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KLIWAS-23B/2013

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

Part B: SST Products

Koblenz, im Oktober 2013

BSH
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

BROCKMANN CONSULT GMBH

Fronts
Recognition and analysis of time series derived from satellite data


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Part B: SST Products

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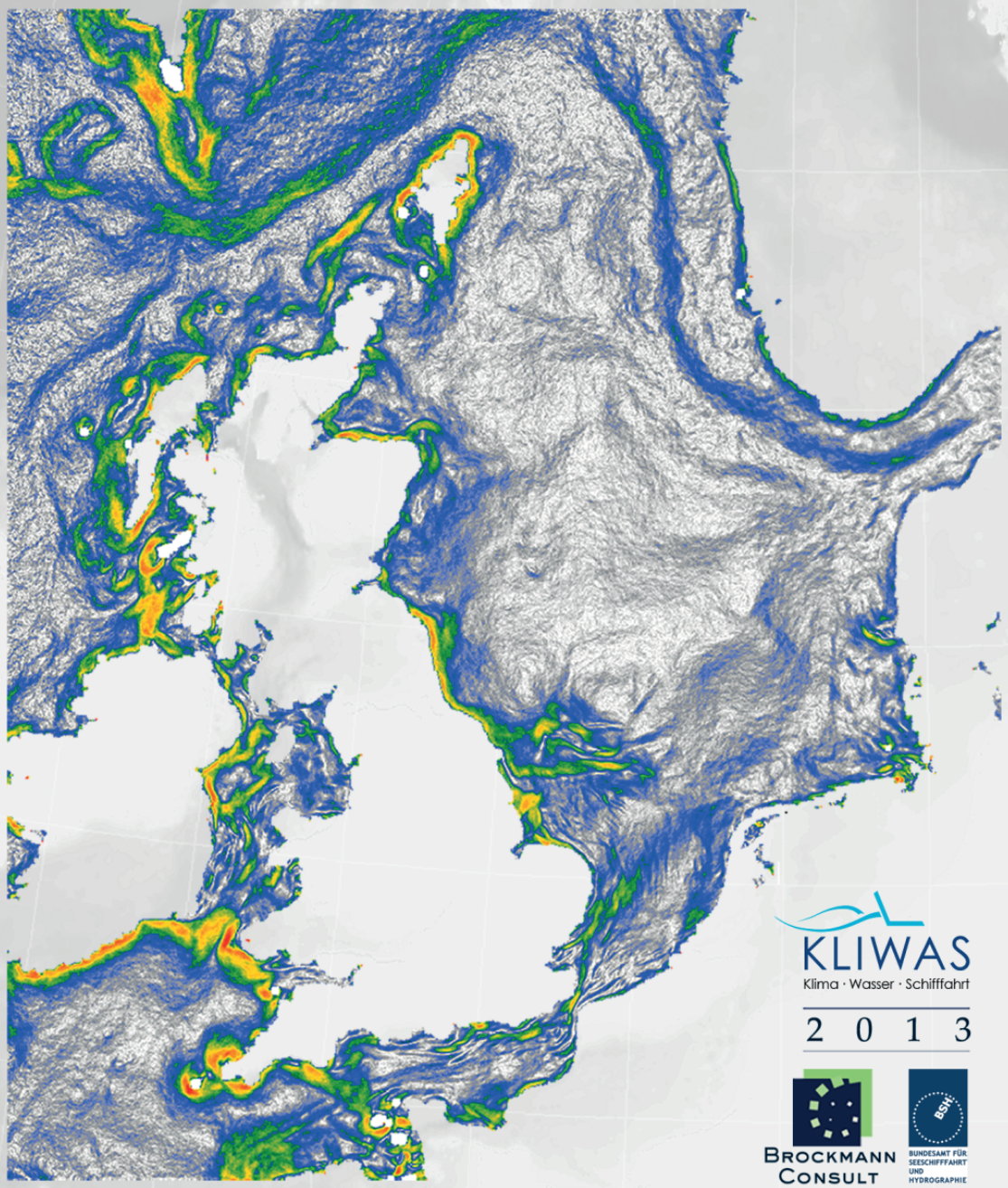
CLIMATOLOGY

of SST and Water Colours Fronts in the North Sea



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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 (this document) presents a selection of SST products, and

Part C presents a selection of OC products.

2 SST-time series

2.1 SST time series based on the data of the AVHRR-sensor on NOAA and METOP

2.1.1 Time period 1990-2011, annual means

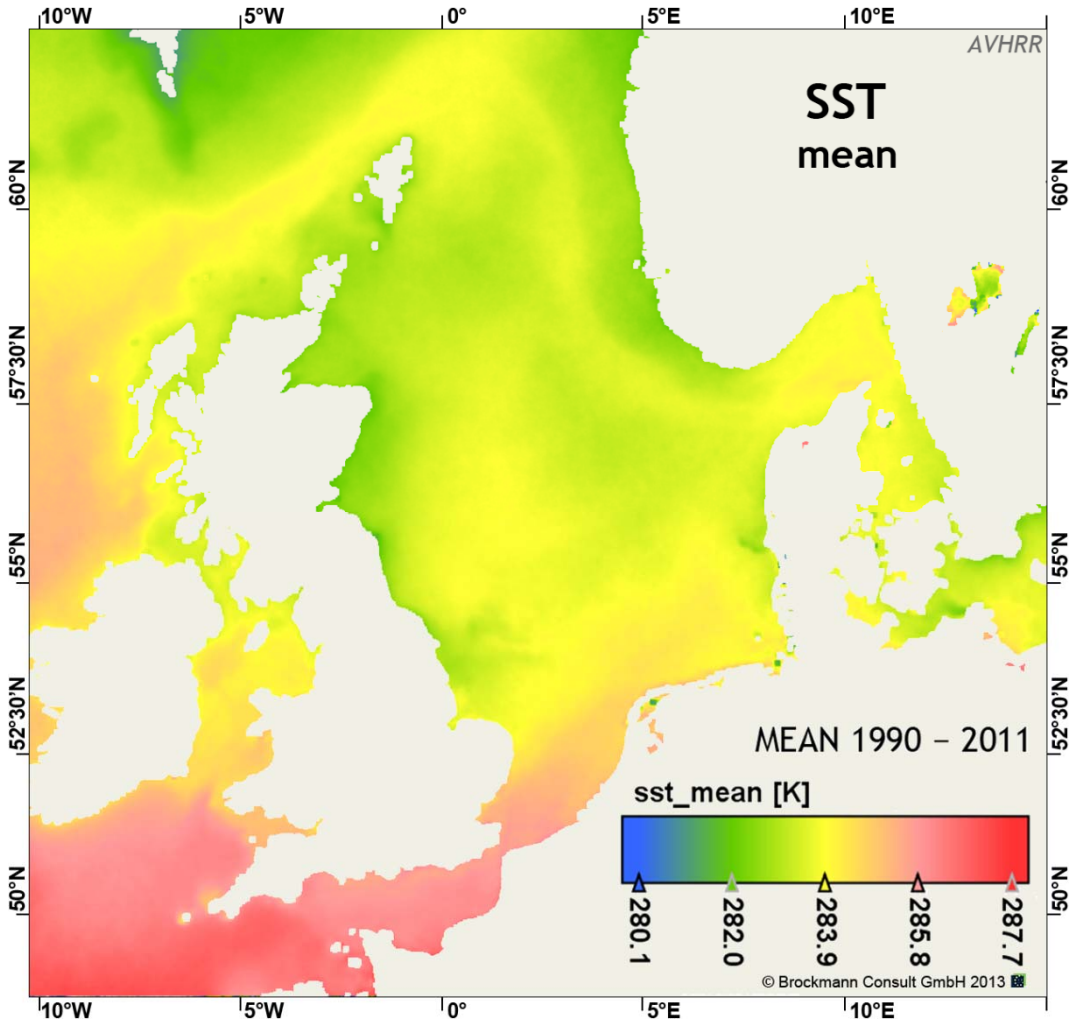


Fig. 1: Mean SST field based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011

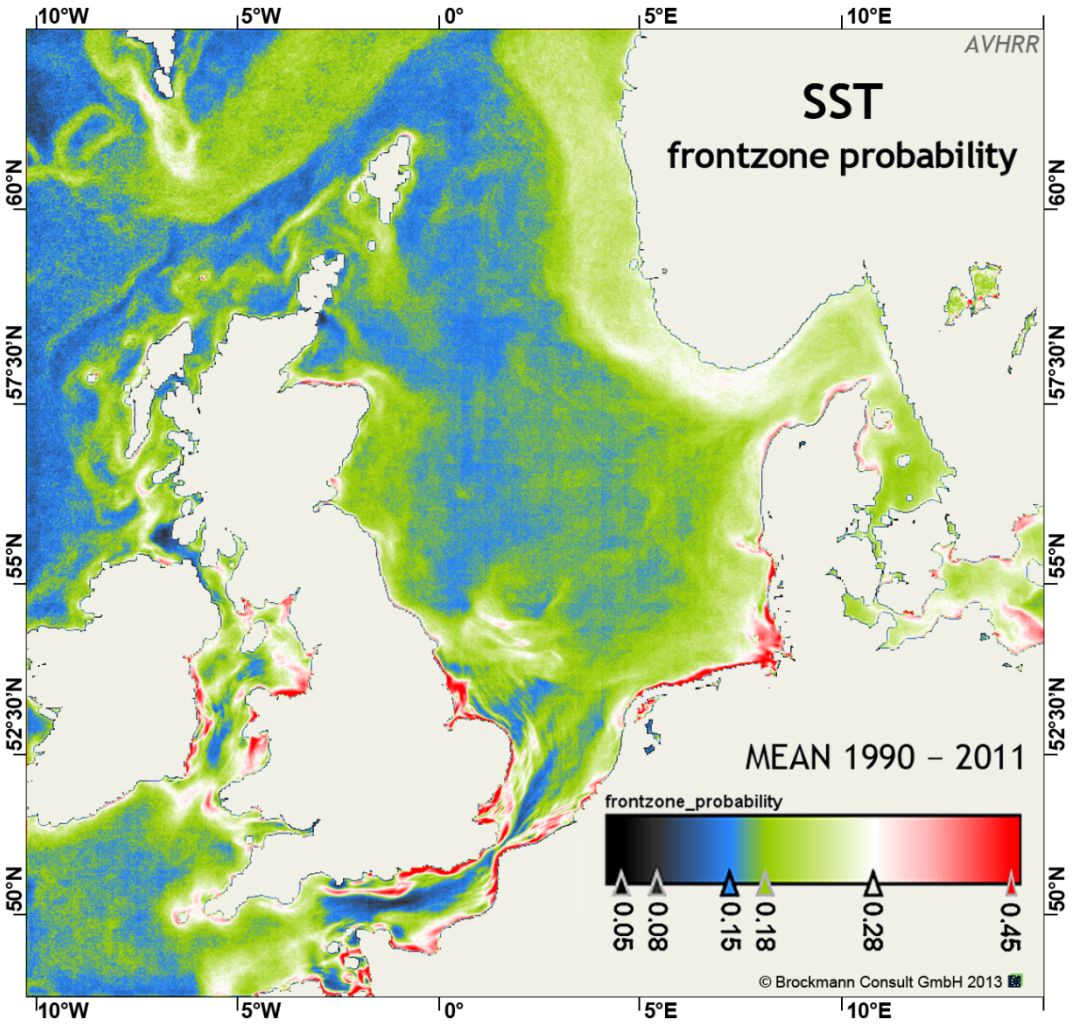


Fig. 2: Front probability based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011

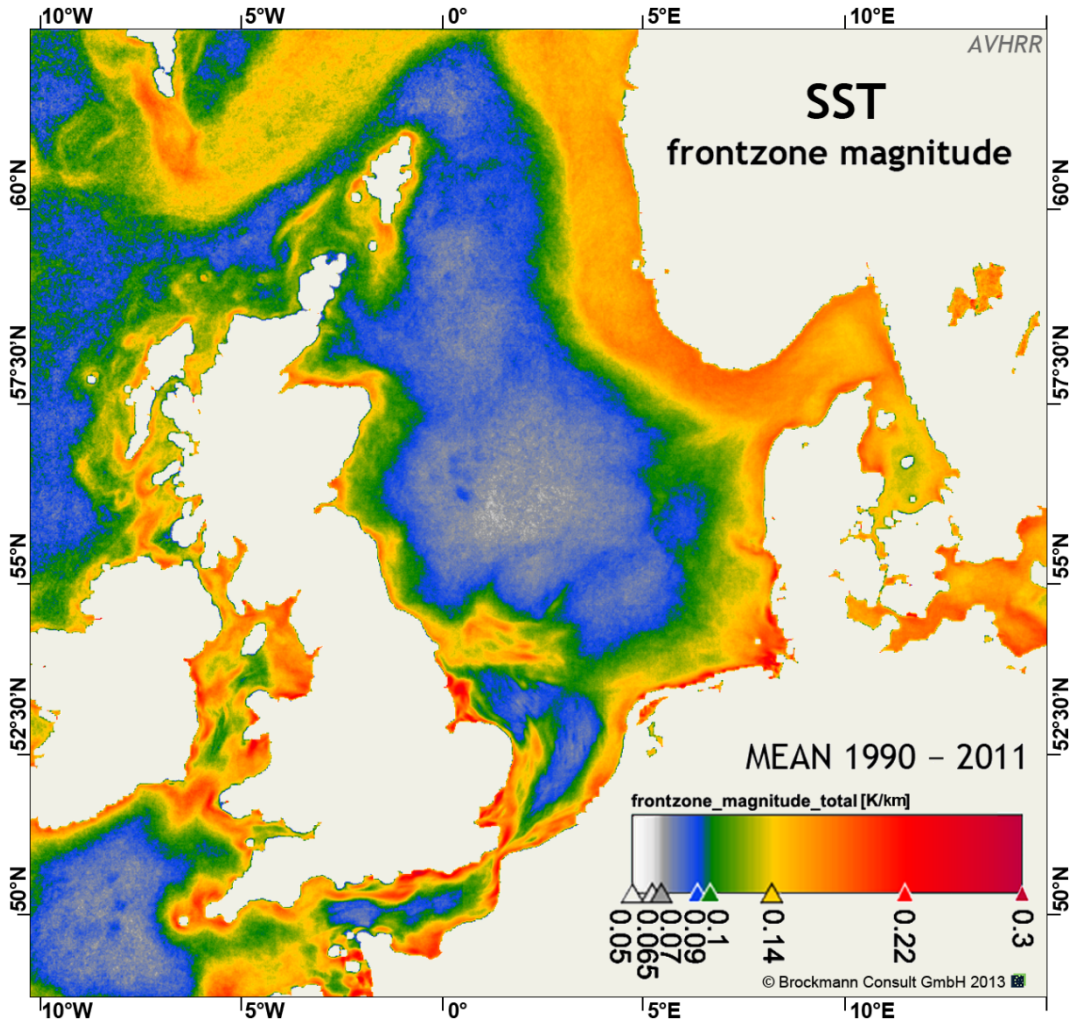


Fig. 3: Mean of gradient magnitude for frontal zone based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011

