

BEAM/VISAT Tutorial



Brockmann Consult GmbH

Esrin, 17.10.2012



BEAM VISAT

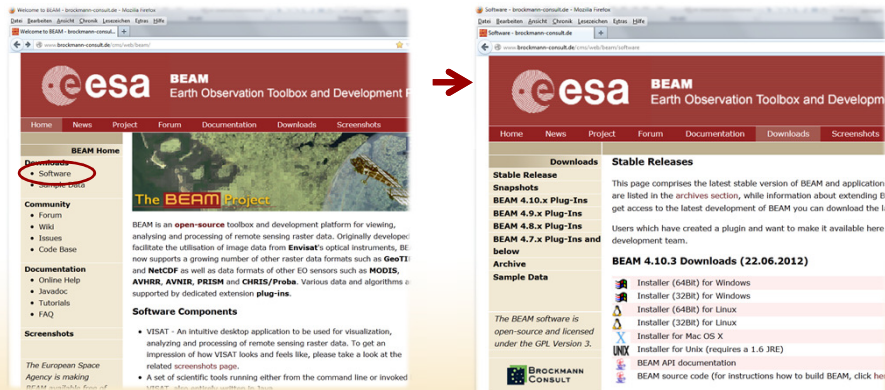
- A-1. Integration of in-situ data and tools for analysis
 - Correlative plot
 - Transect plot
 - Time series
- A-2. Analysing parameterised subsets (BEAM's mask concept)
 - Flagging
 - Creating own masks
 - Masks as tools for regional analyses
- A-3. Extraction of information
 - Pixel extraction of time series and match-ups
- A-4. Working with raster data processors



Tutorial Setup

- BEAM 4.10.3
 - Update with Module Manager
- MERIS Data
 - L1:
 ..\MERIS\MER_RR_1PNMAP20120407_095350_000003443113_00252_52852_0001.N1
 - L2:
 ..\MERIS\MER_RR_2PNMAP20120407_095350_000003443113_00252_52852_0001.N1
- In-situ Data
 - ..\in-situ\fake_NorthSea_2012_import_in-situ.txt
 - ..\in-situ\ferrybox_cosyna_20120402.txt
 - ..\in-situ\Baltic Sea Protected Areas\BSPA_Bothnia.shp
- Colour palettes
 - ..\palettes\CHL_colours.cpd

Installation Files



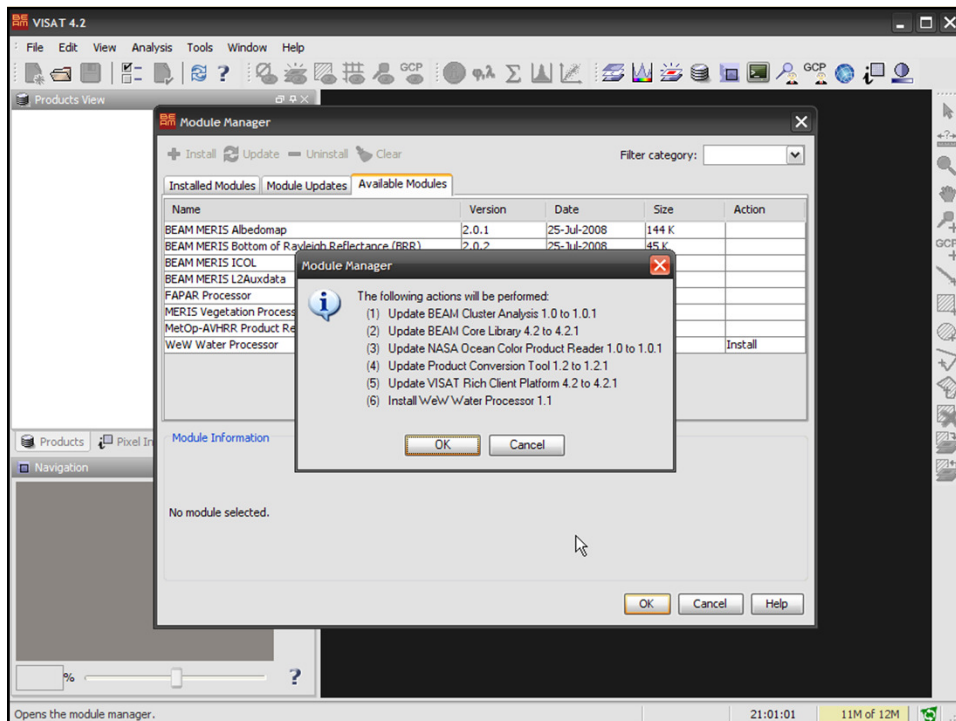
The image shows two screenshots of the BEAM website. The left screenshot shows the main navigation menu with 'Downloads' circled in red. The right screenshot shows the 'Downloads' page, which lists various installers for different operating systems and versions of BEAM.

BEAM 4.10.3 Downloads (22.06.2012)

Sample Data	Installer
	Installer (64Bit) for Windows
	Installer (32Bit) for Windows
	Installer (64Bit) for Linux
	Installer (32Bit) for Linux
	Installer for Mac OS X
	Installer for Unix (requires a 1.6 JRE)
	BEAM API documentation
	BEAM source code (for instructions how to build BEAM, click here)

Module Manager

→ Updating your BEAM Version with **new, additional** and **bug fixed** modules



BEAM Community

Forum - brockmann-consult.de - Mozilla Firefox

www.brockmann-consult.de/cms/web/beam/forum

Sign In

Home News Project Forum Documentation Downloads Screenshots

Categories Recent Posts Statistics

Search Search Categories

Category	Categories	Threads	Posts
BEAM Development This forum contains discussions and questions about BEAM software development, namely how to reuse BEAM components and how to develop BEAM extension modules (plug-ins).	0	161	59
BEAM Extensions This forum discusses issues related to BEAM extensions provided on the BEAM plug-in page or the VISAT module manager.	0	78	28
BEAM Toolbox Usage General questions and discussions about the BEAM toolbox including the usage of BEAM applications such as VISAT or the command-line tools.	0	254	100
Miscellaneous For general feedback and all questions that don't fall into the above categories.	0	49	71

Showing 4 results.

[7] algal_2 - [C:\BC\Projects\Schulung_Tartu\material\products\MER_RR_FUBWeW20080731_093149_000002482070_00437_33557_0001_smile.dim] - VISAT ...

File Edit View Analysis Tools Window Help

Products View: [1] MER_RR_2PNNMAP20080731_093149_000002482; [2] MER_RR_2PNNMAP20080801_090032_00000259; [3] MER_RR_1PNNMAP20080731_084906_00000242; [4] MER_RR_FUBWeW20; [5] MER_RR_1PNNMAP20080731_093149_000002482

World Map: Display product bound

Spectrum View: [1] Display spectrum at the

Pin Manager: [1] MER_RR_1PNNMAP20080731_093149_Subset

X	Y	Lon	Lat	Label
1344.500	253.500	16.798187	58.867451	Pin 1
933.500	205.500	15.112637	59.296021	Pin 2
891.500	505.500	14.462873	58.569504	Pin 3
1285.500	684.500	15.755250	57.847130	Pin 4

Band Maths Expression Editor

Data sources: radiance_1, radiance_2, radiance_3, radiance_4, radiance_5, radiance_6, radiance_7, radiance_8

Expression:

Constants: (0)

Operations: *

Functions: *

OK Cancel Help

Scatter Plot: radiance_11, radiance_5

Statistics Histogram Scatter Plot Profile Plot Coordinate List

Ready. No pos. 22:13:52 225M of 309M

A-1. Integration of in-situ data and tools for analysis

- Correlative Analysis
- Profile Analysis
- Time series Analysis

- Preparation:
 - Open Product
 - Open Band
 - Adjust colours
 - Import in-situ data

