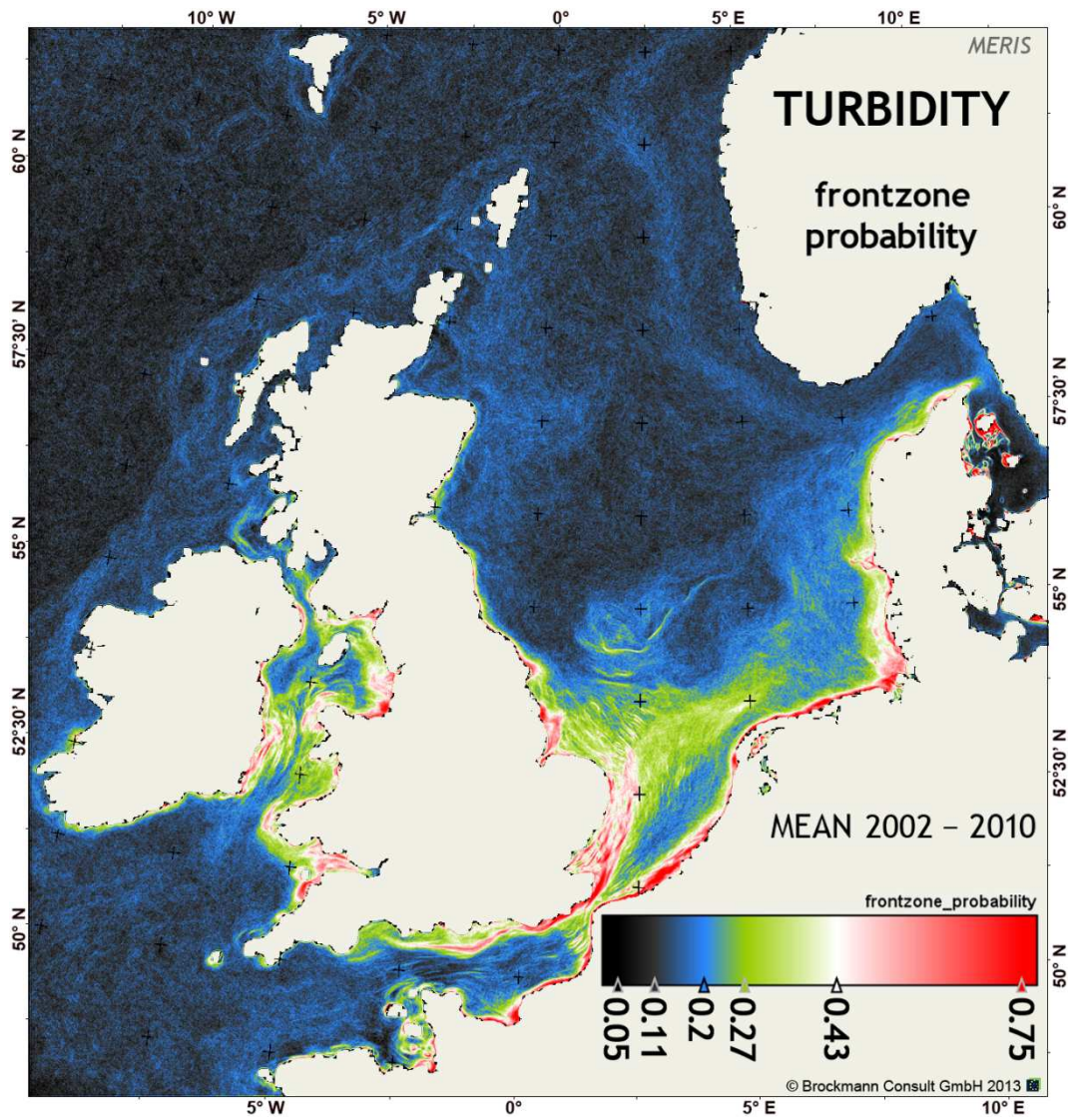


Fig. 22: Turbidity: front probability based on the data of the MERIS sensor on ENVISAT 2002 - 2010