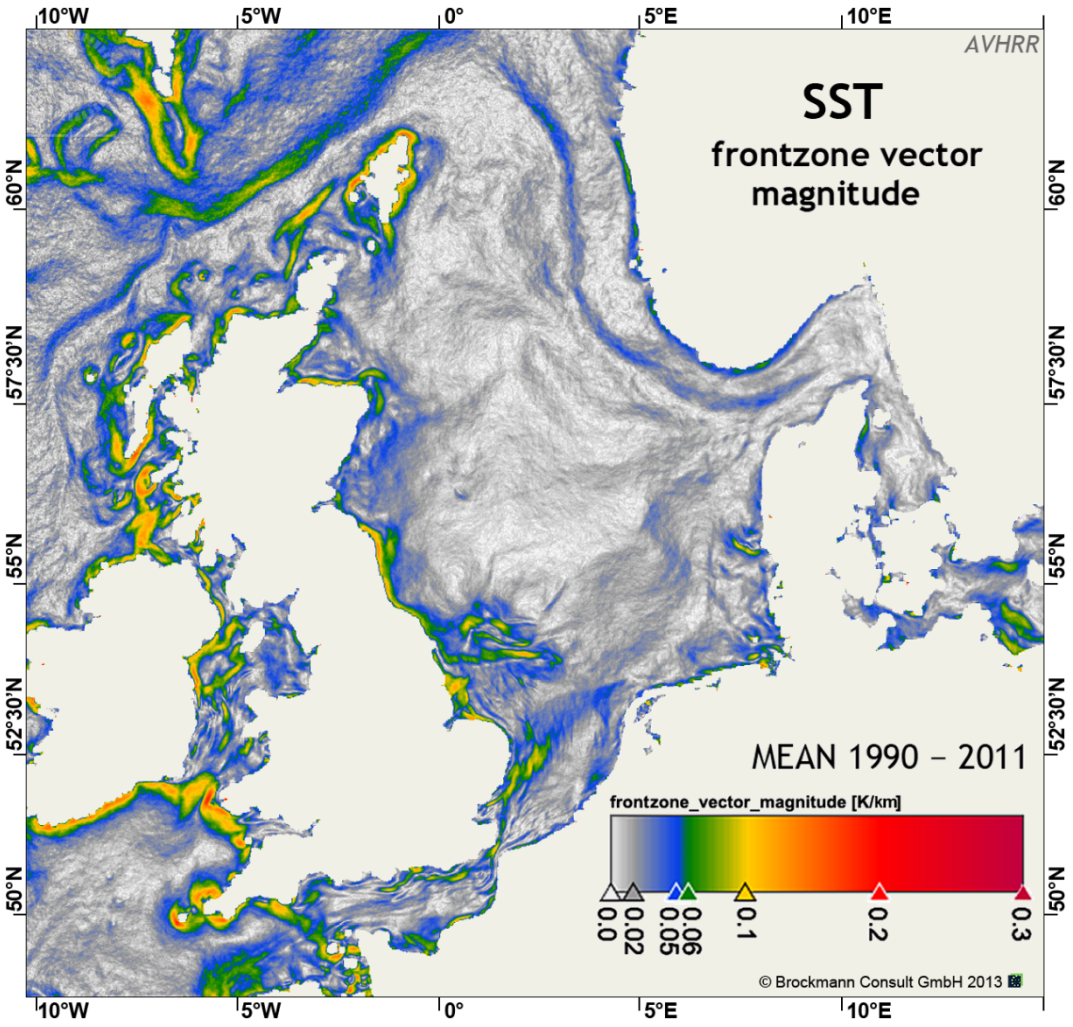


Fig. 4: Magnitude of mean front gradient vector based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011

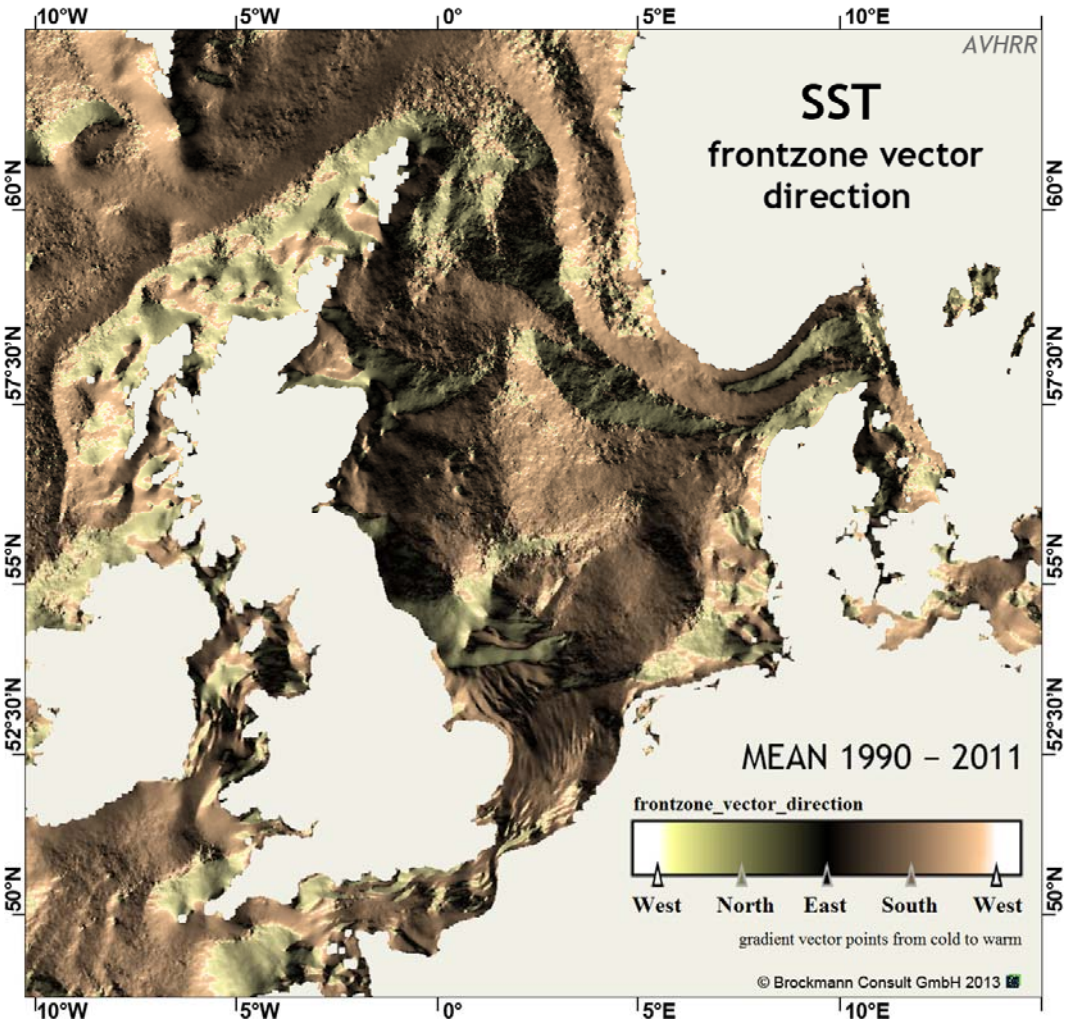


Fig. 5: Direction of mean front gradient vector based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011

2.1.2 Time period 1990-2011, seasonal means

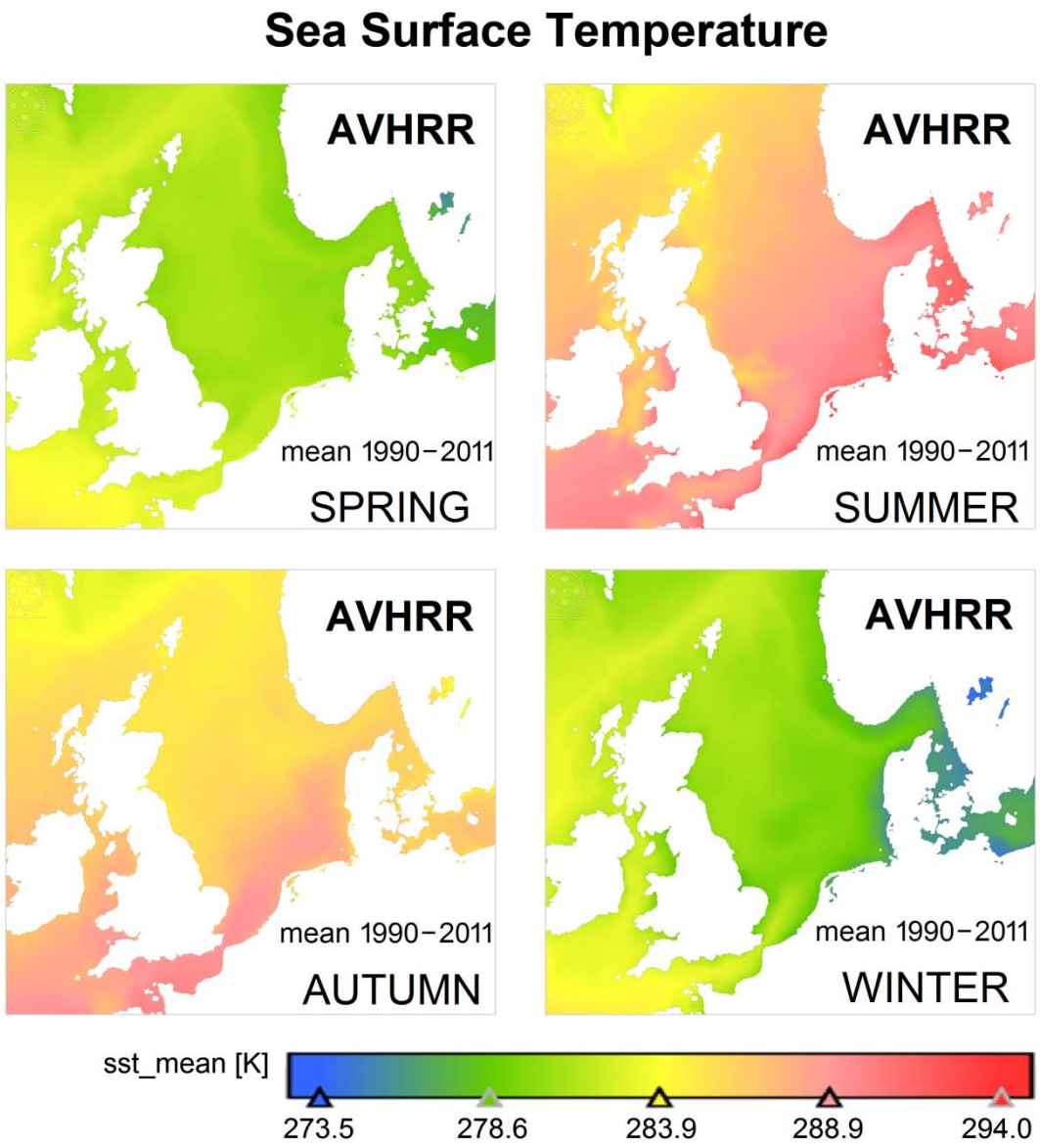
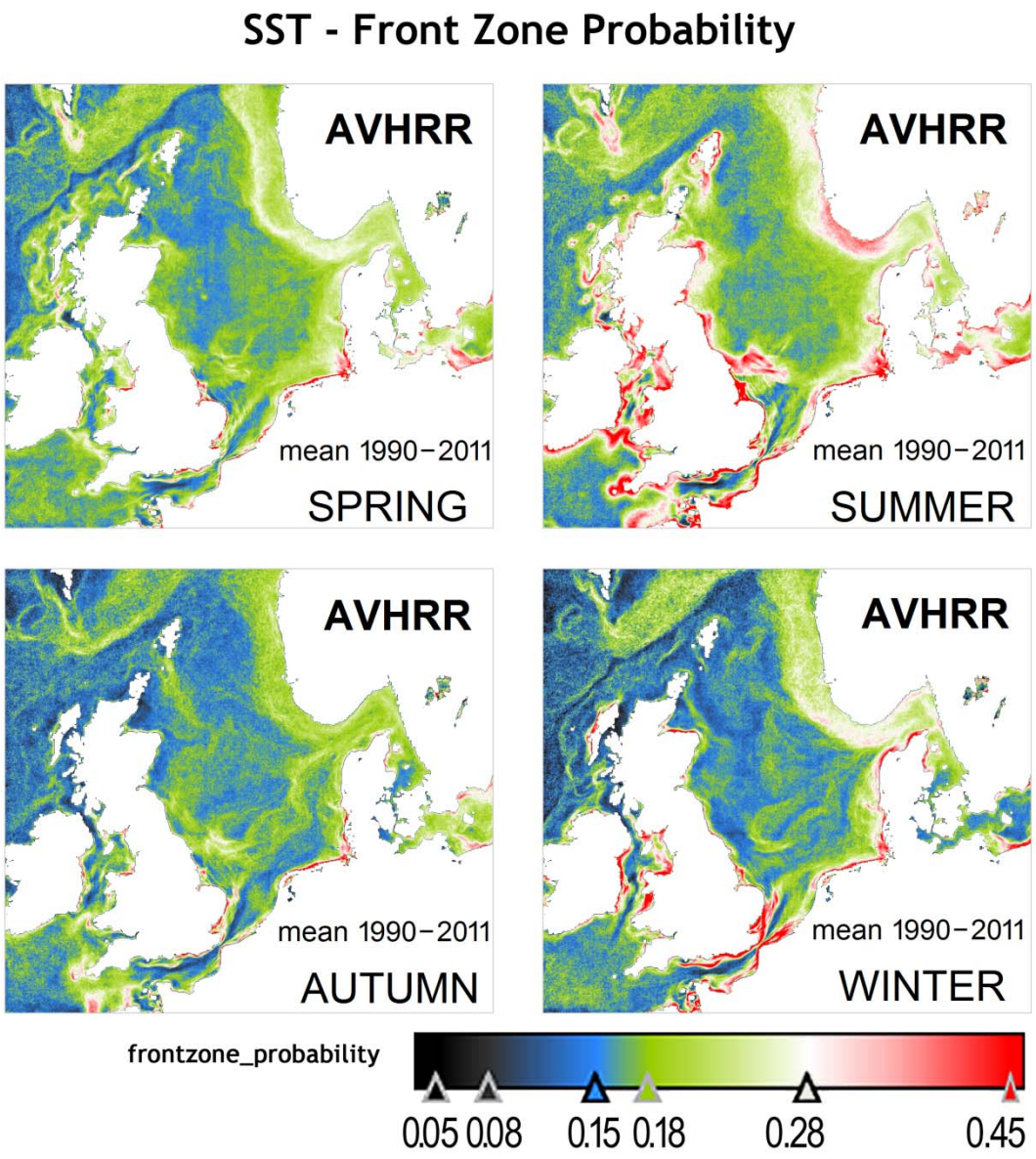