Formats for data import

- CSV
 - Tabstop seperated
 - A CSV file **must** have a header line specifying the column names
 - Latitude: 'lat' or 'latitude'
 - Longitude: 'lon', 'long' or 'longitude'
 - Column(s) with in-situ values
 - Points, Lines, Polygons,

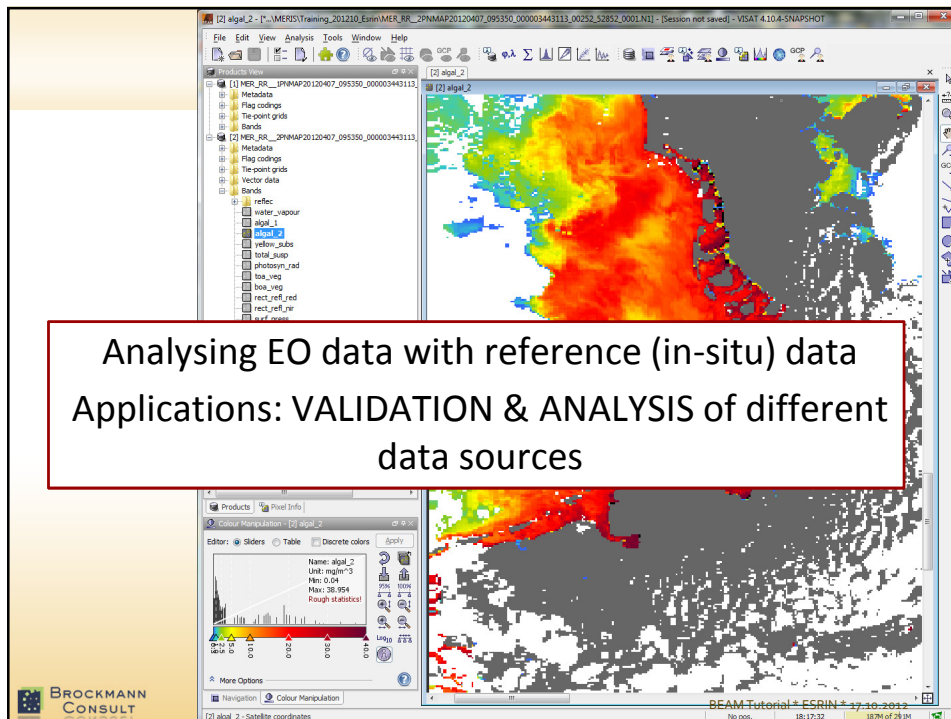
```
# MULTIPOLYGONS
#
# Product:      subset_1_MER_RR_1FQBCM20030809_101416_000002002018_00466_07534_0168
# Created on:   Thu Apr 12 14:48:36 CEST 2012

# Wavelength:      884.94403
org.esa.beam.Multipolygon  Name:String      Geometry:MultiPolygon  radiance_14:Double
0  multipolygon_1  MULTIPOLYGON  (((10 47, 0 43, 6 40, 10 47)), ((2 39, 3 39, 2.5 38, 2 39)))  59.383057
1  multipolygon_2  MULTIPOLYGON  (((8 38, 2 45, 8 42, 8 38)), ((3 35, 5 36, 3.5 39, 3 35)))  59.383057
```

Formats for data import

- Shapefile
 - ESRI shapefile
 - Points, lines, polygons
 - Import of elements as a whole or separately
- MERMAID Extraction file


```
PROCESSING_VERSION;site;PI;lat_IS;lon_IS;TIME_IS;theta_IS;POC;MOC;chl_IS;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030907T130033Z;42.237999;P00000100;M110110101101111010;1.12E-01;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030908T100033Z;41.848999;P00000100;M110110101101111010;1.10E-01;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030910T101533Z;41.109001;P00000100;M110110101101111010;1.05E-01;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030911T110034Z;38.824001;P00000100;M110110101101111010;1.03E-01;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030914T100033Z;43.737999;P00000100;M110110101101111010;9.60E-02;
MEGS_8_0;BOUSSOLE;DavidAntoine;43.367;7.9;20030916T101535Z;43.101002;P00000100;M110110101101111010;9.10E-02;
```
- SeaDAS 6.x Track
 - Points



Analysing EO data with reference (in-situ) data
Applications: VALIDATION & ANALYSIS of different data sources

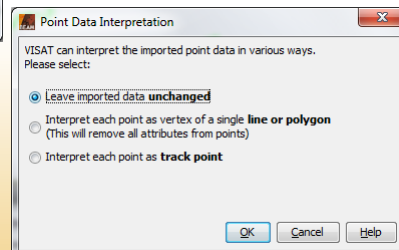
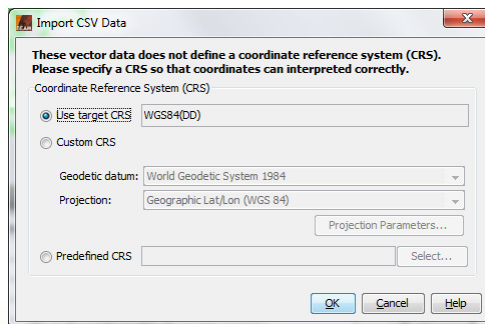
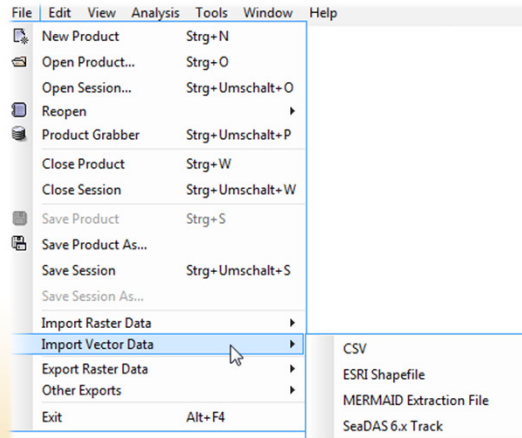
Products Pool Info
Colour Manipulation [algal_2]
Editor: Sliders Table Discrete colors Apply
Name: algal_2
Unit: mg/m³
Min: 0.04
Max: 38,954
Pough statistics
More Options
Navigation Colour Manipulation

