BEAM/VISAT Tutorial

Brockmann Consult GmbH

Esrin, 17.10.2012

Brockmann Consult

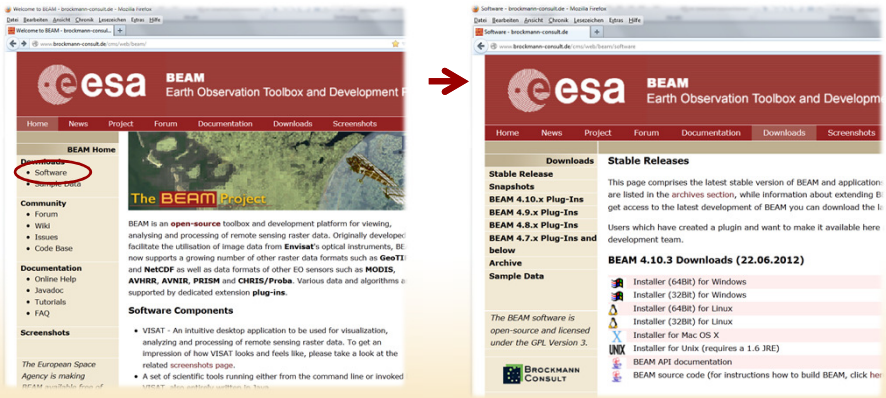
BEAM VISAT

- 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

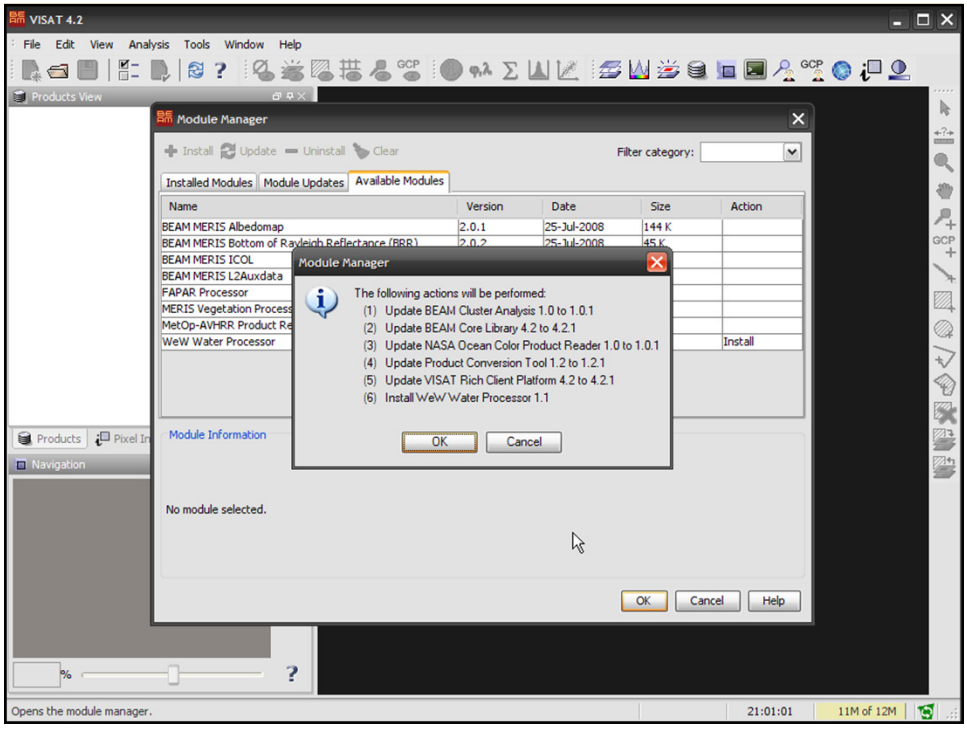
- BEAM 4.10.3
  - Update with Module Manager
- MERIS Data
  - L1:
    ..\MERIS\MER_RR__1PNMAP20120407_095350_000003443113_00252_52852_0001.N1
  - L2:
    ..\MERIS\MER_RR__2PNMAP20120407_095350_000003443113_00252_52852_0001.N1
- In-situ Data
  - ..\in-situ\fake_NorthSea_2012_import_in-situ.txt
  - ..\in-situ\ferrybox_cosyna_20120402.txt
  - ..\in-situ\Baltic Sea Protected Areas\BSPA_Bothnia.shp
- Colour palettes
  - ..\palettes\CHL_colours.cpd