Fig. 6: Mean SST field based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011 and for seasons



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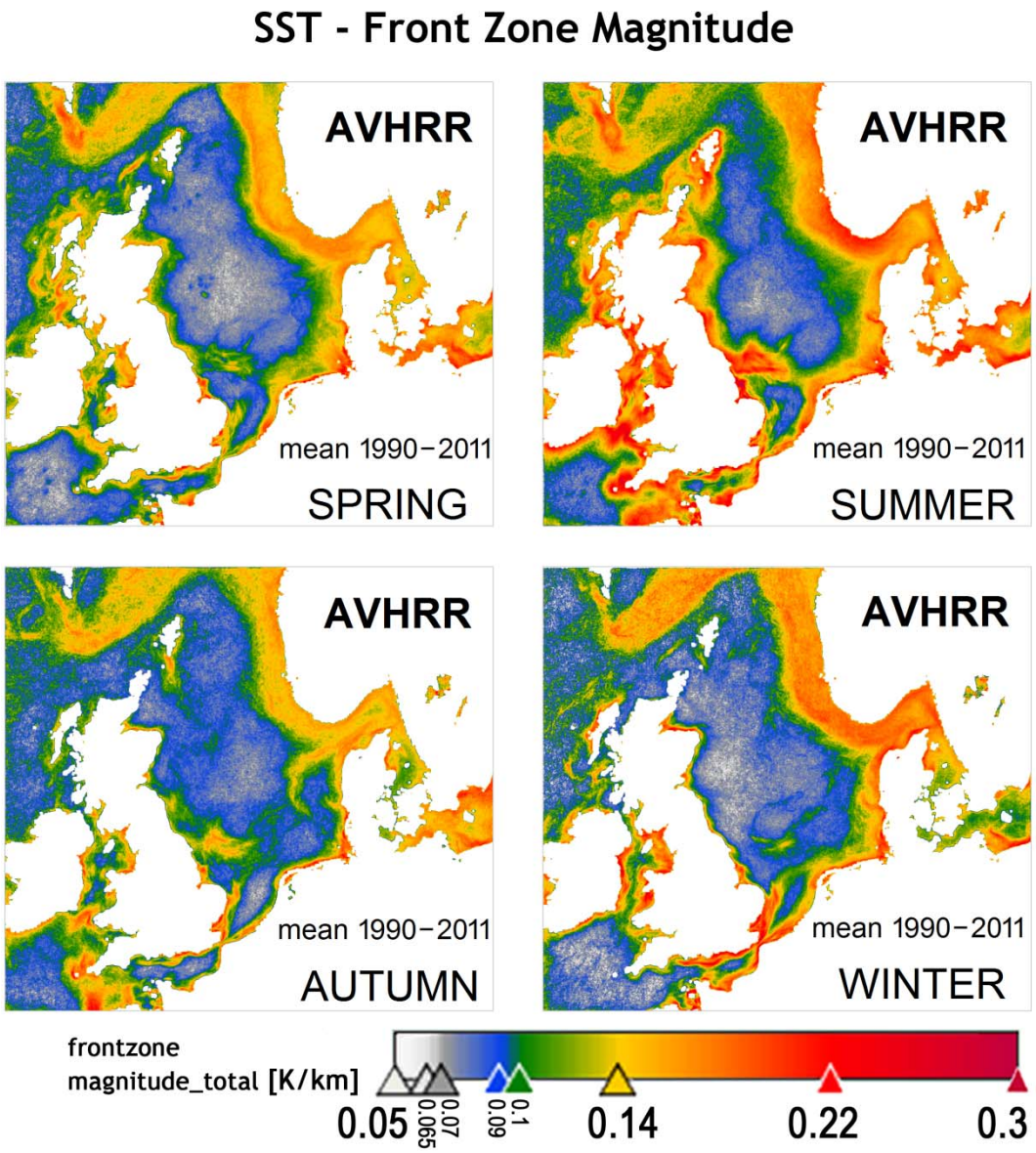

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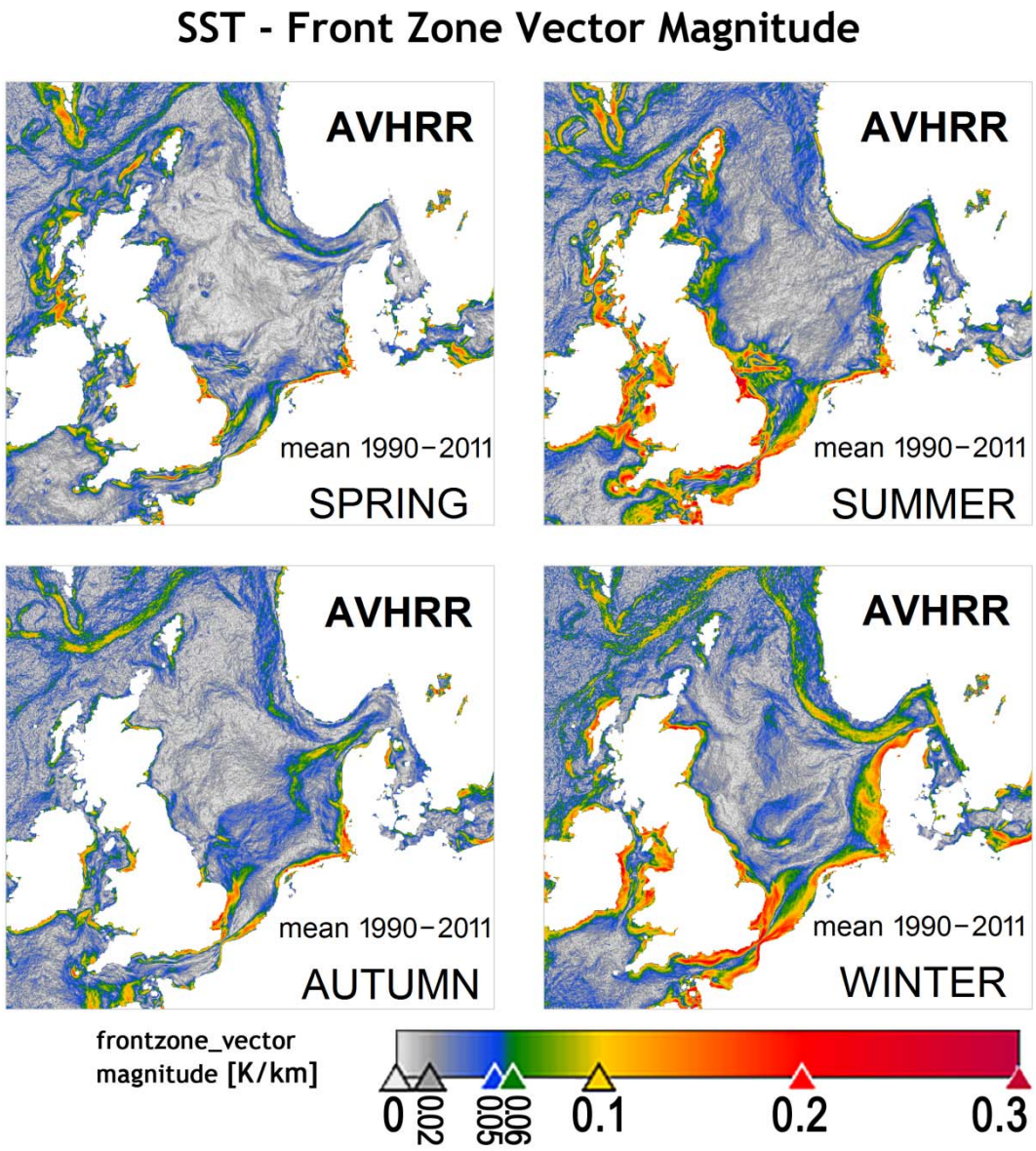

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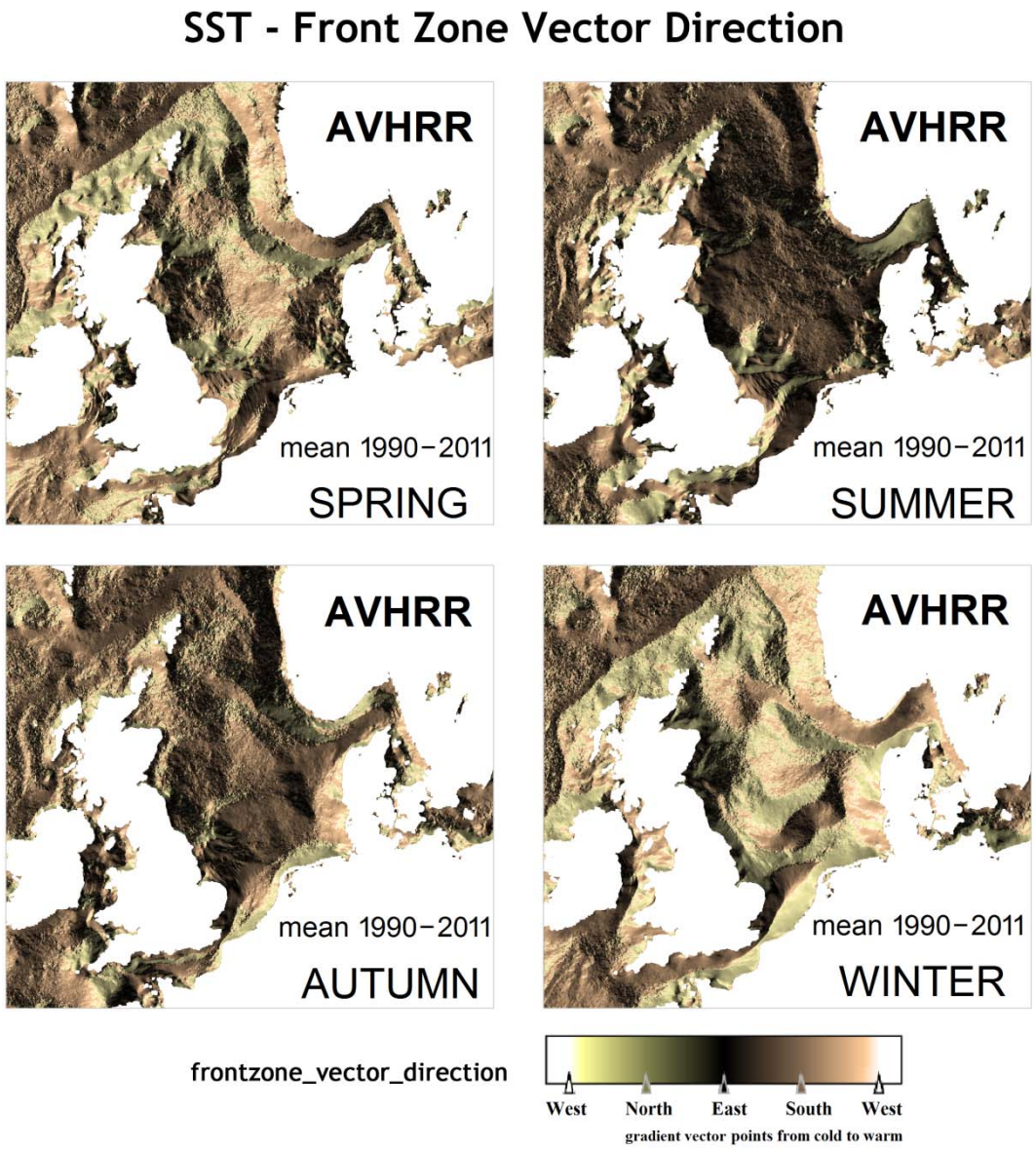

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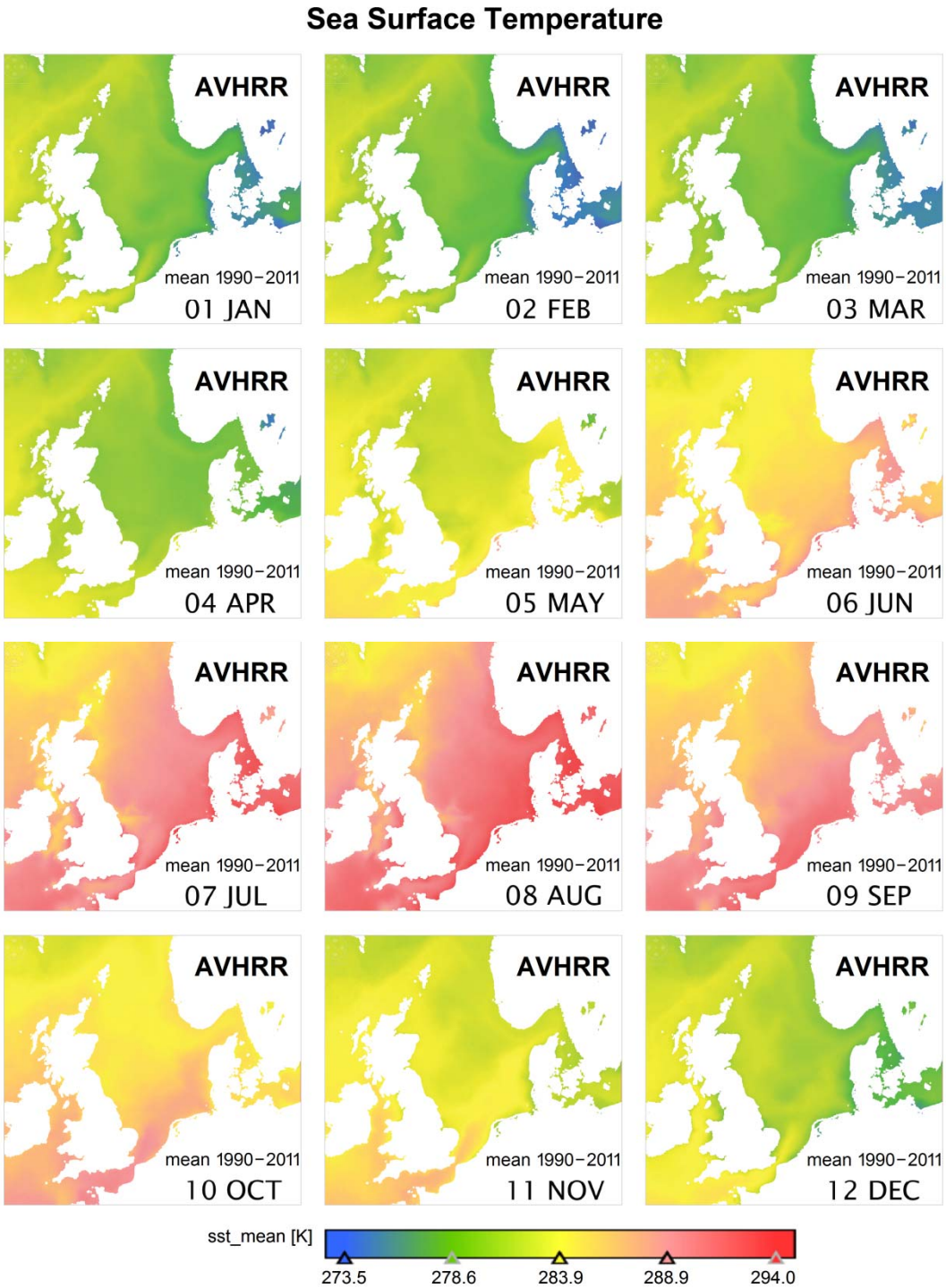