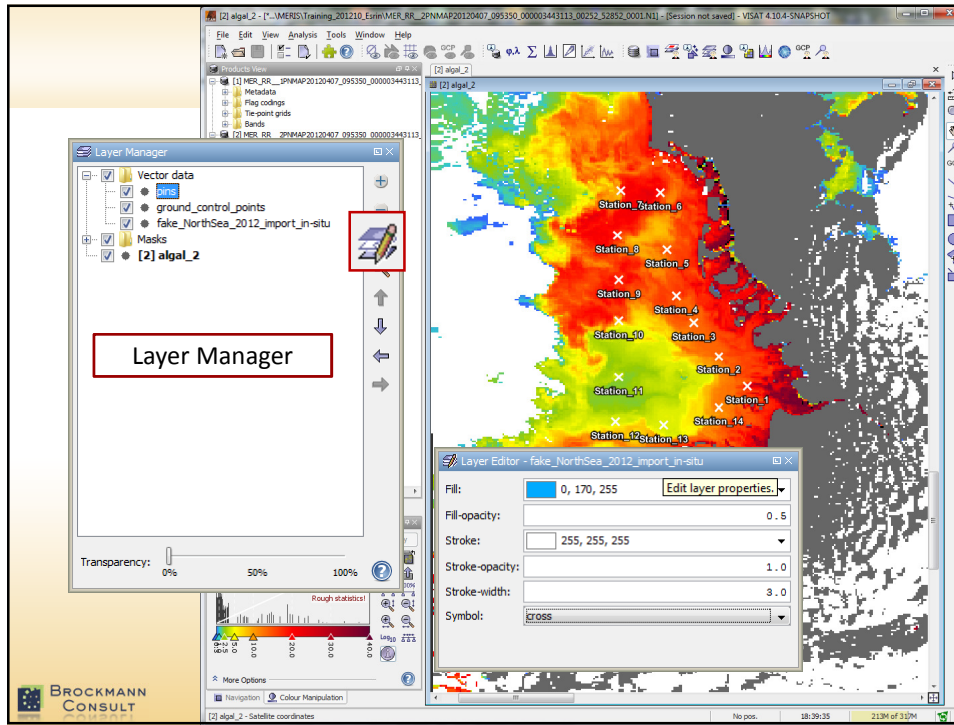
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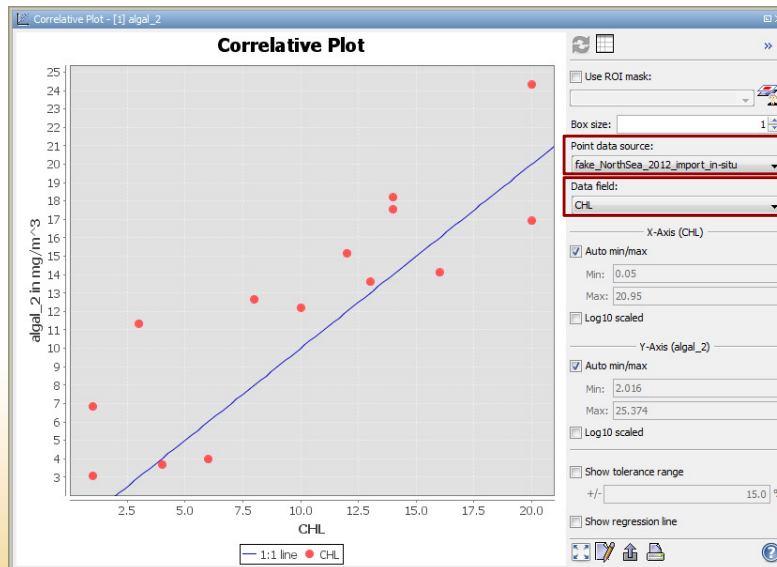
[algal_2 - Satellite coordinates] No pos. 18:17:32 18/76 of 2/31

Import Vector Data

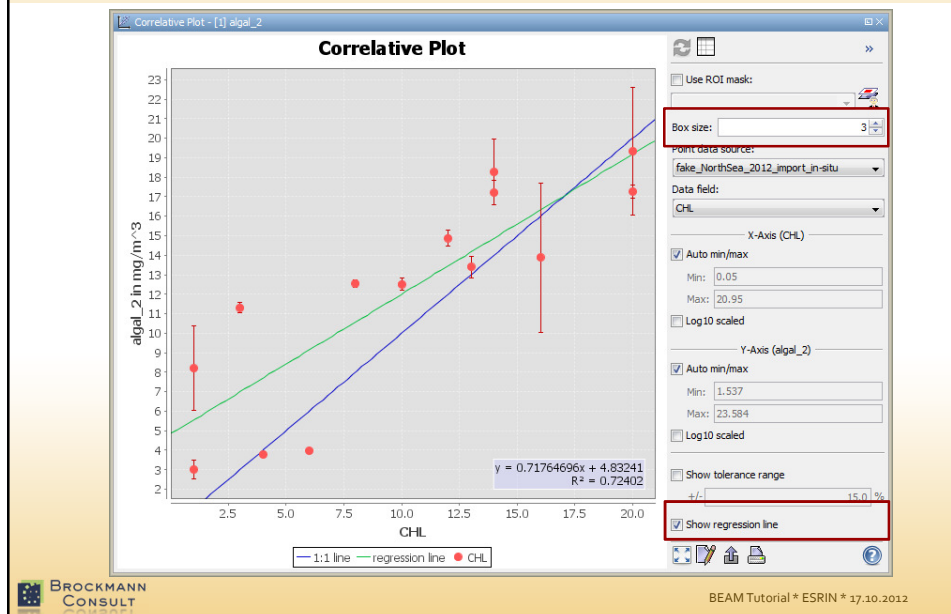




Correlative Plot



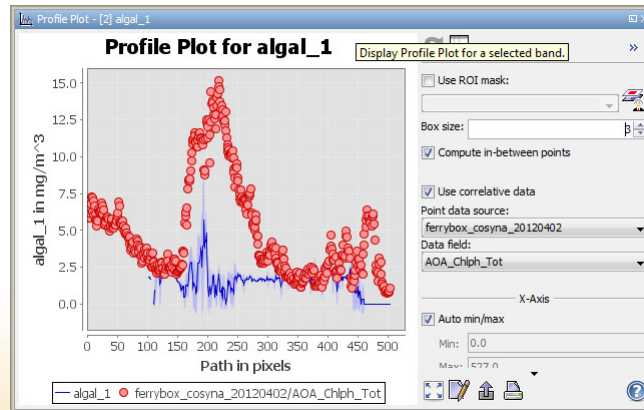
Correlative Plot



Excercise I – Correlative Plot

- Show correlative plot between algal_2 and CHL and between total_susp and TSM
- Steps:
 - Open MERIS L2 product
 - Open band and adjust/change colours
 - Import point data and edit the display of point data
 - Open correlative plot
 - Specify point data source
 - Specify parameter (data field)
 - Display regression line
 - show the variability of neighboring pixels

Profile Plot



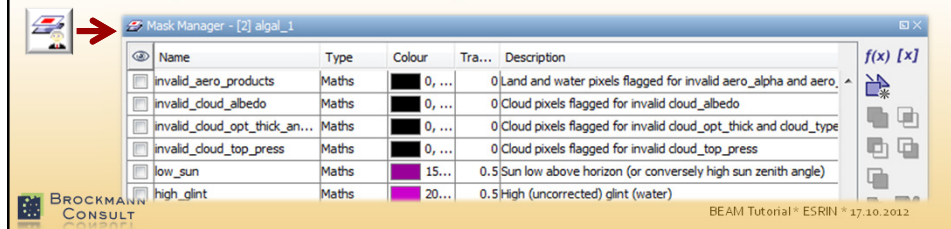
Excercise II – Profile Plot from point data

- Show chlorophyll concentration along a ferry box transect
- Steps:
 - Open MERIS L2 product
 - Open band (algal_1) and adjust/change colours
 - Import ferry-box data as track point data*
 - ... \in-situ \ferrybox_cosyna_20120402.txt
 - Open transect plot
 - Check: compute in-between points → shows EO data values
 - Check: use correlative data → shows in-situ data
 - show the variability of neighboring pixels

Data source: COSYNA web portal (HZG): <http://kofserver2.hzg.de/codm/>

A2 - Masks in BEAM VISAT


- **Flags** of ENVISAT standard products are automatically included as masks
- All geometries, pins and imported vector data are included as masks
- Own masks can be generated
 - from flags, geometries, band math expression
 - By combination of flags