Installation Files

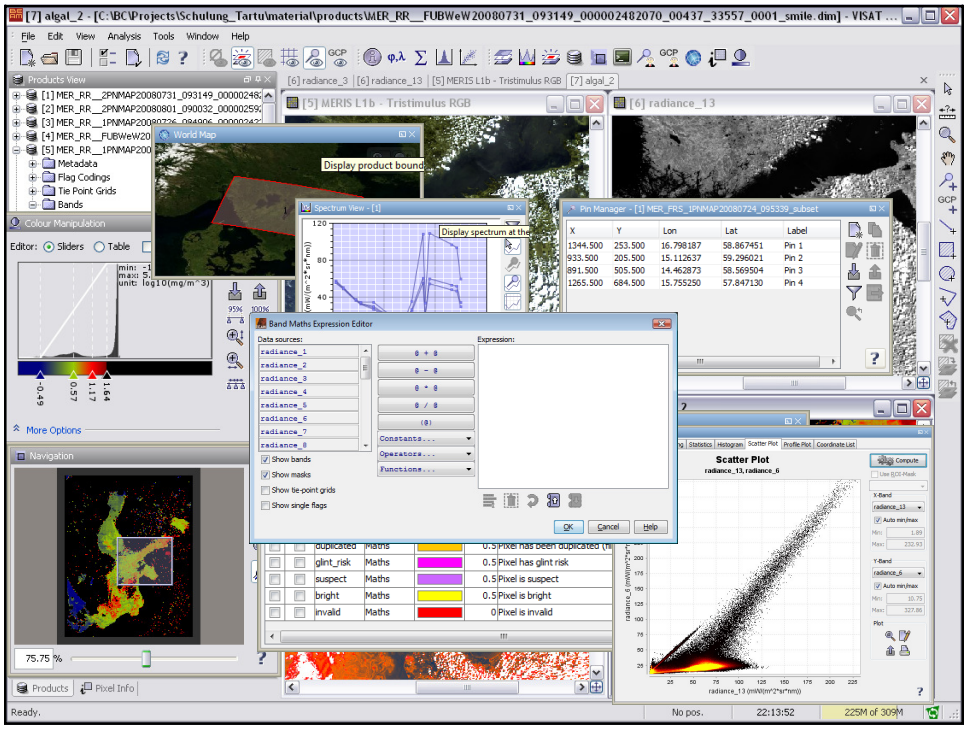


Module Manager

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



BEAM Community



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,

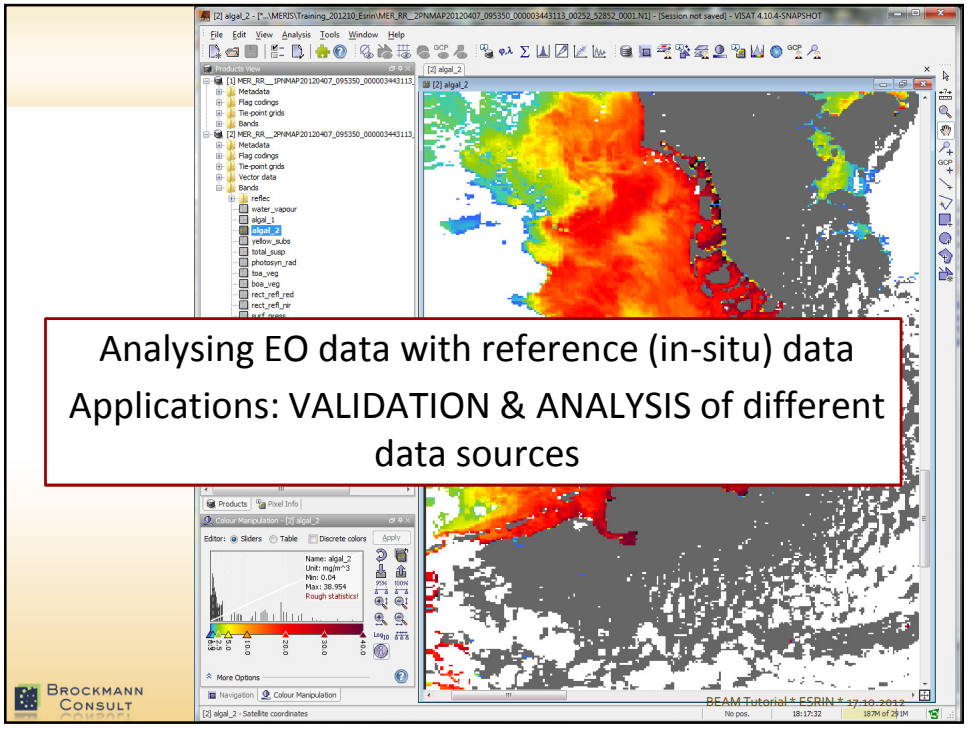
```
# MULTIPOLYGONs
#
# Product:      subset_1_MER_RR__1PQBCM20030809_101416_000002002018_00466_07534_0168
# Created on:   Thu Apr 12 14:48:36 CEST 2012

# 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

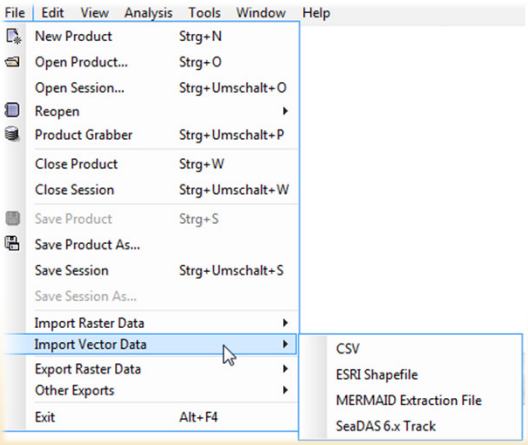
- Shapefile
  - ESRI shapefile
  - Points, lines, polygons
  - Import of elements as a whole or separately
- MERMAID Extraction file