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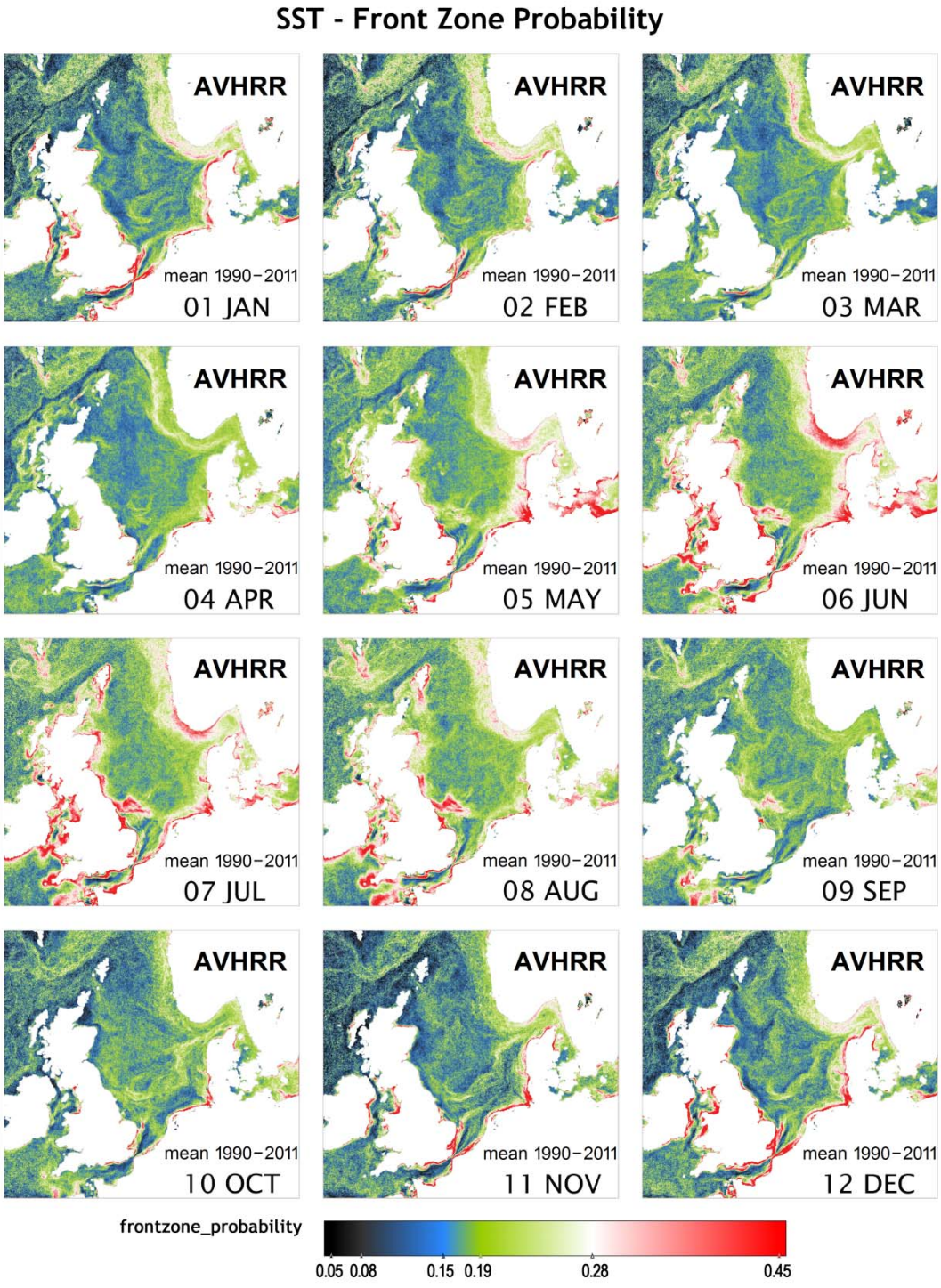


Fig. 12: Front probability based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011 and for months

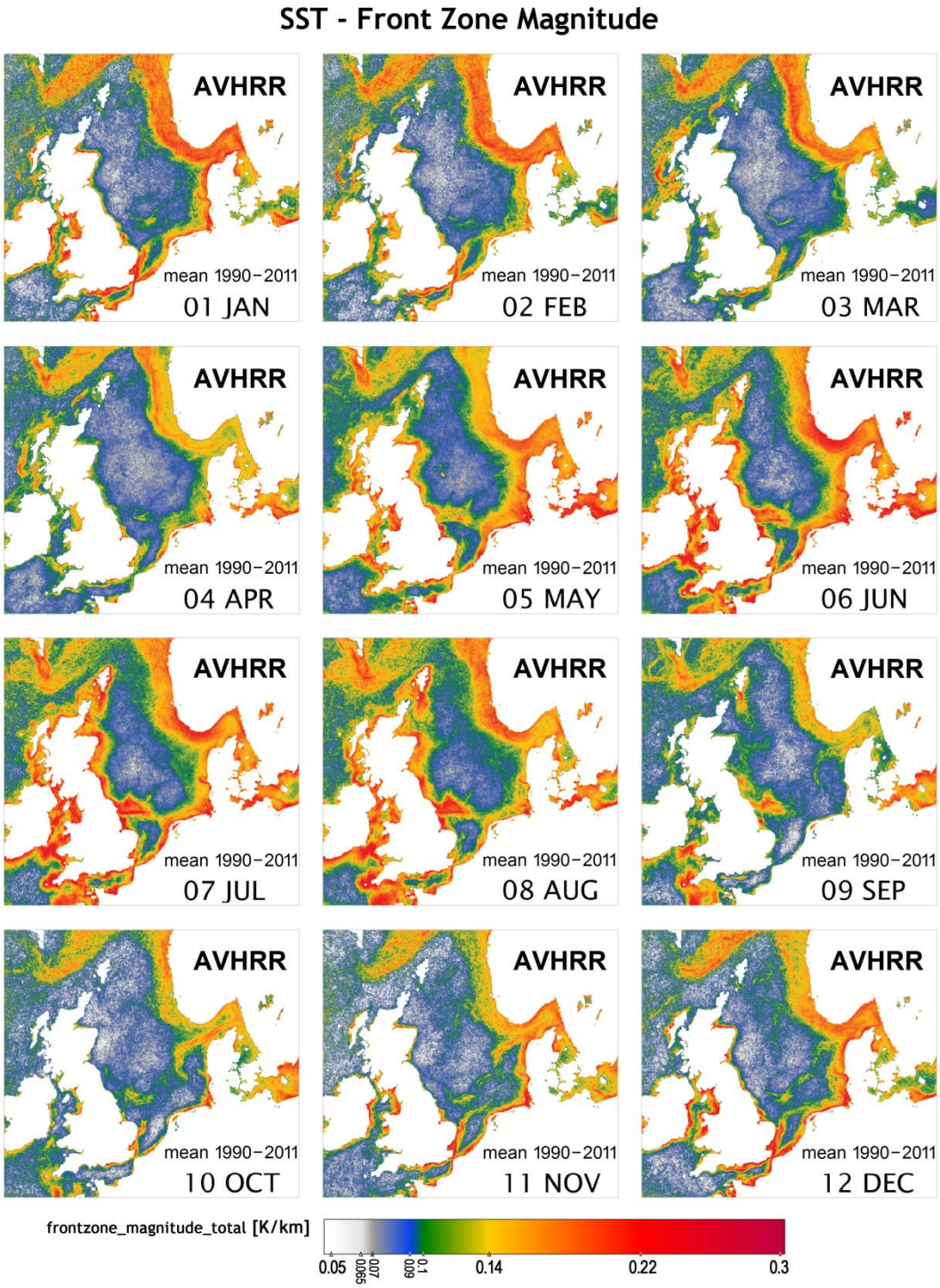
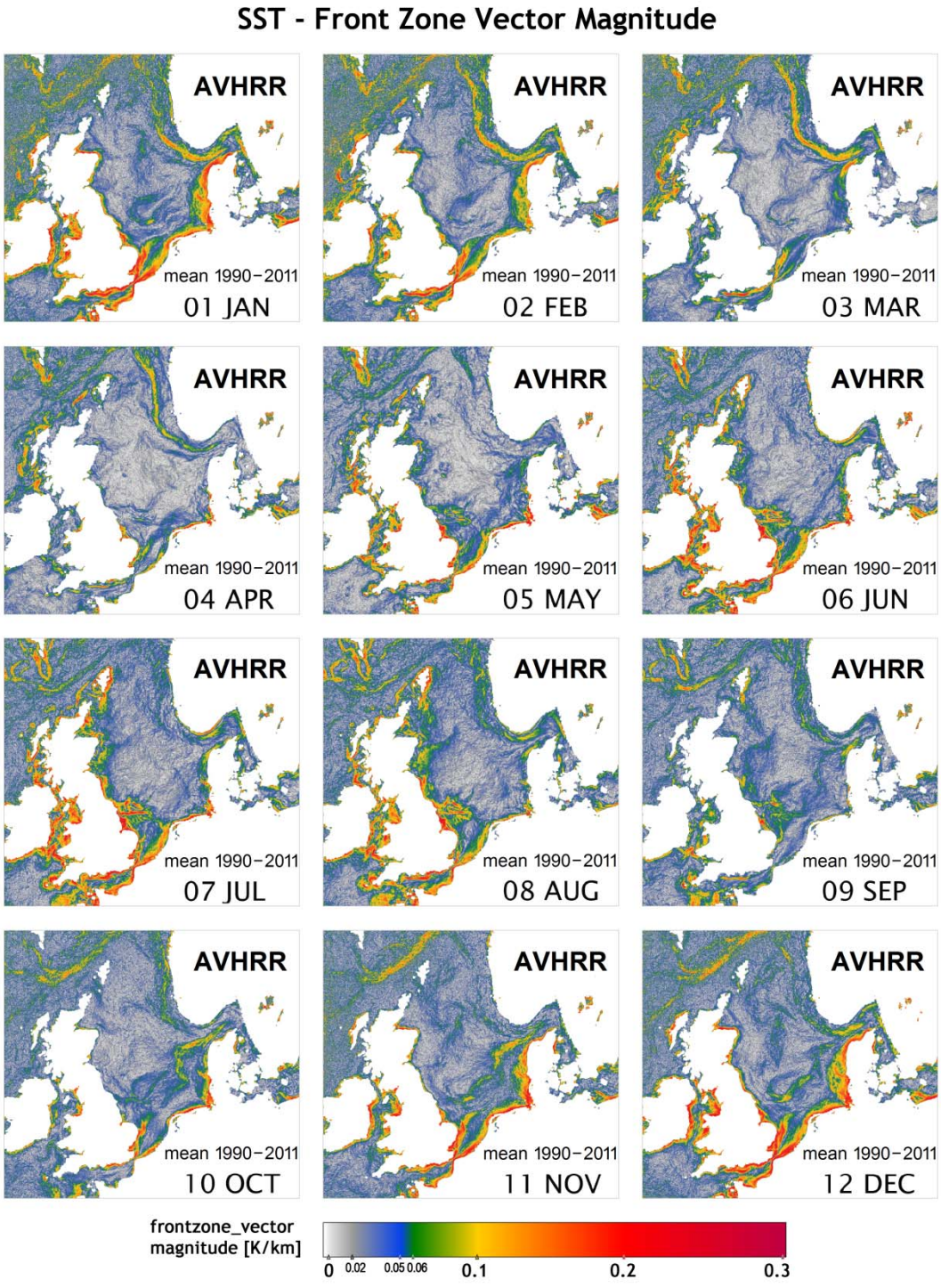


Fig. 13: Mean of gradient magnitude for frontal zone based on the data of the AVHRR sensor on NOAA and METOP 1990 - 2011 and for months



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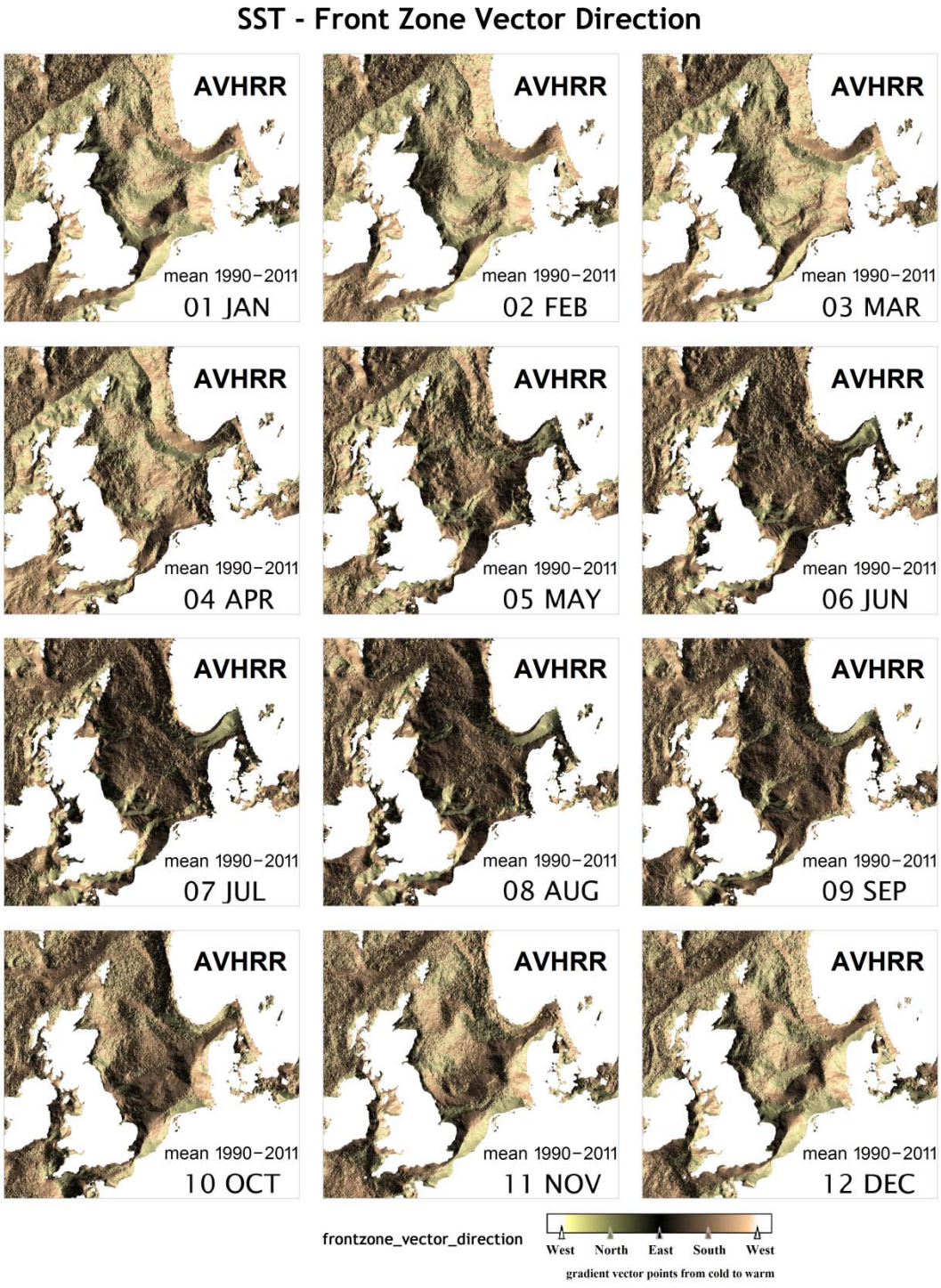