Generation of new Masks

Generation of Masks

- $f(x)$ ▫ Masks defined by a band maths expression

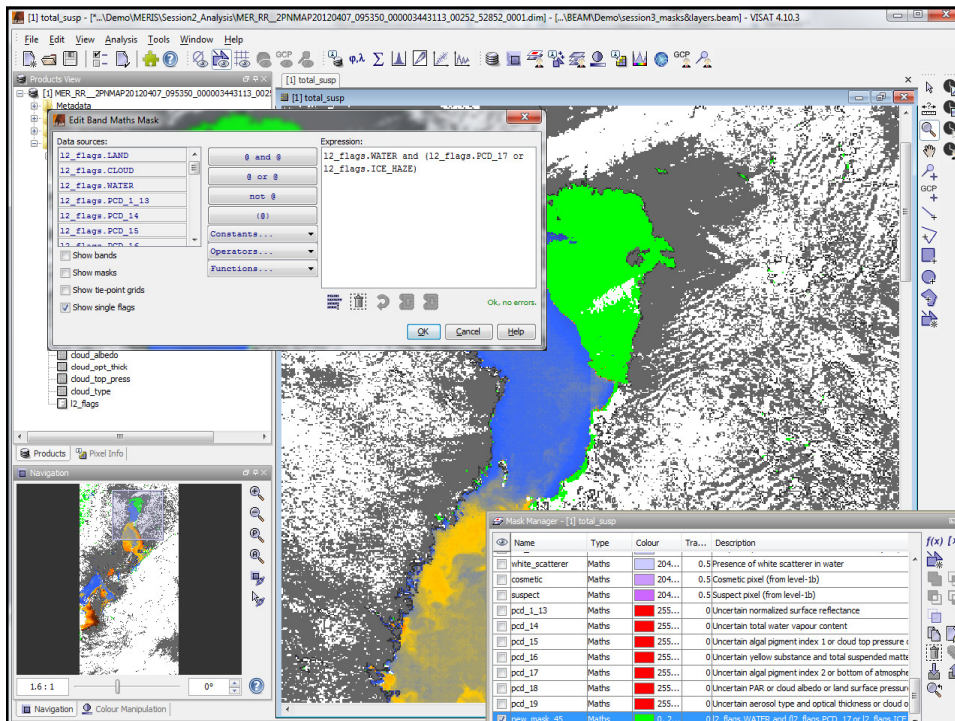
$$\frac{(\text{radiance}_{13} - \text{radiance}_{7})}{(\text{radiance}_{13} + \text{radiance}_{7})} < 0.2$$
- $[x]$ ▫ Masks defined by a value range
-  ▫ Masks defined by a geometry such as lines and polygons

Combination of Masks

-  ▫ Union
-  ▫ Intersection
-  ▫ Differences
-  ▫ Complement of a mask o

Concept Definitions

- **Geometry**
 - A geometric shape (point, line, polyline or polygon).
 - Geometries can be drawn on a product view or imported from external files.
- **Mask**
 - Masks a regions of raster dataset.
 - Masks can be derived from an expression, a value range, a geometry or from combinations of different masks.
- **ROI**
 - Statistical computation and Analysis Tools can be performed on ROIs.
 - Masks are always and automatically applicable ROIs (→ ROIs are a role of Masks).
- **Layer**
 - Views in BEAM are composed of multiple, configurable layers
 - A layer is used to visualise a certain data source
 - Vector data, raster data and masks and represented by special layer types



The screenshot displays the BEAM software interface with the 'Edit Band Maths Mask' dialog box open. The dialog shows data sources on the left and an expression field containing: `12_flags.WATER and (12_flags.PCD_17 or 12_flags.ICE_BAZE)`. Below the dialog, the 'Mask Manager' table is visible, listing various masks and their descriptions.

Name	Type	Colour	Tra...	Description
white_scatterer	Maths	204...	0.5	Presence of white scatterer in water
cosmetic	Maths	204...	0.5	Cosmetic pixel (from level-1b)
suspect	Maths	204...	0.5	Suspect pixel (from level-1b)
pcd_13	Maths	255...	0	Uncertain normalized surface reflectance
pcd_14	Maths	255...	0	Uncertain total water vapour content
pcd_15	Maths	255...	0	Uncertain algal pigment index 1 or cloud top pressure
pcd_16	Maths	255...	0	Uncertain yellow substance and total suspended matter
pcd_17	Maths	255...	0	Uncertain algal pigment index 2 or bottom of atmosphere
pcd_18	Maths	255...	0	Uncertain PAR or cloud albedo or land surface pressure
pcd_19	Maths	255...	0	Uncertain aerosol type and optical thickness or cloud
new_mask_45	Maths	0, 2...	0	12_flags.WATER and (12_flags.PCD_17 or 12_flags.ICE...

Exercise III: Create new Masks

- Create a new mask that covers the invalid pixels and the ice covered pixels in the Bothnian Bay
- Steps:
 - Zoom to the Bothnian Bay and test the flagging of the `algal_2` product
 - Ice areas are not covered fully by the PCD flag
 - Create a new mask that includes the PCD as well as the `ice_haze` flag



→ • A) Using the tools for combinations

- select both flags: `invalid_algal2_tsm_ys` and `ice_haze`
- Choose the tool: *union of selected flags*

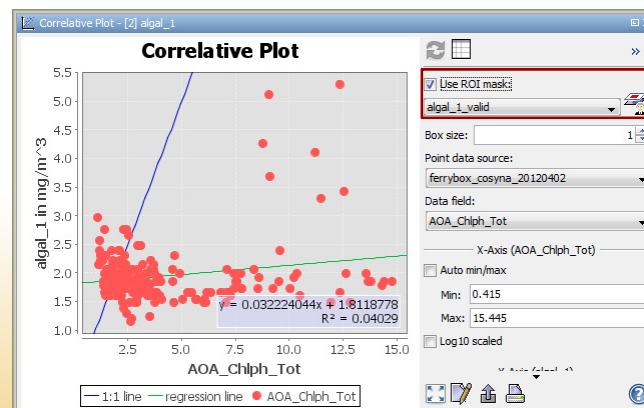
$f(x)$

→ • B) Using math expression

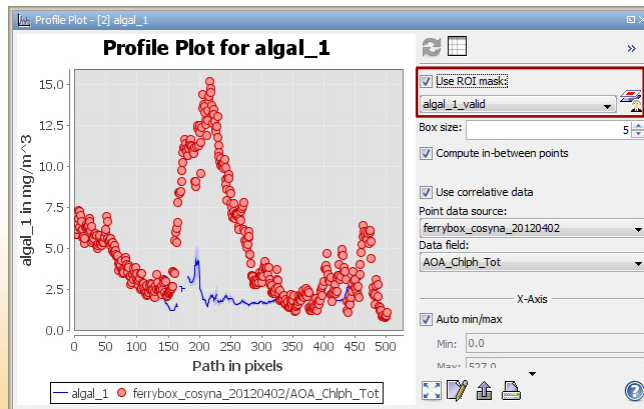
- `invalid_algal2_tsm_ys` or `ice_haze`

Usage Masks as ROIs

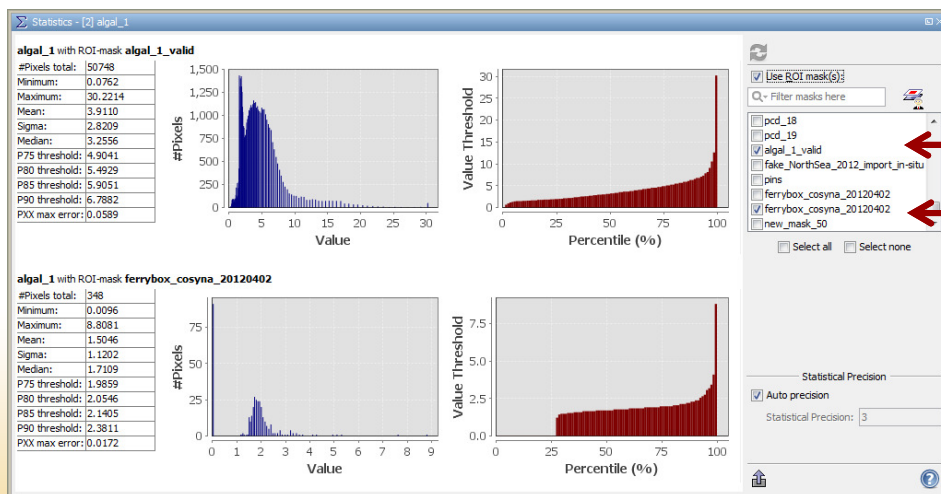
- Masks can be used as Region of Interest (ROIs) in all analysis tools