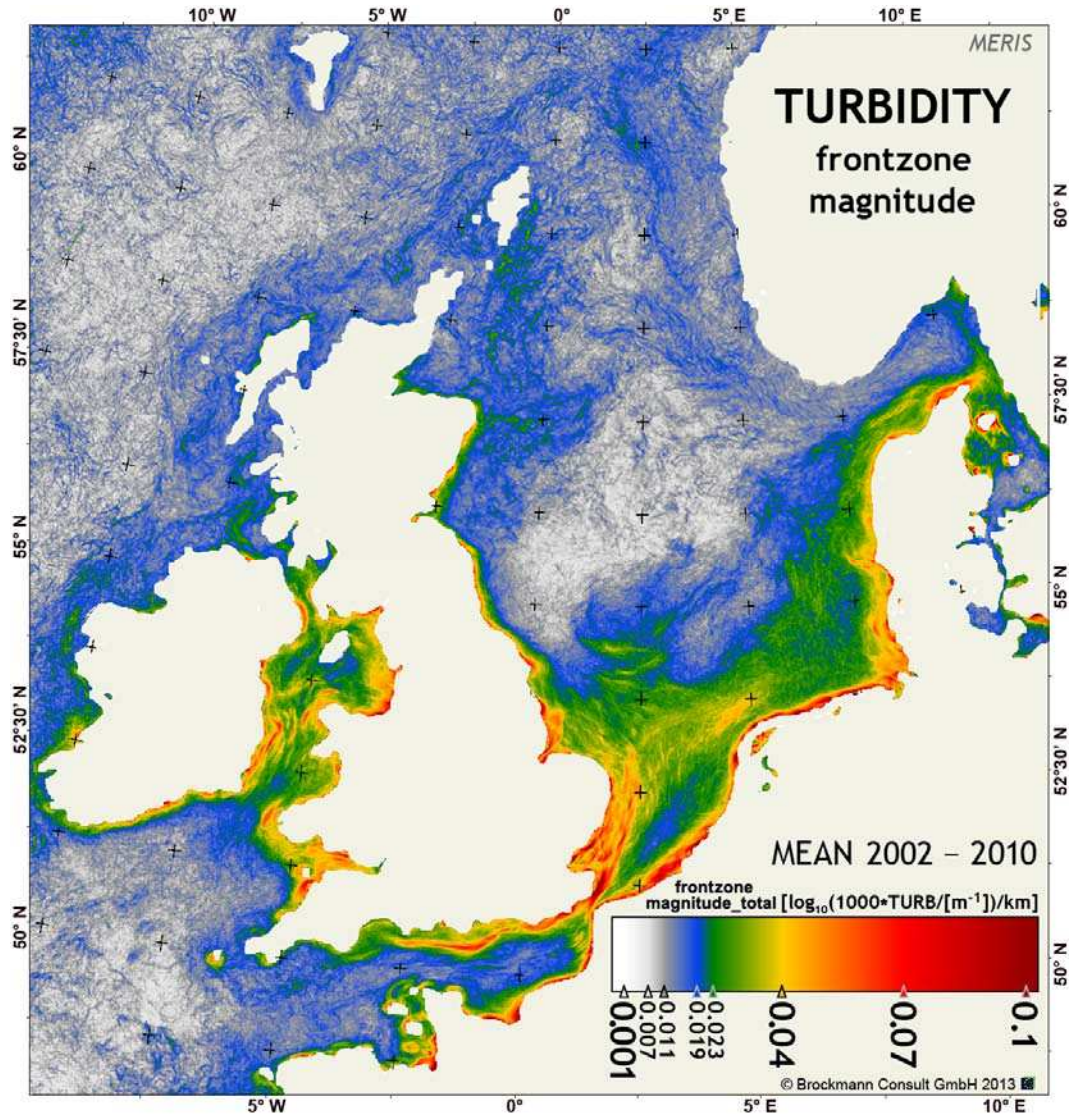


Fig. 23: Turbidity: mean of gradient magnitude for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