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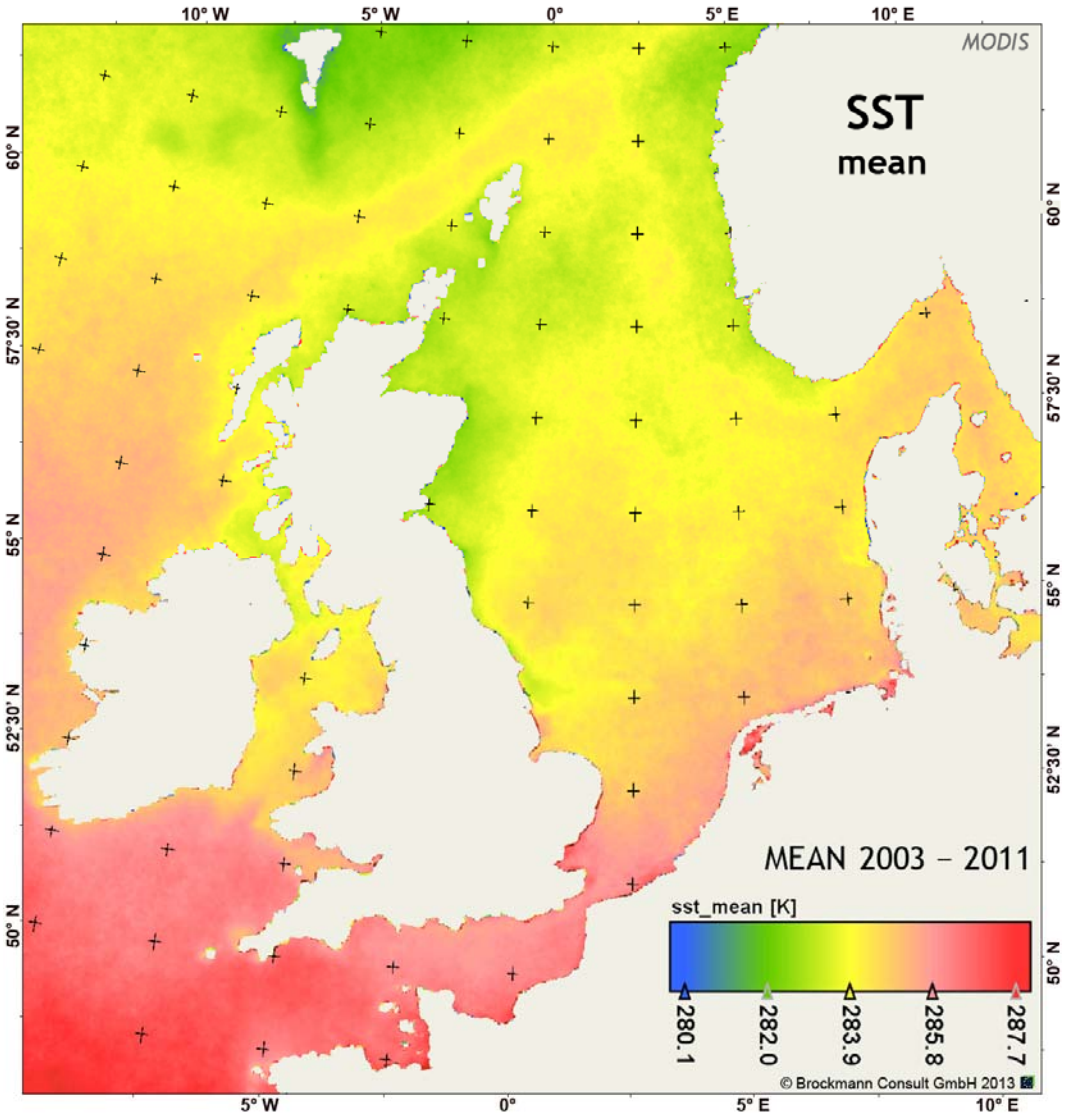
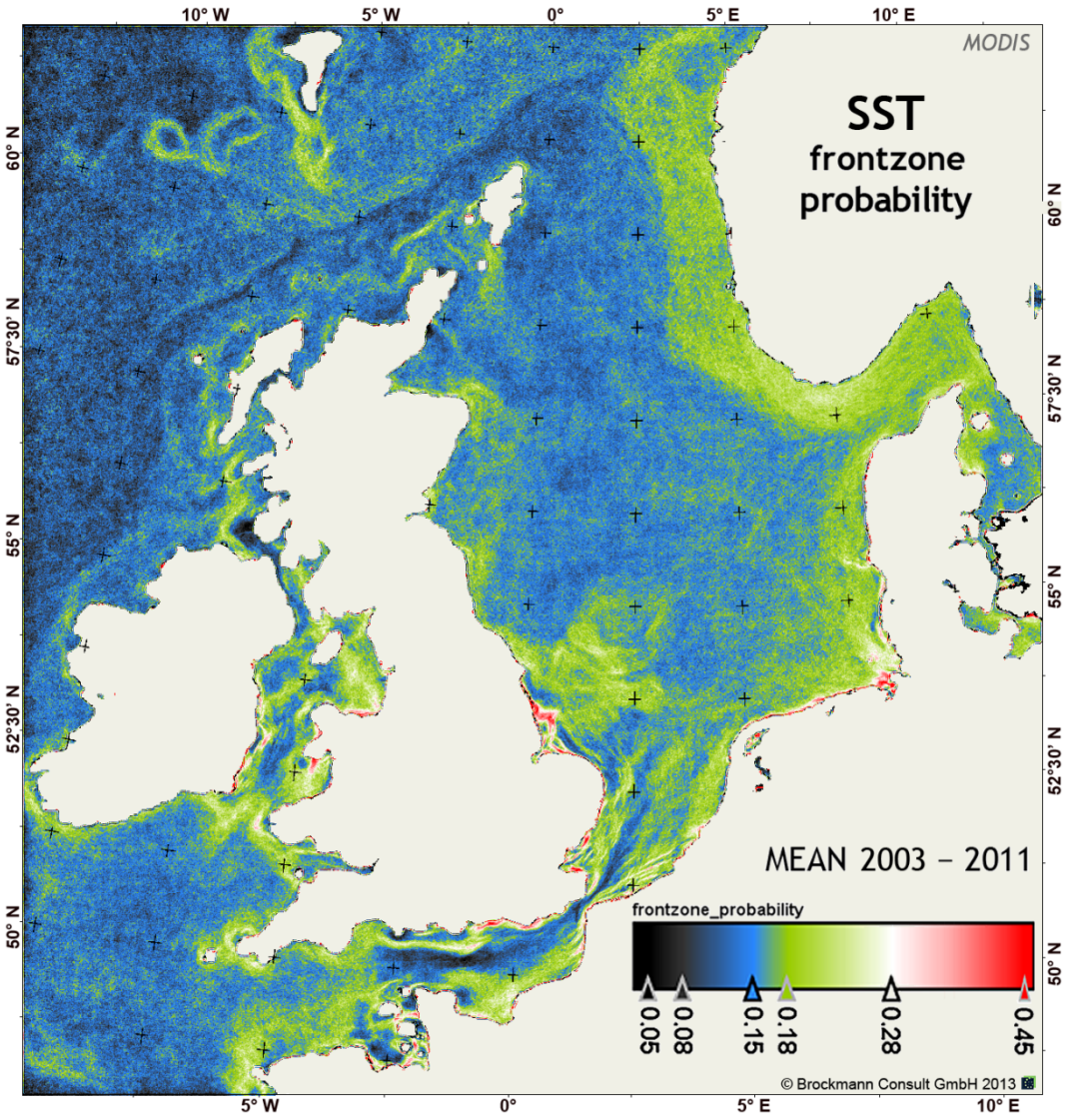


Fig. 16: Mean SST field based on the data of the MODIS sensor on AQUA 2003 - 2011



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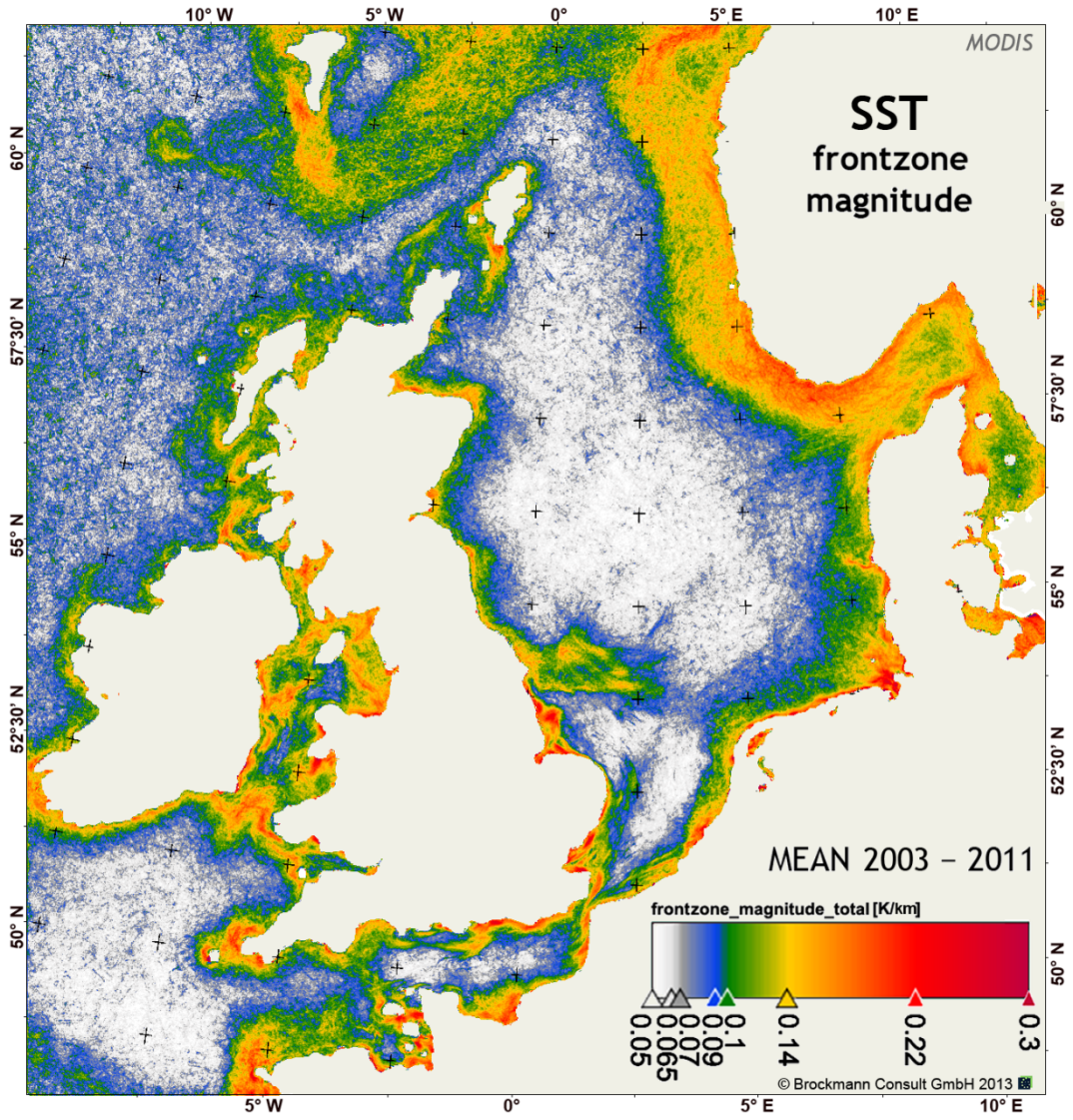
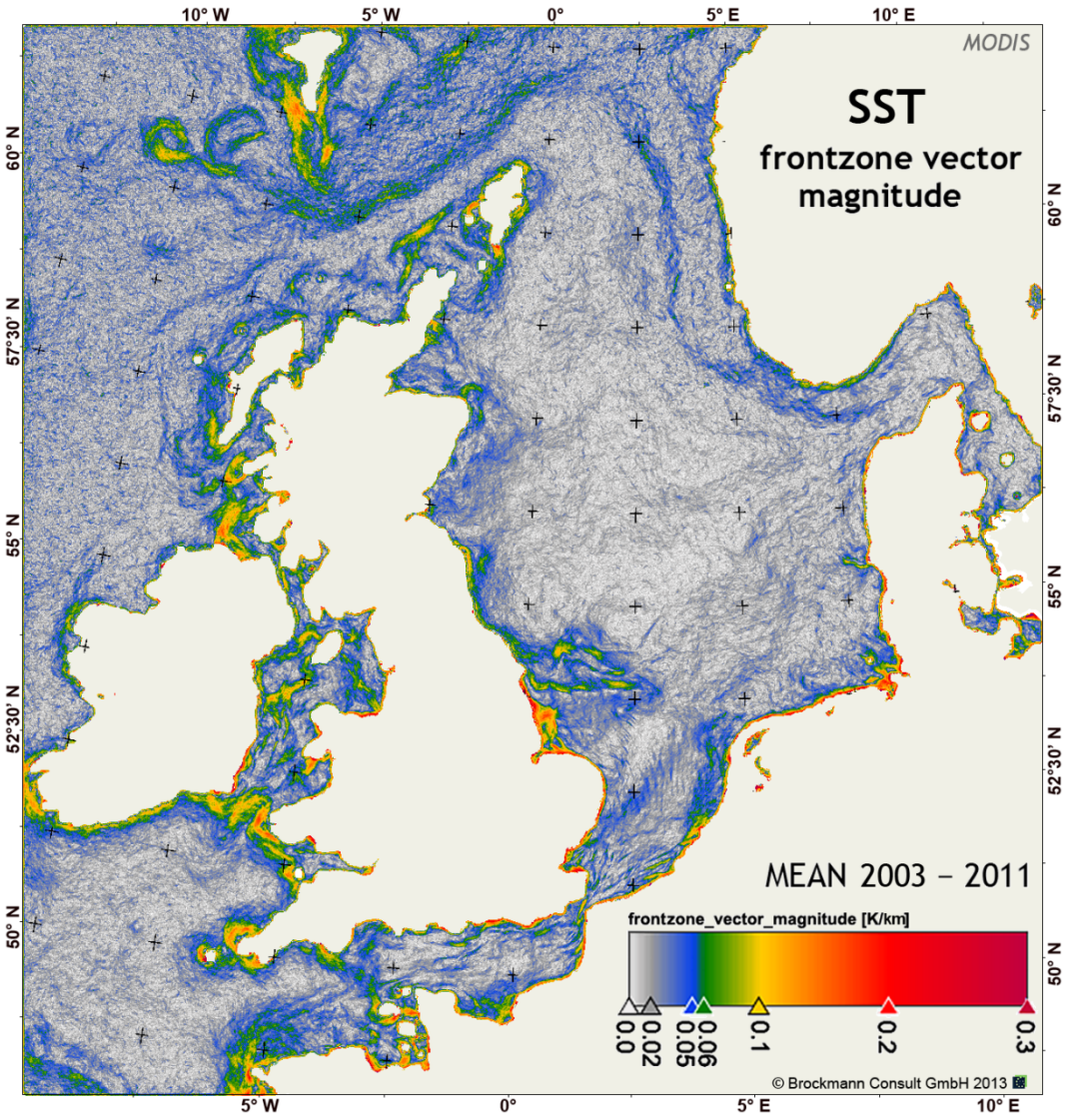