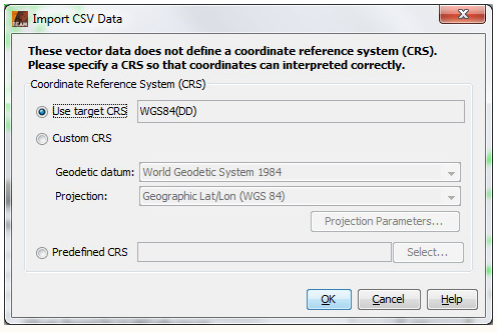
```
PROCESSING_VERSION;site;PI;lat_IS;lon_IS;TIME_IS;thetas_IS;PQC;MQC;chl_IS;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030907T130033Z;42.237999;P00000100;M11011010101111010;1.12E-01;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030908T100033Z;41.848999;P00000100;M11011010101111010;1.10E-01;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030910T101533Z;41.109001;P00000100;M11011010101111010;1.05E-01;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030911T110034Z;38.824001;P00000100;M11011010101111010;1.03E-01;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030914T100033Z;43.737999;P00000100;M11011010101111010;9.60E-02;
MEGS_8.0;BOUSSOLE;DavidAntoine;43.367;7.9;20030916T101535Z;43.101002;P00000100;M11011010101111010;9.10E-02;
```

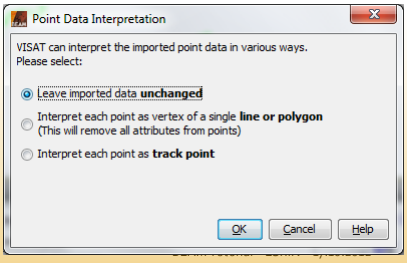
- SeaDAS 6.x Track
  - Points

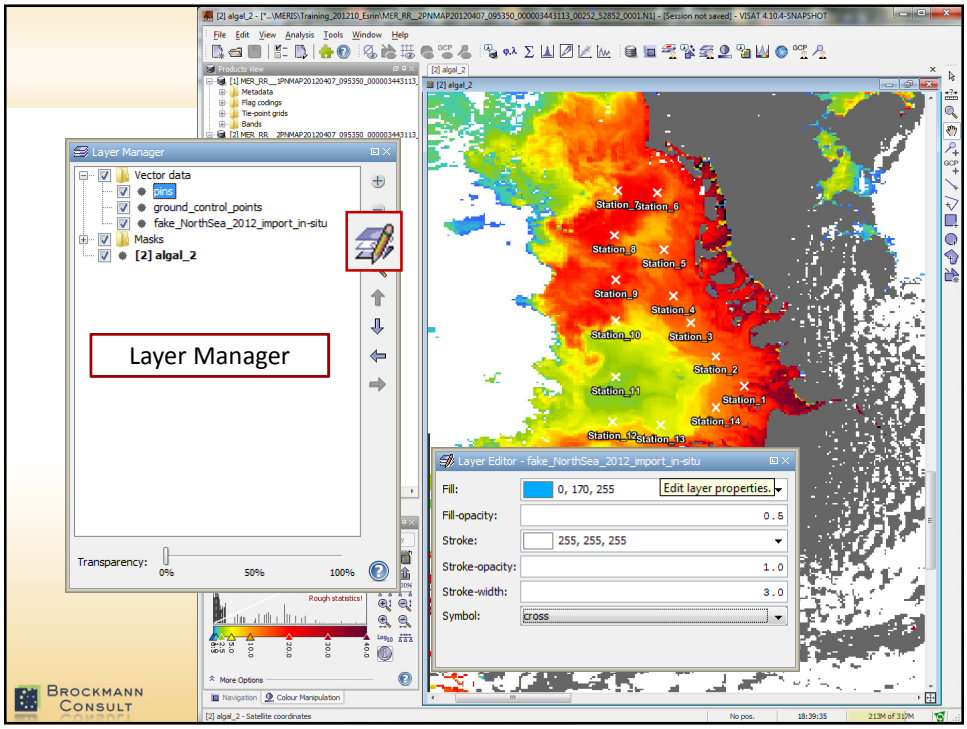


Import Vector Data

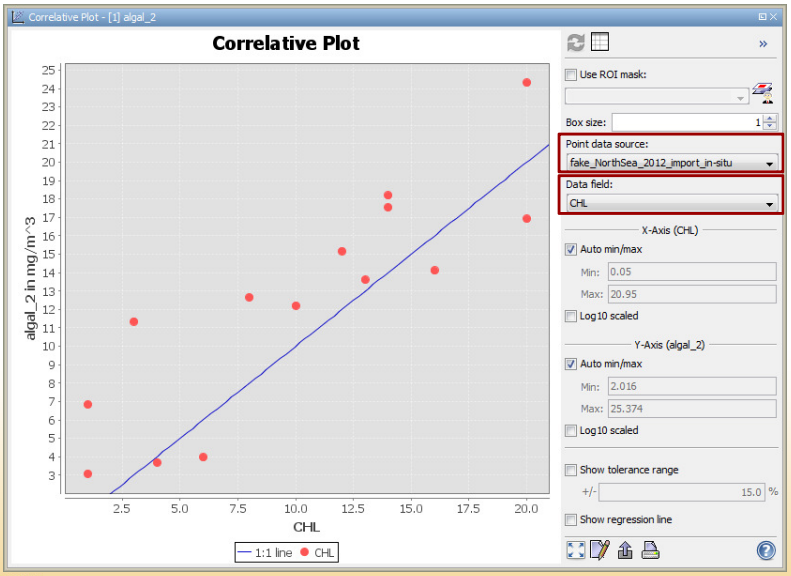




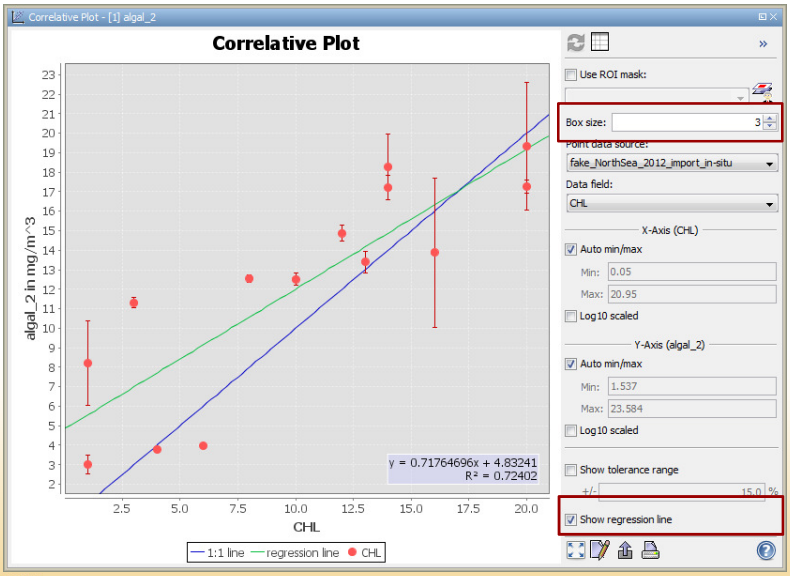




Correlative Plot



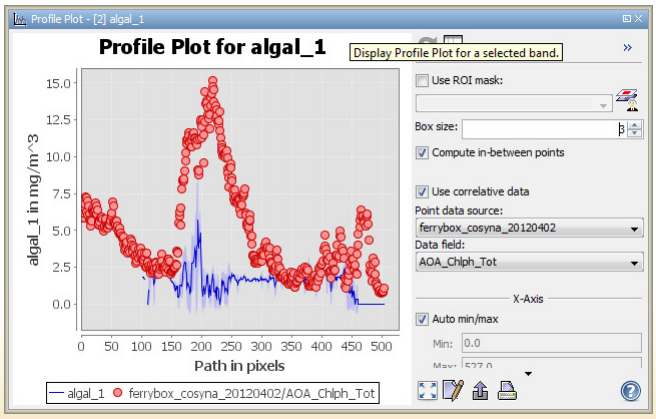
Correlative Plot



Excersise 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 variablility of neighboring pixels

Profile Plot



Excersise II – Profile Plot from point data