ROIs in Profile Plot

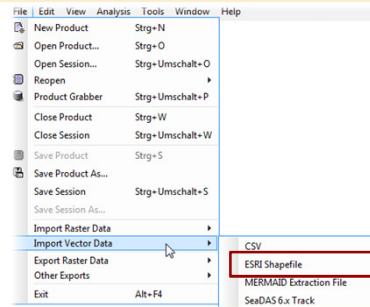


ROIs in Statistic Tool

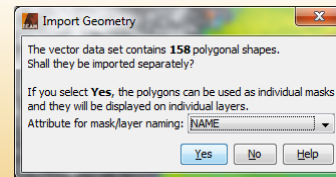


Statistics using Polygons as ROIs

- Importing Shapefiles



- Decision if polygons in the shapefile are imported as individual masks or as one one mask
 - Specify the attribute for separation

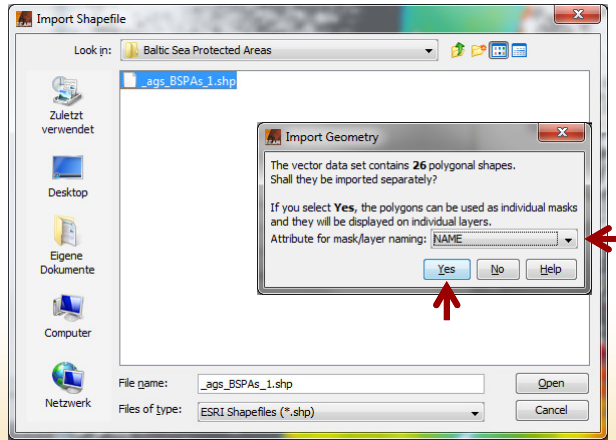


Exercise IV: Statistics for polygons from Shapefile

- Show the distribution of Chlorophyll values for Marine Protected Areas in the Baltic Sea*
- Steps:
 - Open MERIS L2 product
 - Open band algal_2 and move to the Baltic Sea
 - Import shapefile as single
 - ...\\in-situ\Baltic Sea Protected Areas_ags_BSPAs_1.shp
 - Open statistic tool
 - Check the Protected Areas you want to display the statistics for (note: algal_2 band needs to be selected in the band list)

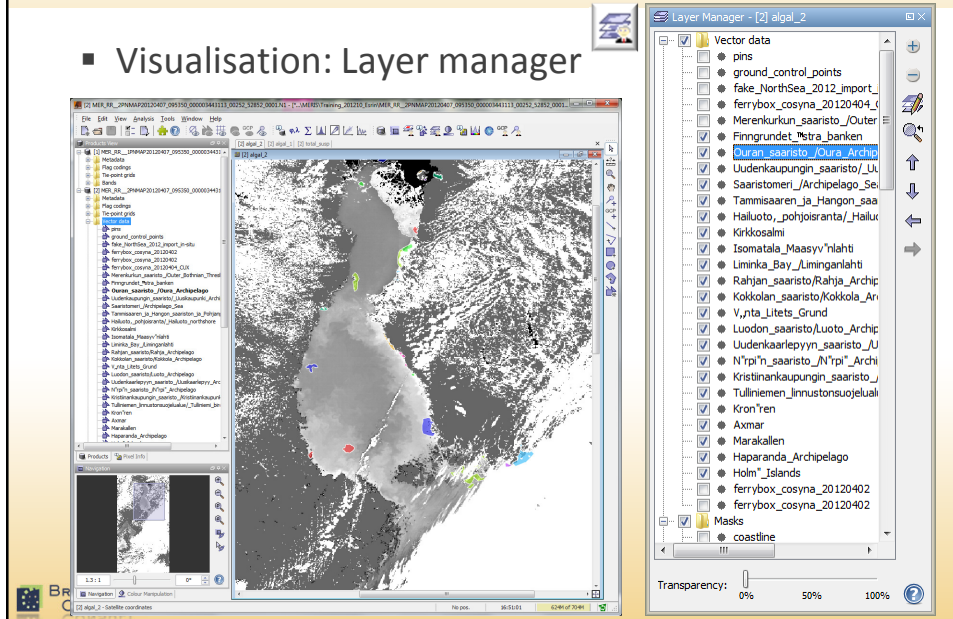
*The shapefile of Protected Areas has been downloaded from the HELCOM Maps and Data Service:
<http://maps.helcom.fi/website/mapservice/index.html>

Importing Shapefile



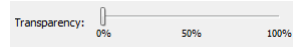
Handeling Protected Areas via Layer Manager

Visualisation: Layer manager

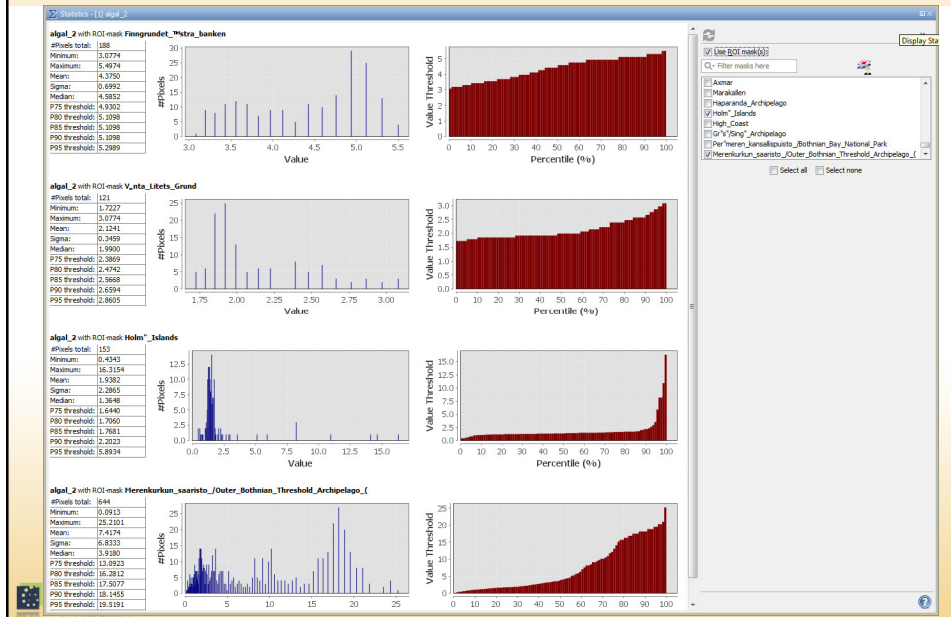


Layer Concept in BEAM VISAT


- Handling visualisation
 - Order of layers
 - Transparency of overlays
- Add and remove layers
 - Overlay two bands
 - Overlay polygon files (visualisation only)

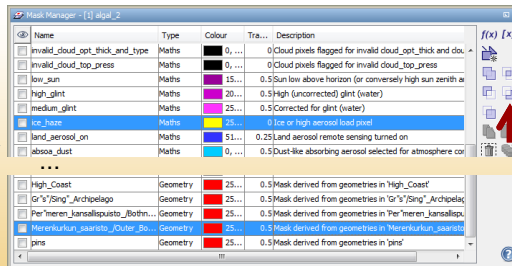


Derive Statistics for individual Protected Areas



Exercise IV (optional): Erase invalid pixels from statistics

- Show statistics for only valid pixels within the protected area „Merenkurkun_...“
- Steps
 - Open Mask Manager 
 - Select masks for „Merenkurkun_“ AND „ice_haze“
 - Select option: difference of selected mask (bottom-up order)
 - Rename the new mask
 - Apply statistics for
 - „Merenkurkun_“
 - „Valid_Merenkurkun_“



Statistics - [1] algal_2

algal_2 with ROI-mask Merenkurkun_saaristo_Outer_Bothnian_Threshold_Archipelago_...