Fig. 18: Mean of gradient magnitude for frontal zone based on the data of the MODIS sensor on AQUA 2003 - 2011



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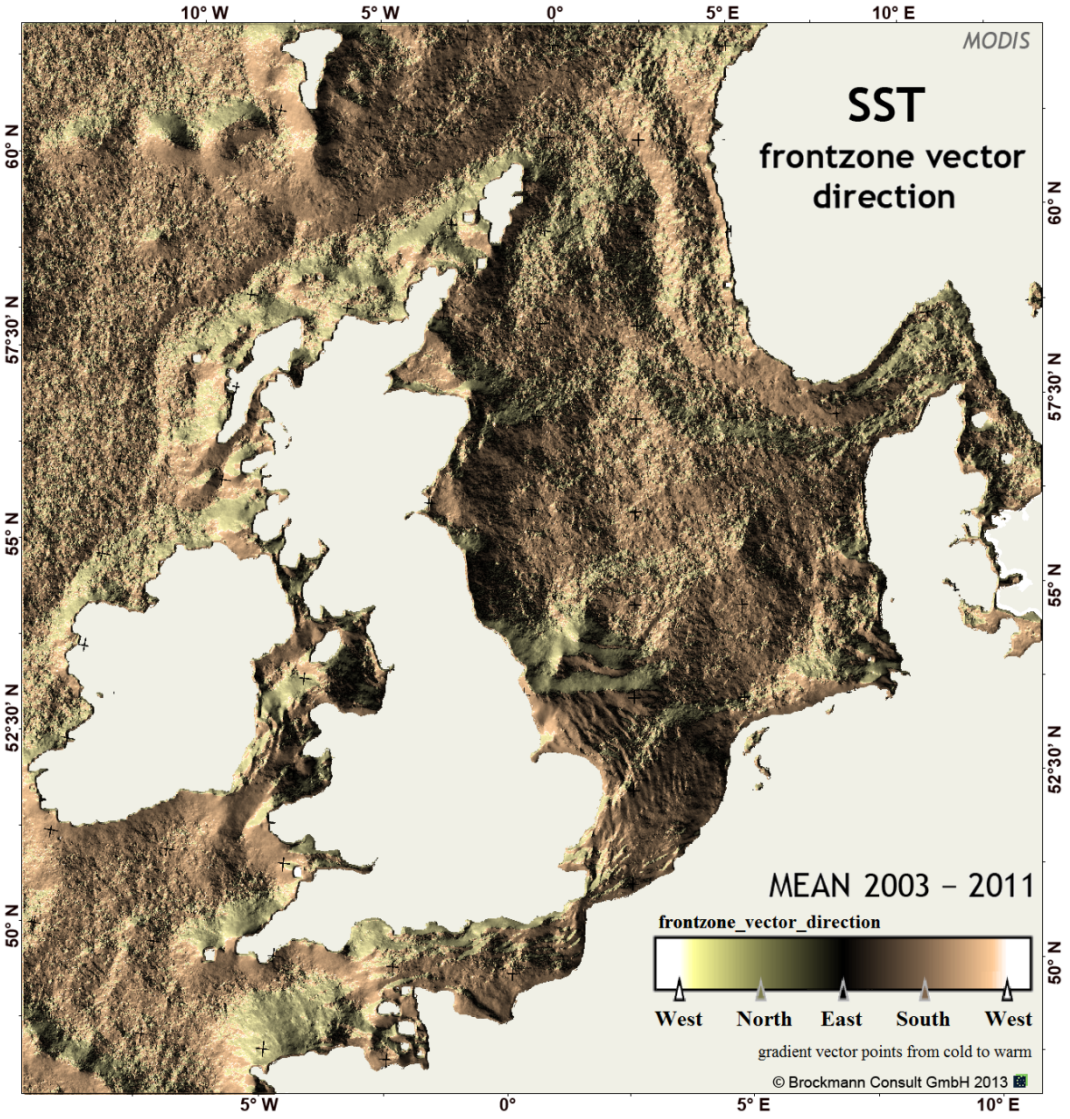

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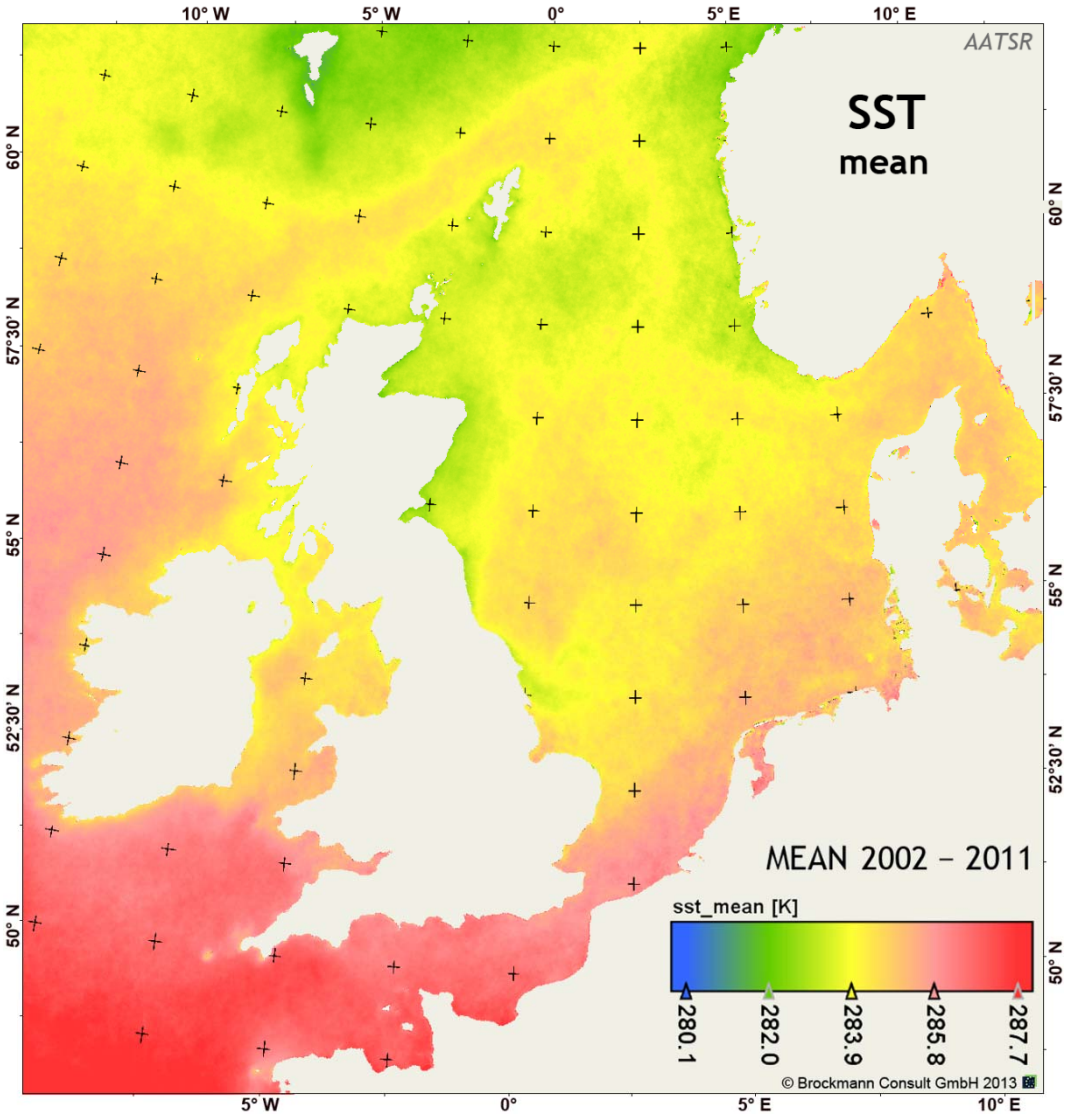

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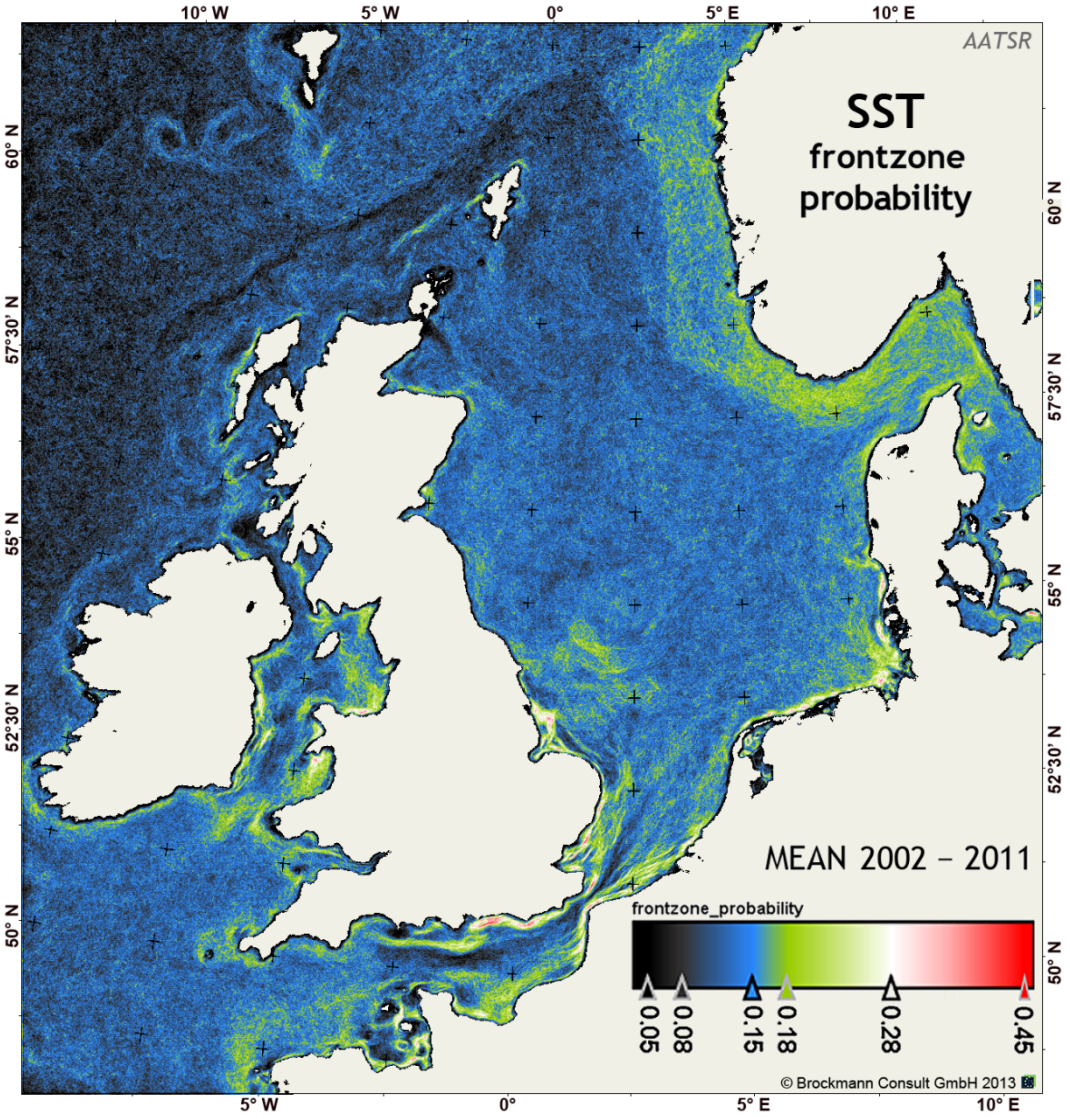
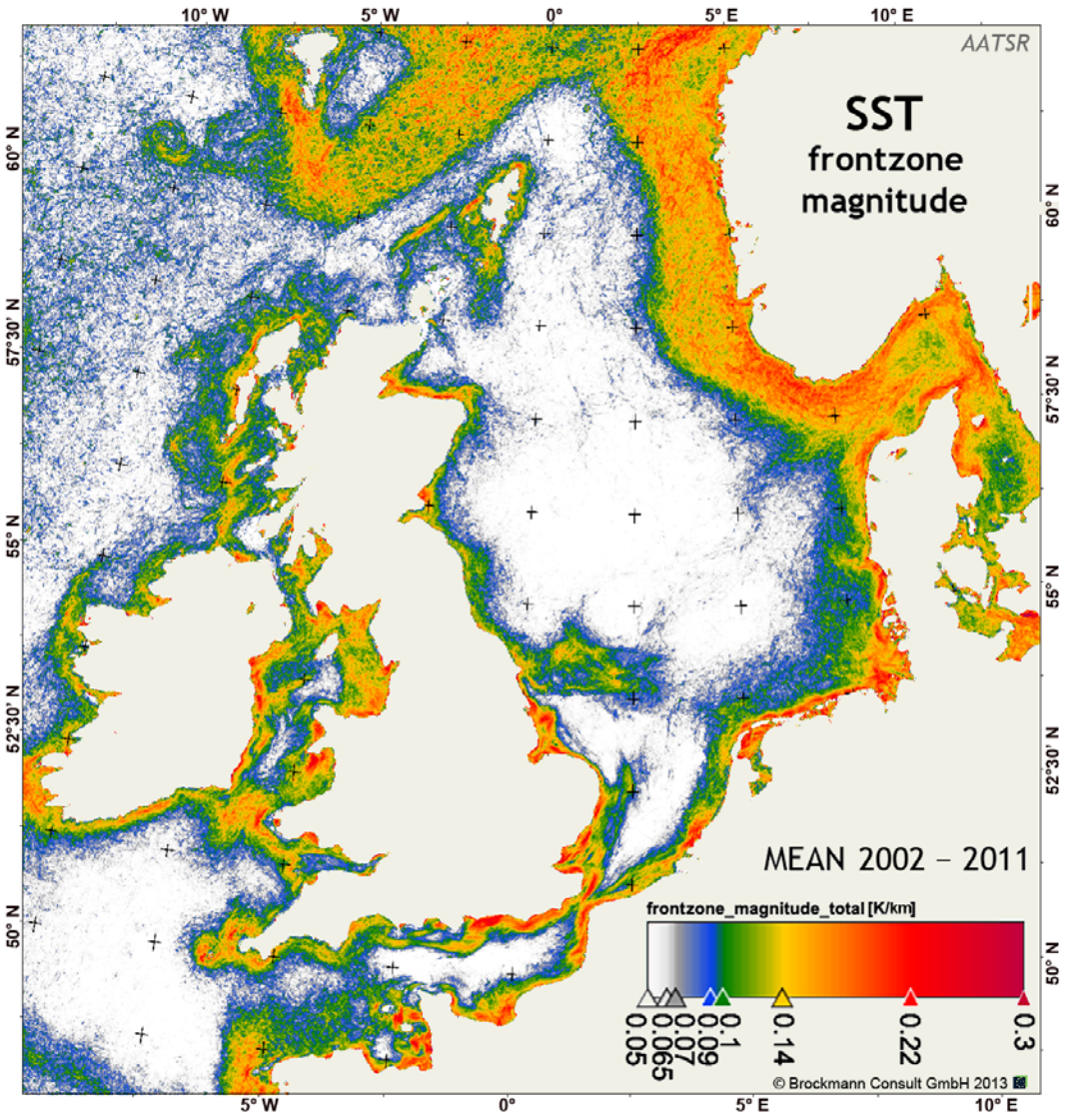