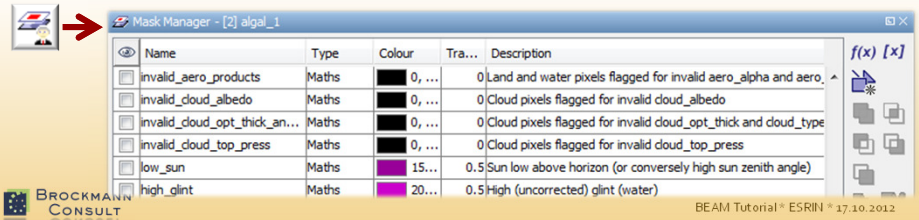
- Show chlorophyll concentration along a ferry box transect
- Steps:
  - Open MERIS L2 product
  - Open band (algal_1) and adjust/change colours
  - Import ferry-box data as track point data*

    ...\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 variablility 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

(radiance_13 – radiance_7) /
(radiance_13 + radiance_7) < 0.2

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

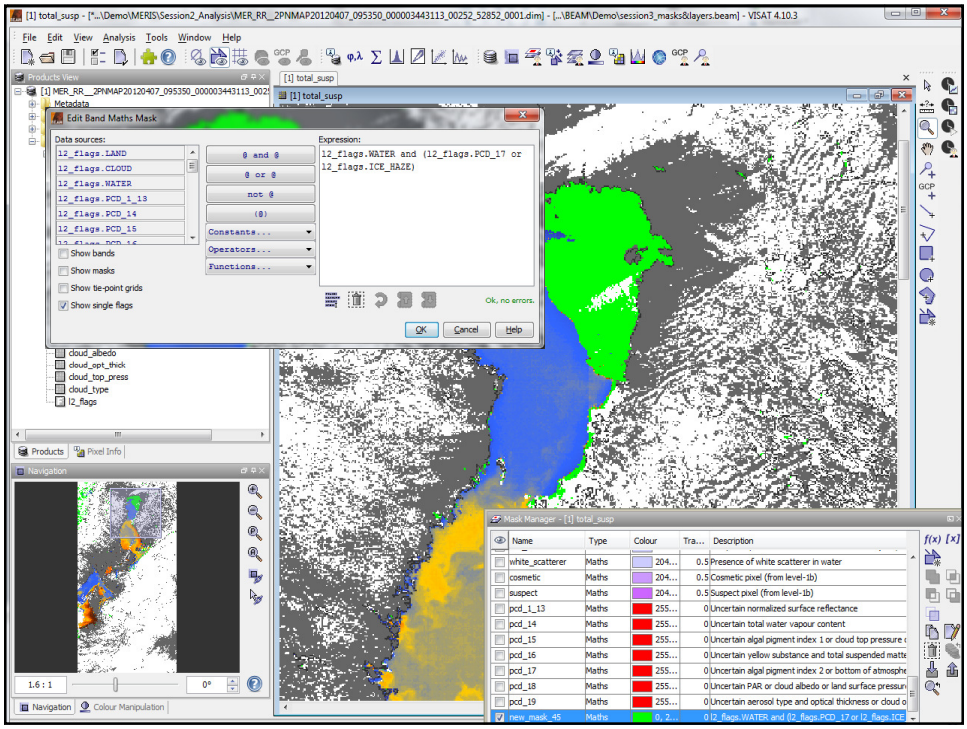
[x]
  - Masks defined by a value range

  - 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