#Pixels total:	644
Minimum:	0.0913
Maximum:	25.2101
Mean:	7.4174
Sigma:	6.8333
Median:	3.9180
P75 threshold:	13.0923
P80 threshold:	15.2812
P85 threshold:	17.5077
P90 threshold:	18.1455
P95 threshold:	19.5191

algal_2 with ROI-mask new_mask_74

#Pixels total:	370
Minimum:	0.2915
Maximum:	25.2101
Mean:	4.1601
Sigma:	4.0341
Median:	2.5302
P75 threshold:	5.1097
P80 threshold:	6.5698
P85 threshold:	8.7959
P90 threshold:	9.7820
P95 threshold:	10.9014

Use ROI mask(s)

Filter masks here

- Haparanda_Archipelago
- Holm_Islands
- High_Coast
- Gr'o/Sing'_Archipelago
- Per'Meren_kansallispusto_Bothn..._Bay_National_Park
- Merenkurkun_saaristo_Outer_Bothnian_Threshold_Archipelago_...
- pins
- valid Merenkurkun

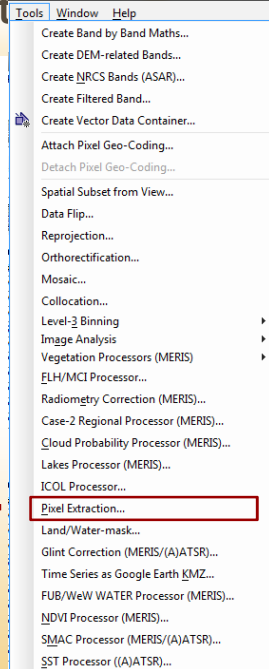
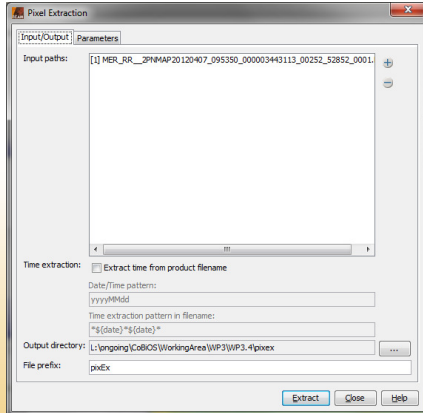
Select all Select none

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A3 - Extraction of Pixel information

- For extraction of
 - Match ups
 - Time series



Name	Latitude	Longitude	DateTime (UTC)
Station_1	54.0632	8.4331	
Station_2	54.2703	8.2485	
Station_3	54.4937	8.1007	
Station_4	54.6679	7.9993	
Station_5	54.9460	8.0172	
Station_6	55.2841	8.0734	



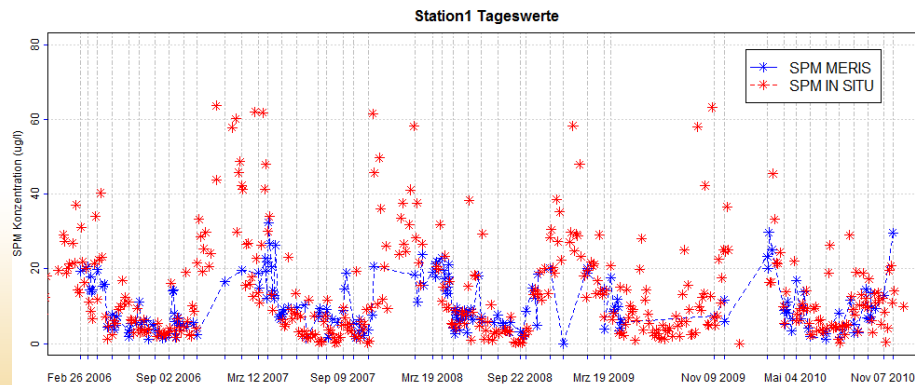
Pixel Extraction - Output

- Table of extracted pixels, all bands
- List of input products (product ID)

```
# Product ID Map
ProductID ProductType ProductLocation
0 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110410_100226_000000763101_47637
1 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110418_100912_000000763101_47752
2 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110419_093237_000000873101_47766
3 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110423_102559_000000613101_47824
4 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110424_094915_000000873101_47838
5 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110427_093920_000000903102_47881
6 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110430_092927_000000873102_47924
7 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110508_093613_000000873102_48039
8 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110510_100253_000000783102_48068
9 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110530_092957_000000873103_48355
10 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110603_102318_000000643103_484
11 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110604_094634_000000903103_484
12 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110626_094016_000000903104_487
13 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110628_100703_000000733104_487
14 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110629_093024_000000873104_487
15 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110630_103345_000000563104_488
16 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110709_100352_000000763104_489
17 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110916_093337_000001543106_499
18 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20110929_095811_000001153107_501
19 MER_FSG_1N_FLH_MCI U:\OutputPool\MERIS\FRS\WAQS-WeW\sweden\LakeBolmen\MER_FRS_WeW_20111023_101719_000002843108_504
```

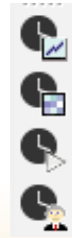
Time Series EO – in-situ

- Extraction of data with Pixel Extraction Tool
- Time series generation using R scripts



Time Series Tool

- BEAM VISAT module
 - Will be available with BEAM 4.10
 - Release planned for April/May 2012
- Implemented in Aquamar WP 5.2
- Mode of operation
 - Insert input data (time series satellite data)
 - Insert coordinates and values of in-situ data
 - Select parameter to be investigated
 - Plot time series plot including satellite and in-situ data
 - Display movie of satellite time series
 - Generate time series from regions of interest (e.g. water bodies) and provide statistics (not yet implemented)



BEAM Tutorial * ESRIN * 17.10.2012

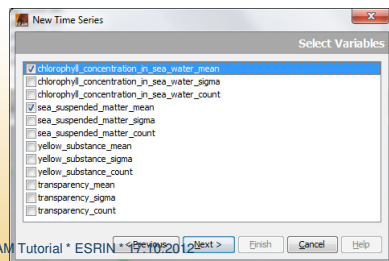
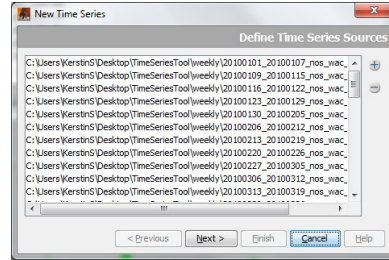
Time Series Tools

The screenshot displays the BEAM VISAT software interface. On the left, there is a 'Variables' panel with a tree view of data sources, including 'weekly_MC_2010' and 'chlorophyll_concentration_in_ssa_water_mean'. Below this is a 'Time Series Graph' showing a plot of 'chlorophyll_concentration_in_ssa_water_mean' over time from February 2010 to November 2010. The plot shows a significant peak in May 2010. On the right, a satellite map shows a coastal region with a color-coded overlay representing chlorophyll concentration. A table of coordinates and labels is overlaid on the map, listing locations like NS02, UR01, SY01, BIW04, NS01, AN R07, NE01, NO01, and US04 HE00. The bottom of the interface shows a 'Valid expression' field with the formula: $[\text{chlorophyll_2010}] > [\text{chl_concentration_in_ssa_water_mean}] > 0.01$.