Fig. 22: Front probability based on the data of the AATSR sensor on ENVISAT 2002 - 2011



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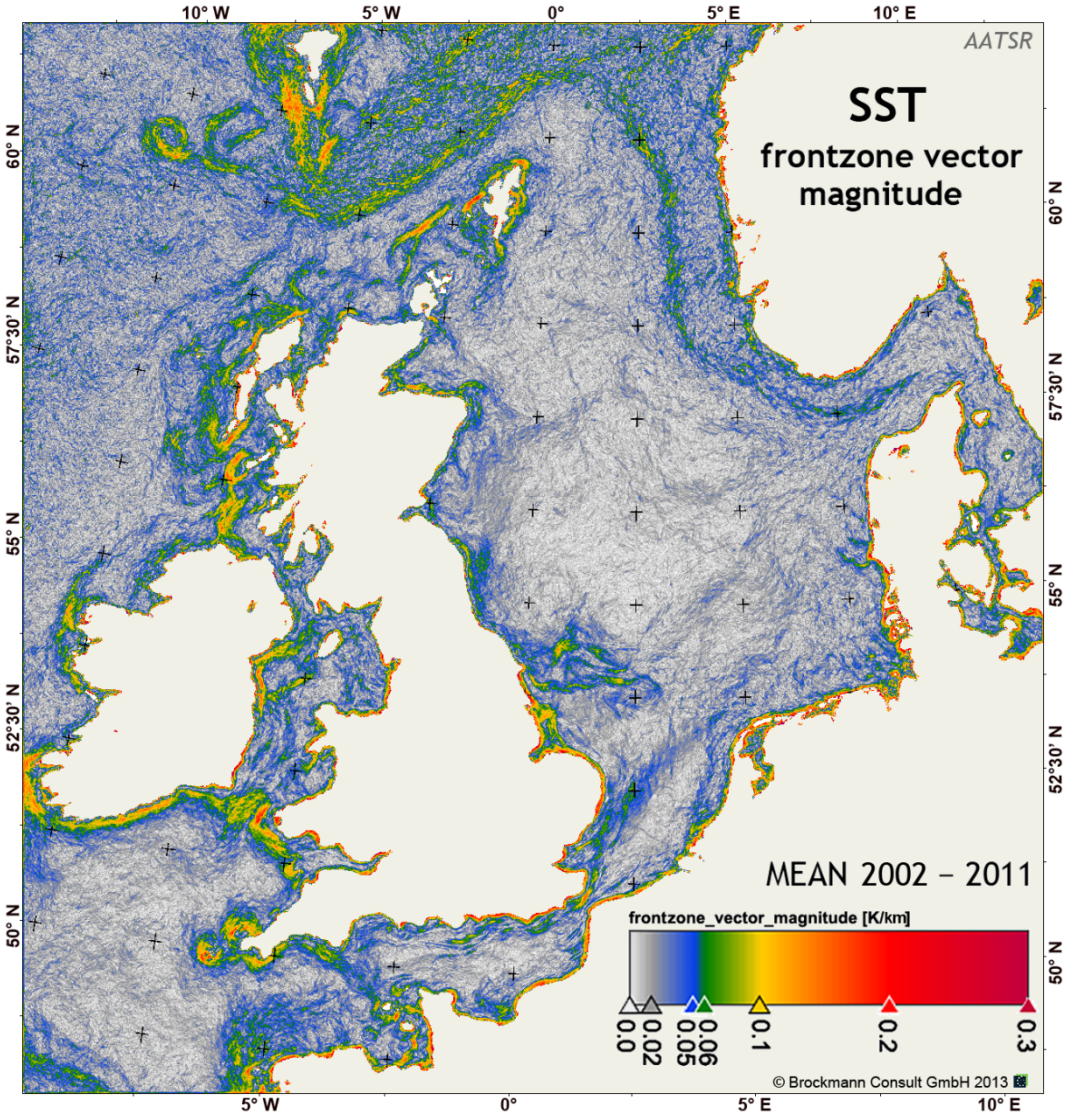

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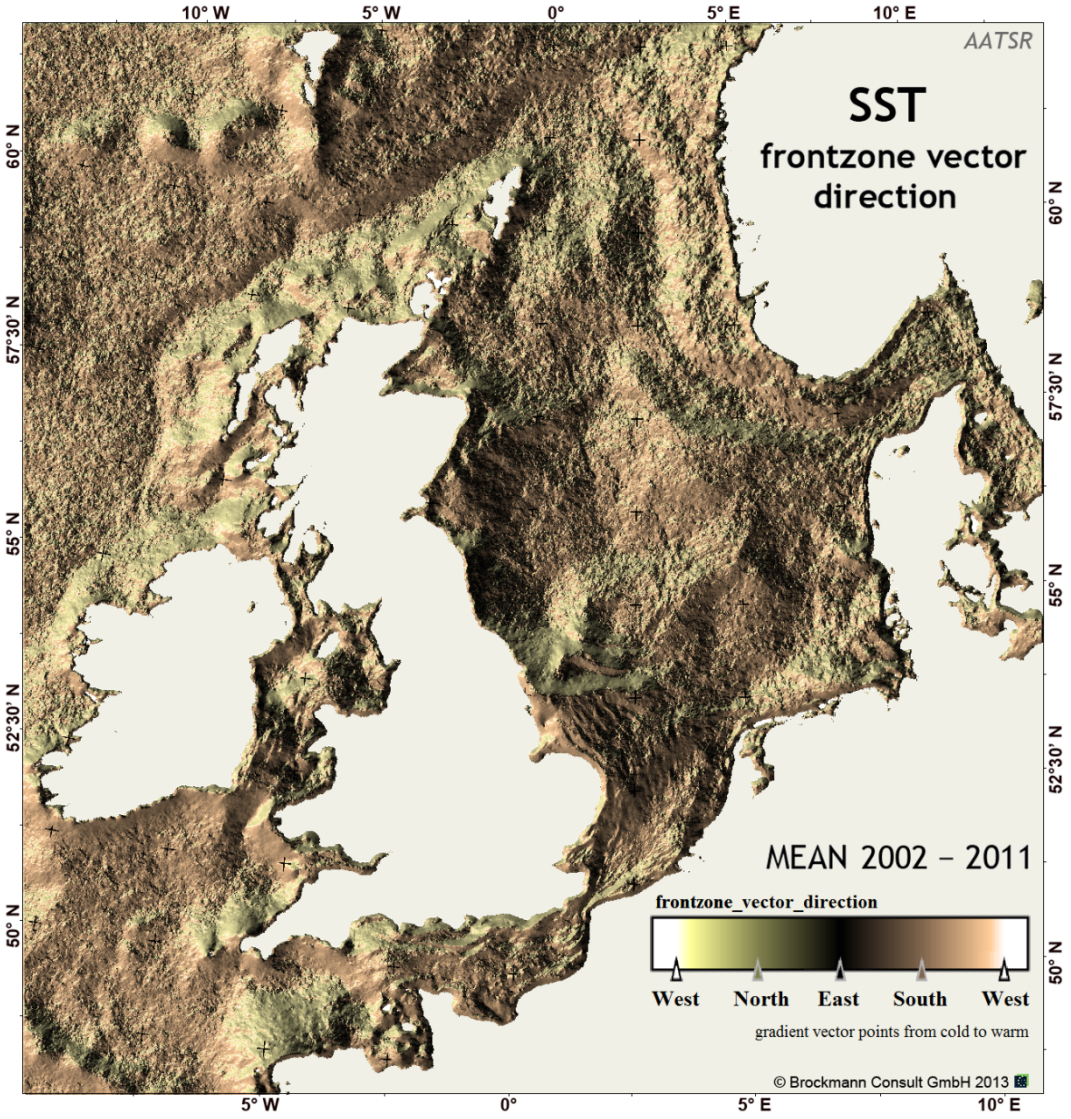

Fig. 25: Direction of mean gradient vector for frontal zone based on the data of the AATSR sensor on ENVISAT 2002 - 2011

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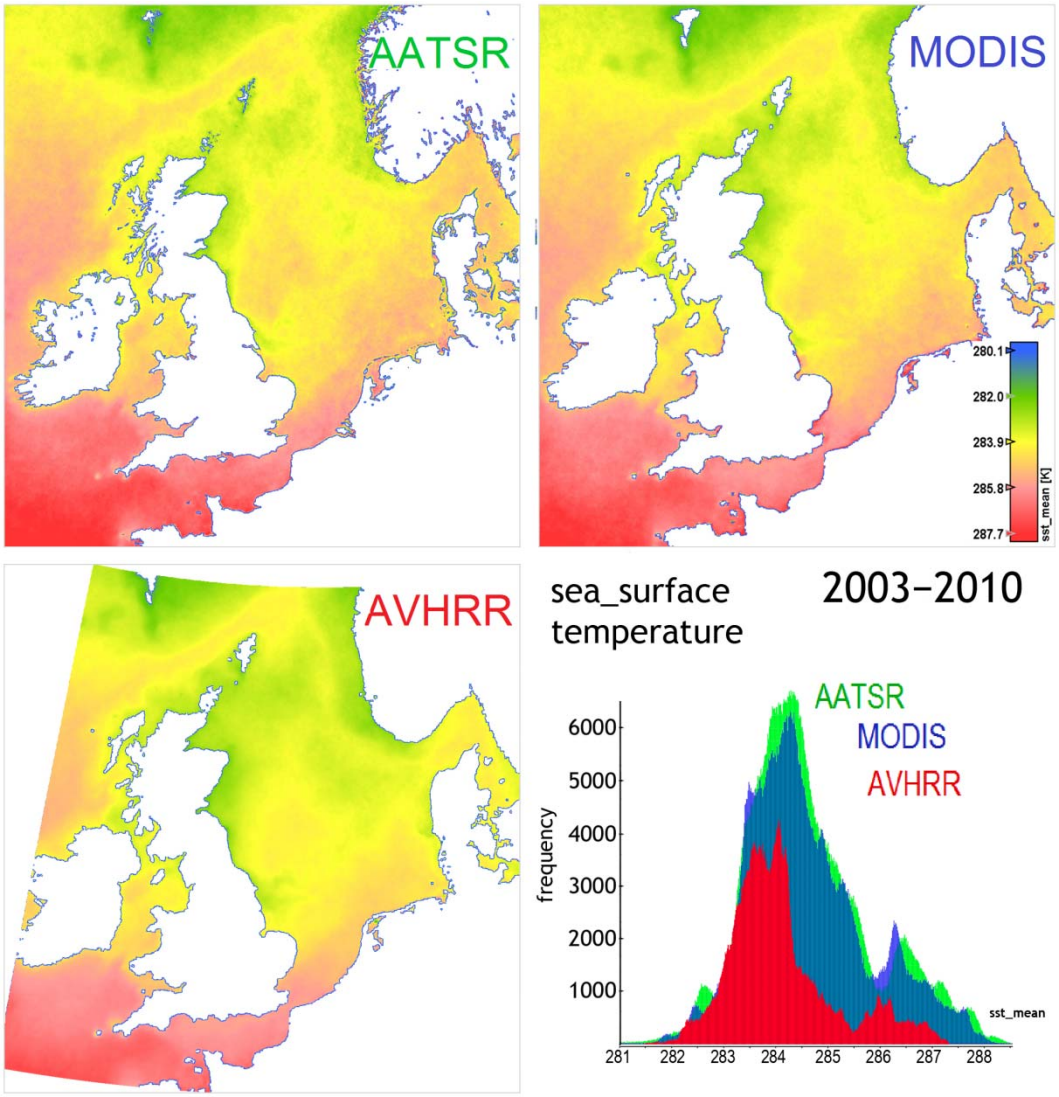