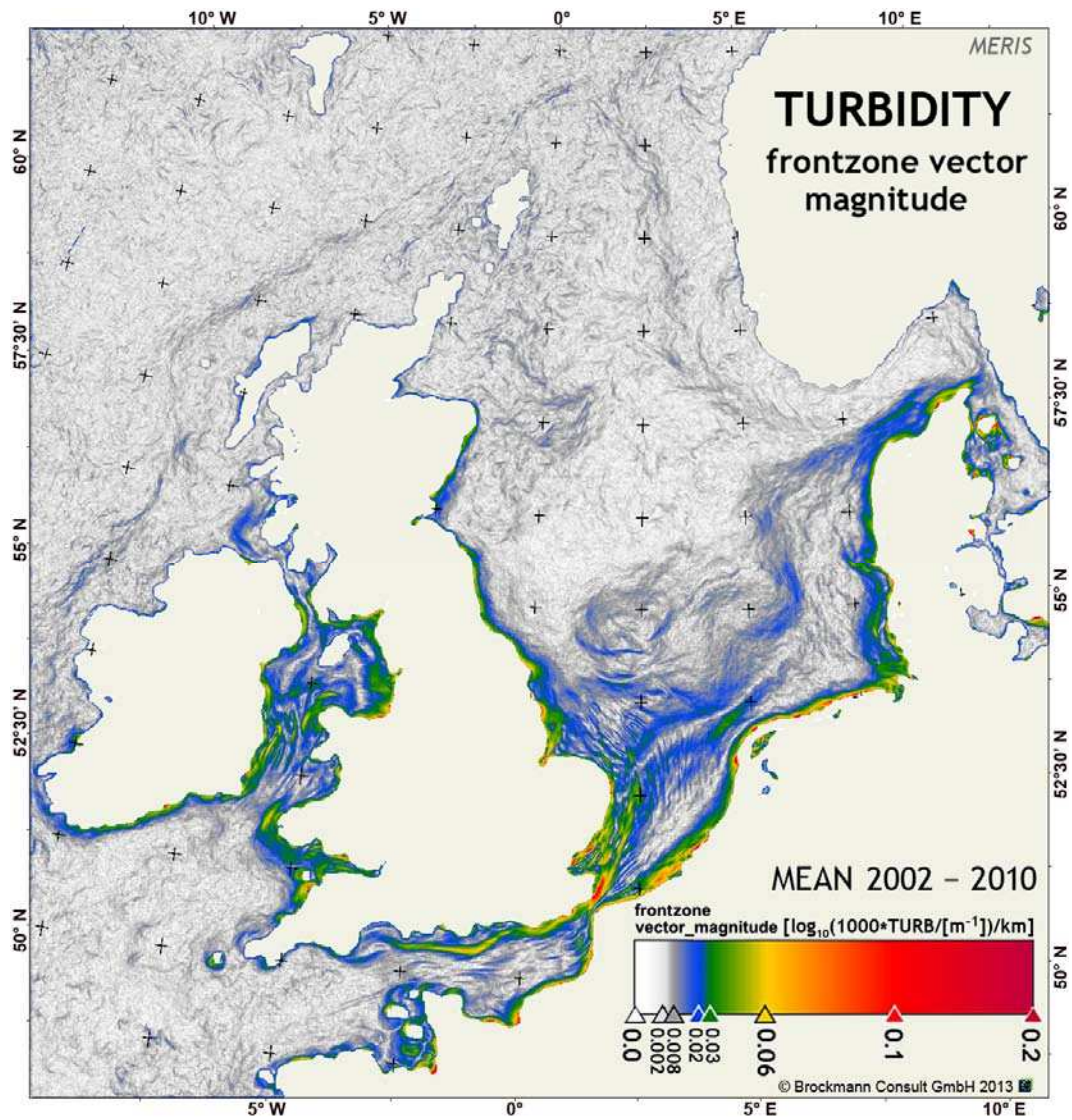


Fig. 24: Turbidity: magnitude of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010