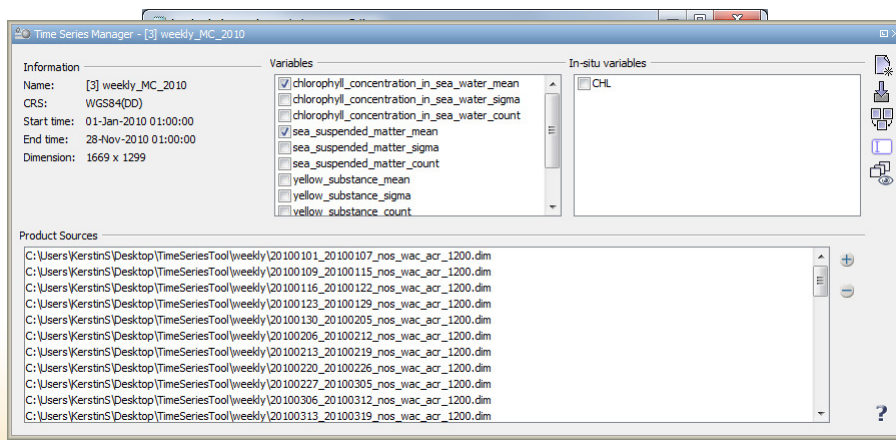
Define the time series

- Select input products
 - geolocation
 - Time stamp or timecode in the name

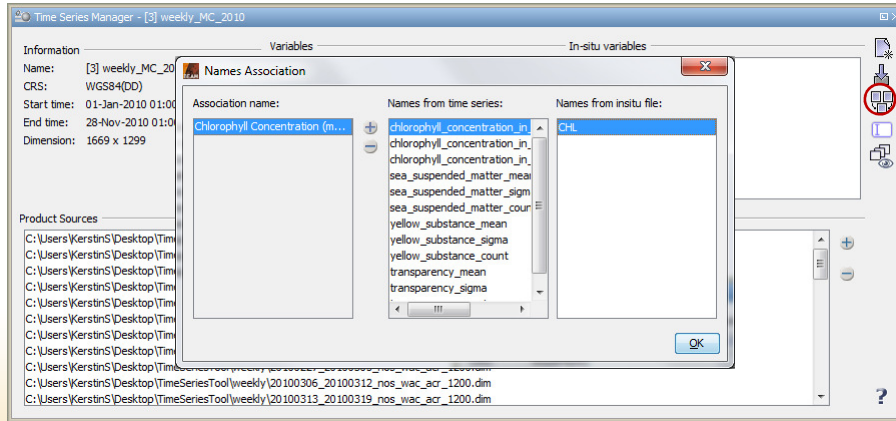
- Select parameter
 - Bands that are common in all products
 - Can be changed later



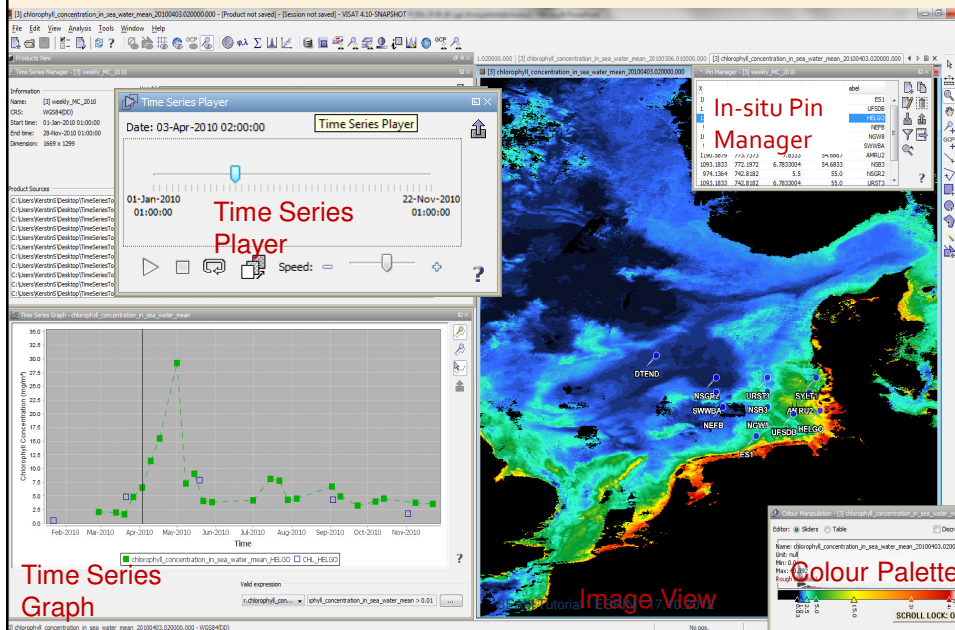
Time Series Manager



Time Series Manager

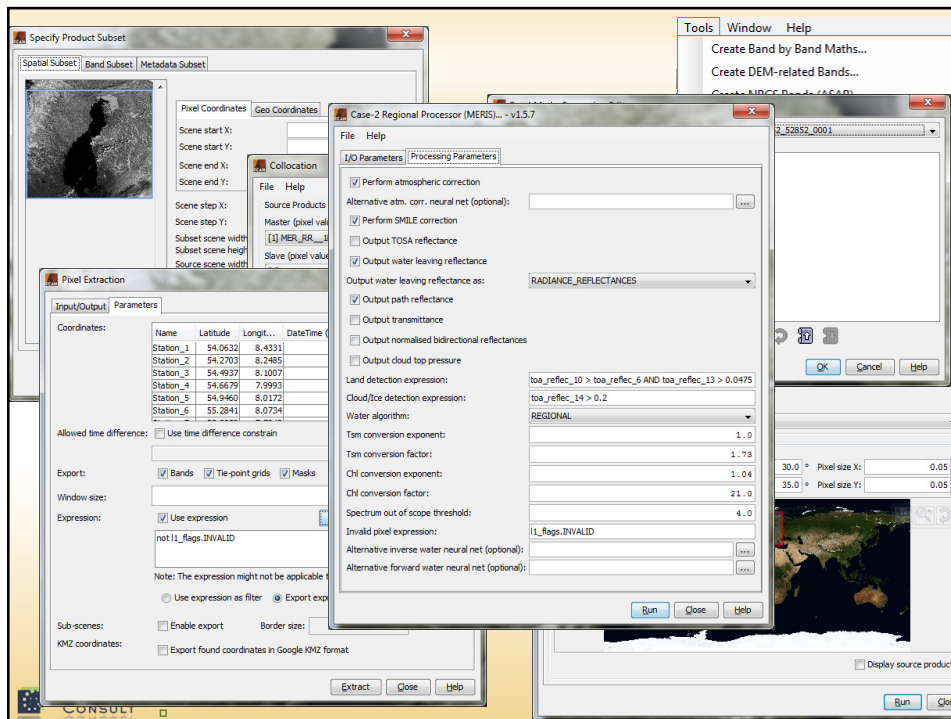
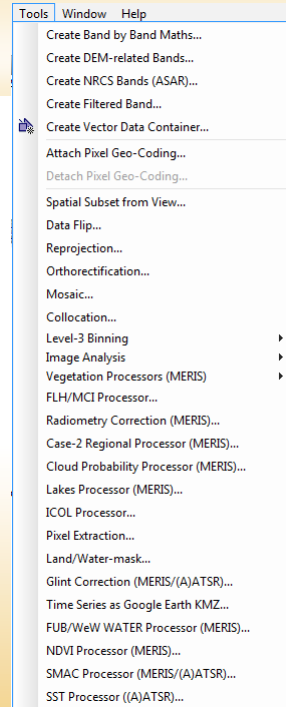


Time Series Tools



A4 - Processors

- Generic Processors
 - Cluster Analyses
 - Reprojection / Orthorectification
 - Mosaic
 - Collocation
 - Level-3 Binning
 - Pixel Extraction
 - ...
- Dedicated Processors
 - Radiometric Correction
 - Case-2 Regional Processor
 - ICOL Processor
 - FUB/WeW Water Processor
 - MERIS Case-2 Waters Processors
 - QAA for IOPs
 - FLH/MCI Processor
 - ...