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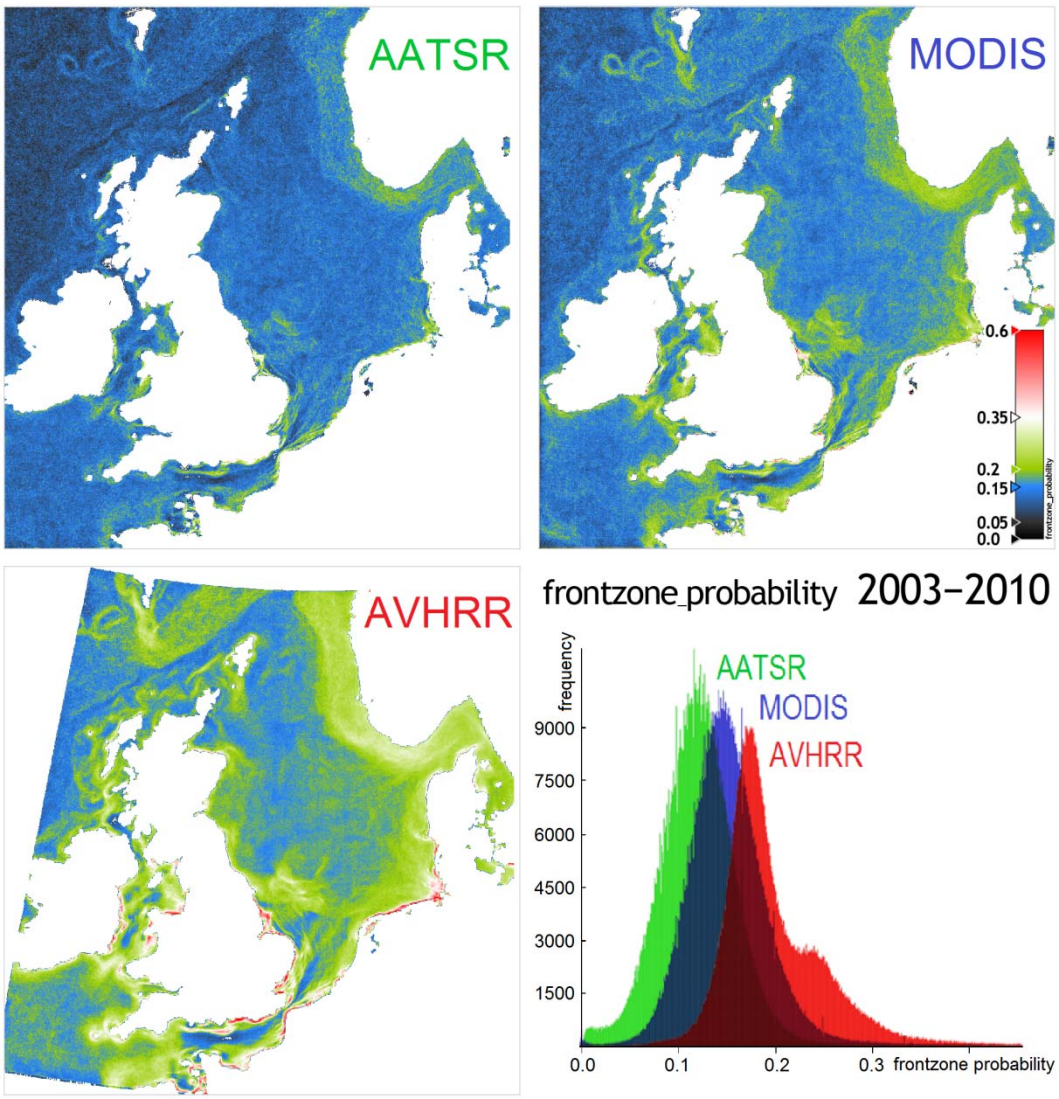


Fig. 27: Front probability based on the data of the AATSR sensor on ENVISAT, MODIS sensor on AQUA, of the AVHRR sensor on NOAA and METOP 2003 - 2010

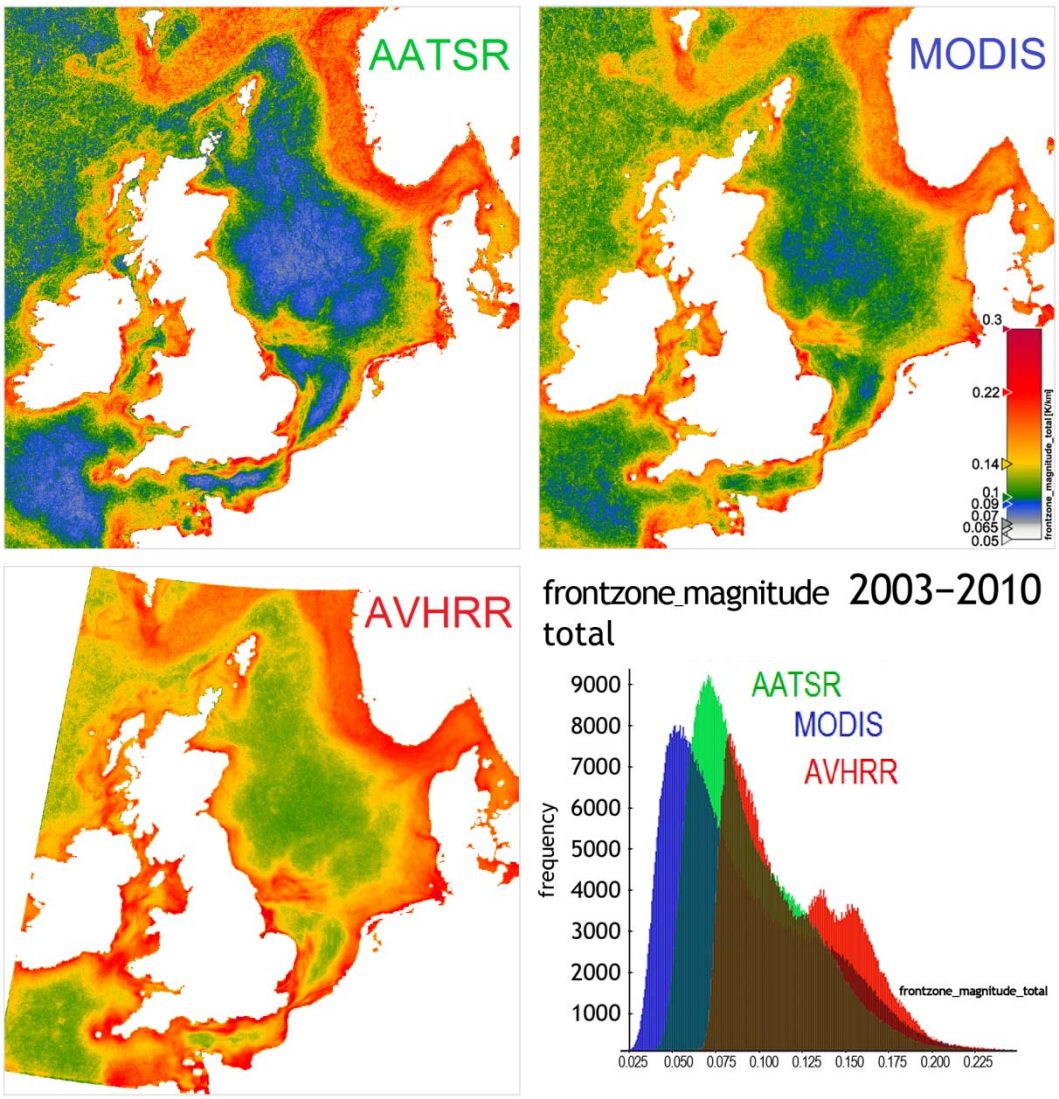


Fig. 28: Mean of gradient magnitude for frontal zone based on the data of the AATSR sensor on ENVISAT, MODIS sensor on AQUA, of the AVHRR sensor on NOAA and METOP 2003 - 2010

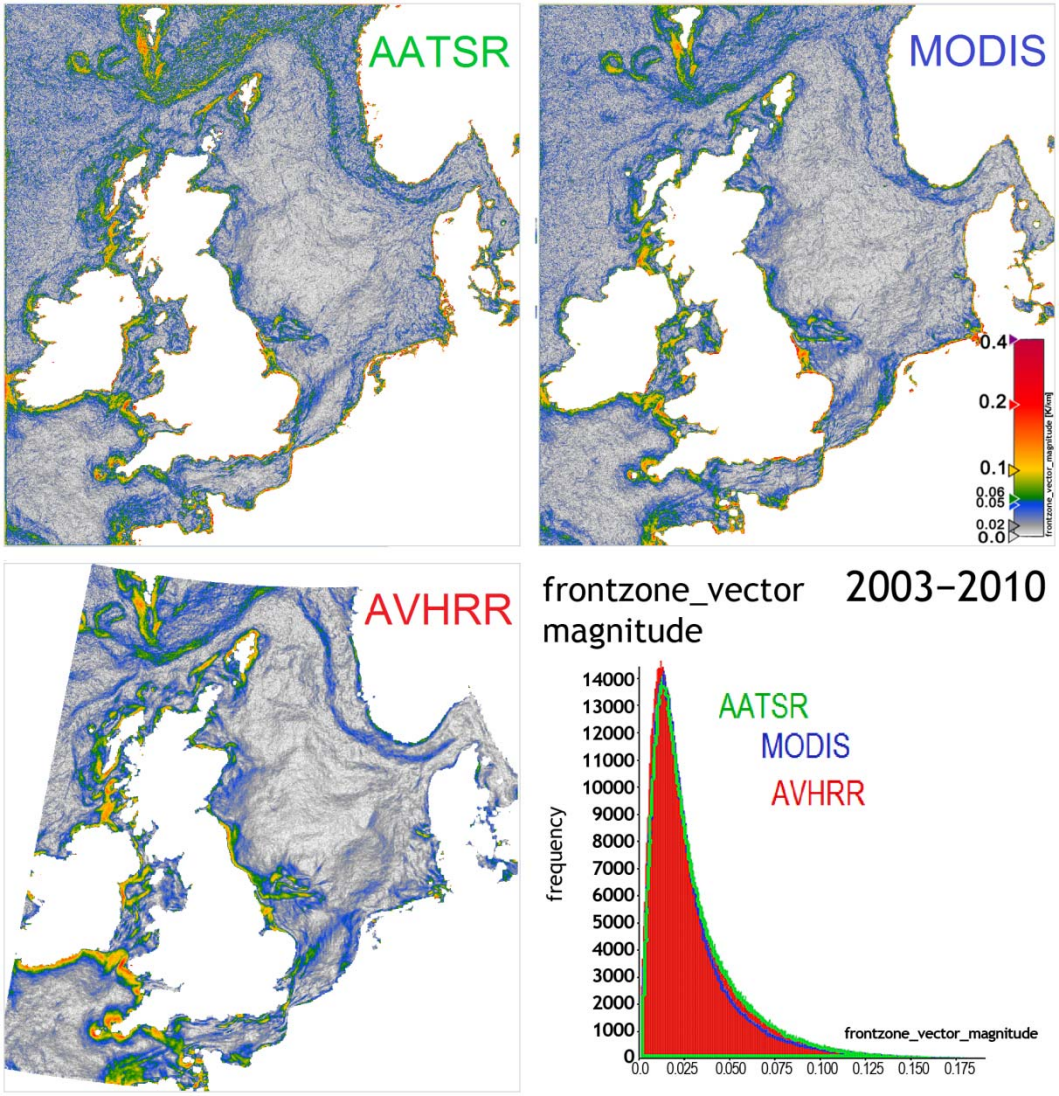
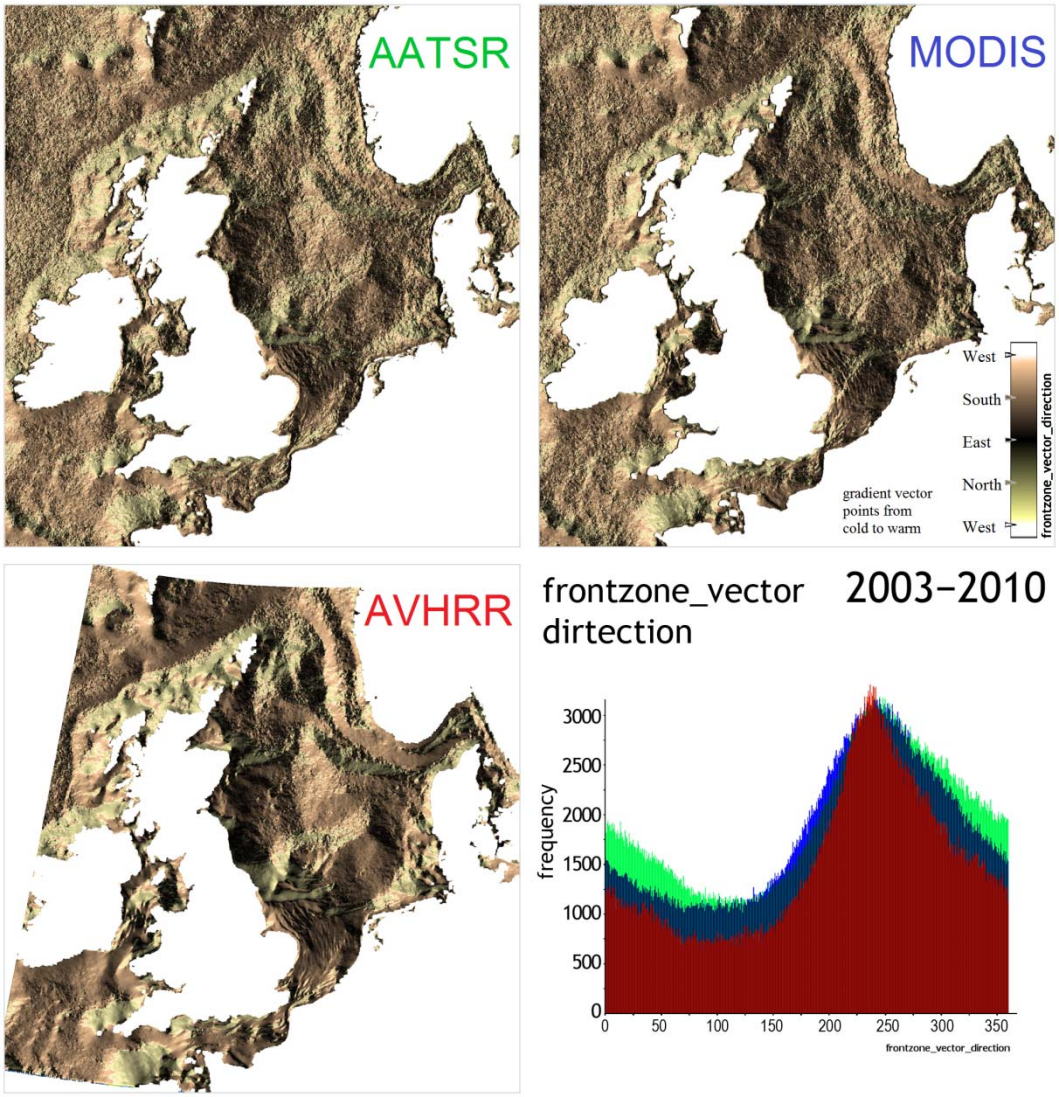


Fig. 29: Magnitude of mean gradient vector for frontal zone based on the data of the AATSR sensor on ENVISAT, MODIS sensor on AQUA, of the AVHRR sensor on NOAA and METOP 2003 - 2010



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