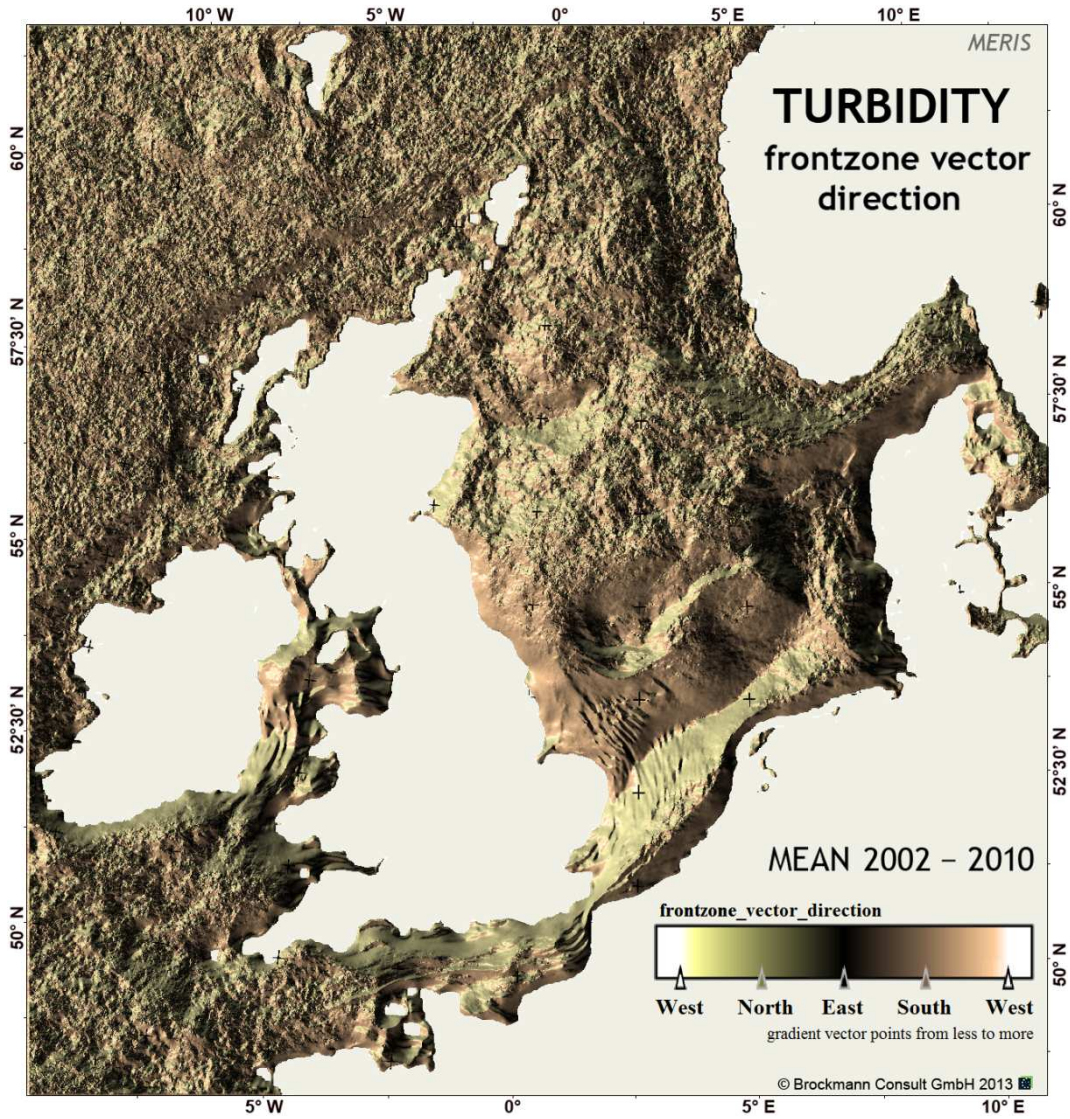


Fig. 25: Turbidity: direction of mean gradient vector for frontal zone based on the data of the MERIS sensor on ENVISAT 2002 - 2010



Bundesanstalt für Wasserbau
Kompetenz für die Wasserstraßen

**Bundesanstalt für Wasserbau
(BAW)**

Kußmaulstraße 17
76187 Karlsruhe

www.baw.de
info@baw.de

**Bundesamt für Seeschifffahrt
und Hydrographie (BSH)**

Bernhard-Nocht-Straße 78
20359 Hamburg

www.bsh.de
posteingang@bsh.de



**BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE**



Deutscher Wetterdienst (DWD)

Frankfurter Straße 135
63067 Offenbach/Main

www.dwd.de
info@dwd.de

**Bundesanstalt für
Gewässerkunde (BfG)**

Am Mainzer Tor 1
56068 Koblenz

www.bafg.de
posteingang@bafg.de



IMPRESSUM

Herausgeber:

Bundesanstalt für Gewässerkunde
KLIWAS Koordination
Am Mainzer Tor 1
Postfach 20 02 53
56002 Koblenz
Tel.: 0261 / 1306-0
Fax: 0261 / 1306-5302
E-Mail: kliwas@bafg.de
Internet: <http://www.kliwas.de>

Redaktion: Andrea Mehling
Bundesanstalt für Gewässerkunde

Autoren: Grit Kirches, Michael Paperin,
Carsten Brockmann, Kerstin Stelzer
(Brockmann Consult GmbH)
Holger Klein
(Federal Maritime and Hydrographic Agency)

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