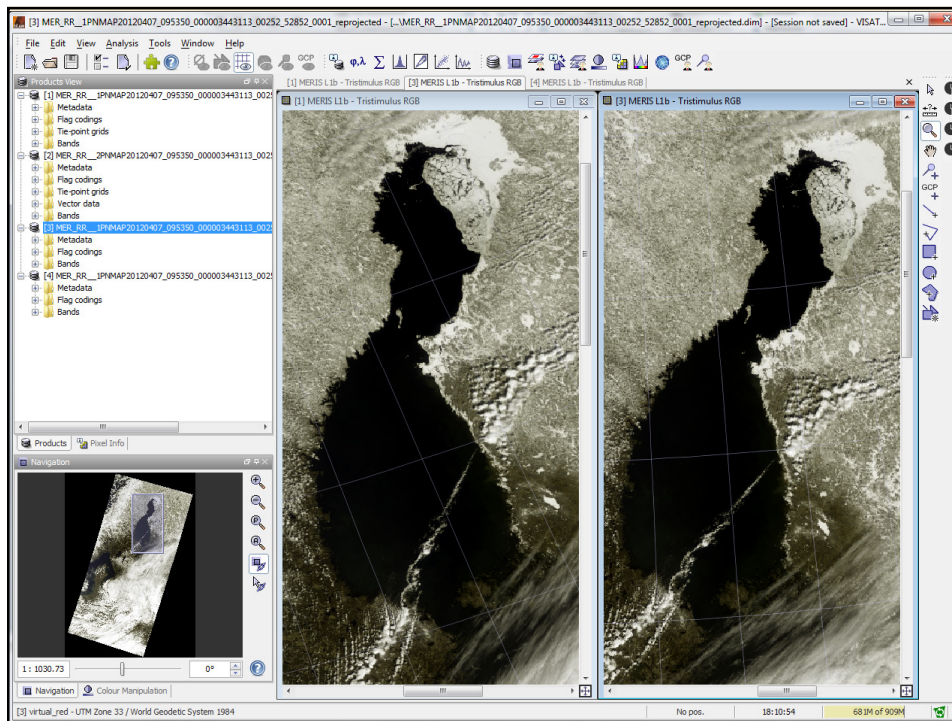


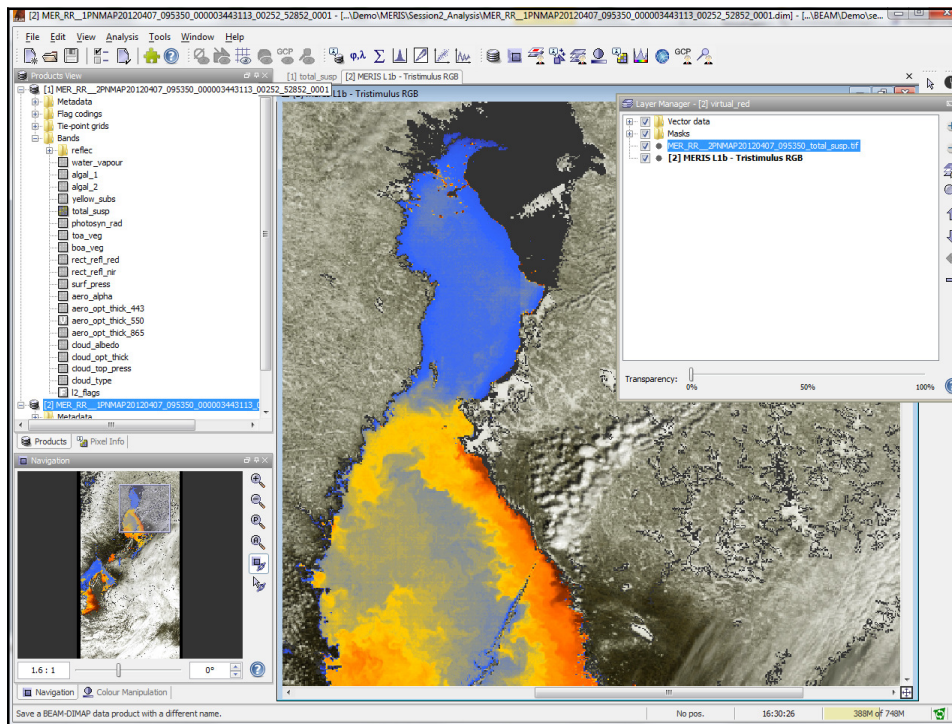
Spatial processing of raster data sets

- Geo-processing
 - Subsetting
 - Reprojection
 - Collocation of products

- L3 binning
 - Temporal and spatial aggregation
 - Statistics per bin cell
 - Definition of output boundary and bin cell size

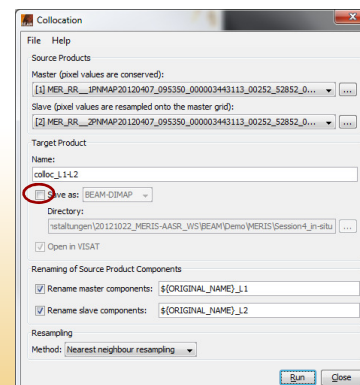
- Mosaiking






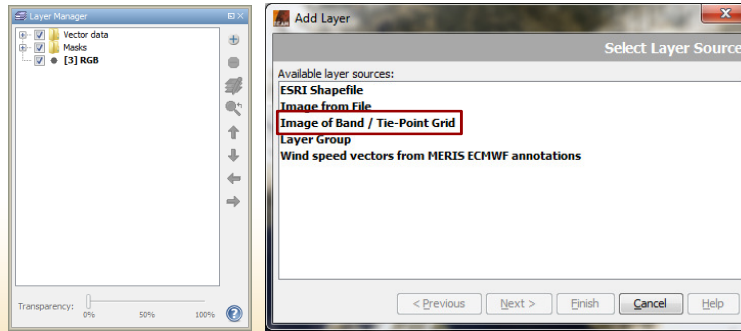
Exersice V: Overlay different bands

- Overlay an RGB (L1) with a coloured TSM band (L2)
- Steps:
 - Collocate the MERIS Level 1 and the Level 2 products
 - Tools → Collocation...
 - Specify both input products
 - Define scheme for renaming of bands
 - DON'T Save output product
 - Open RGB from L1 spectral bands
 - Open total_susp band
 - Import colour palette or define own colours

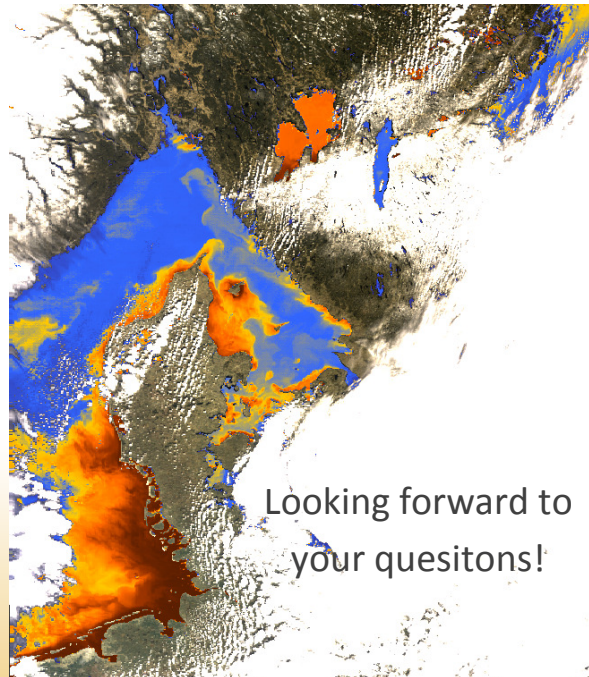


Exersice V (cont.)

- Open Layer Manager
 - Add layer by clicking 
 - Chools *Image of Band / tie-Point Grid*



- Select band total_susp
- Change transparency of total_susp band (Layer manager)



Looking forward to
your quesitons!