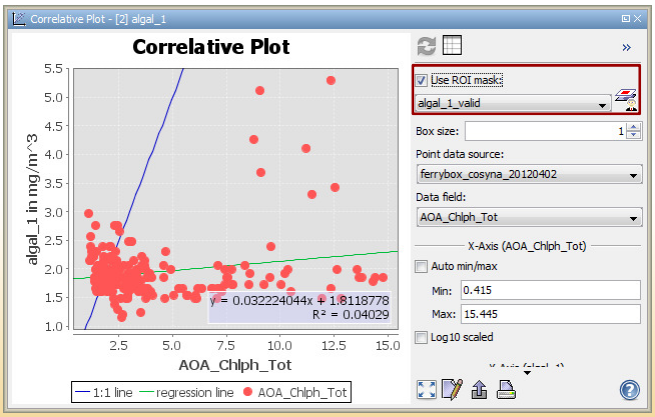


Exercise III: Create new Masks

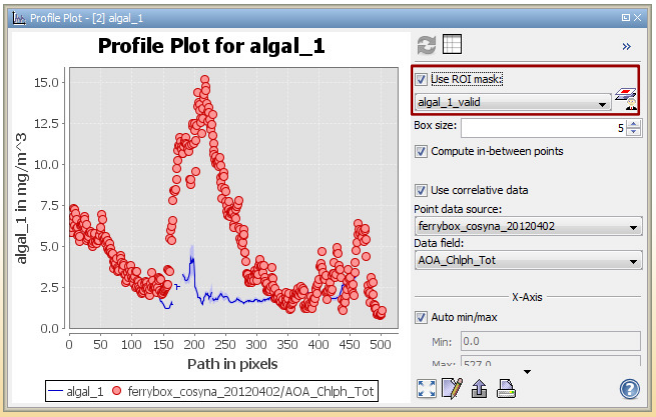
- Create a new mask that covers the invalid pixels and the ice covered pixels in the Bothnian Bay
- Steps:
  - Zoom to the Bothnian Bay and test the flagging of the algal_2 product
    - Ice areas are not covered fully by the PCD flag
  - Create a new mask that includes the PCD as well as the ice_haze flag
- A) Using the tools for combinations
  - select both flags: *invalid_algal2_tsm_ys* and *ice_haze*
  - Choose the tool: *union of selected flags*
- B) Using math expression
  - *invalid_algal2_tsm_ys or ice_haze*

Usage Masks as ROIs

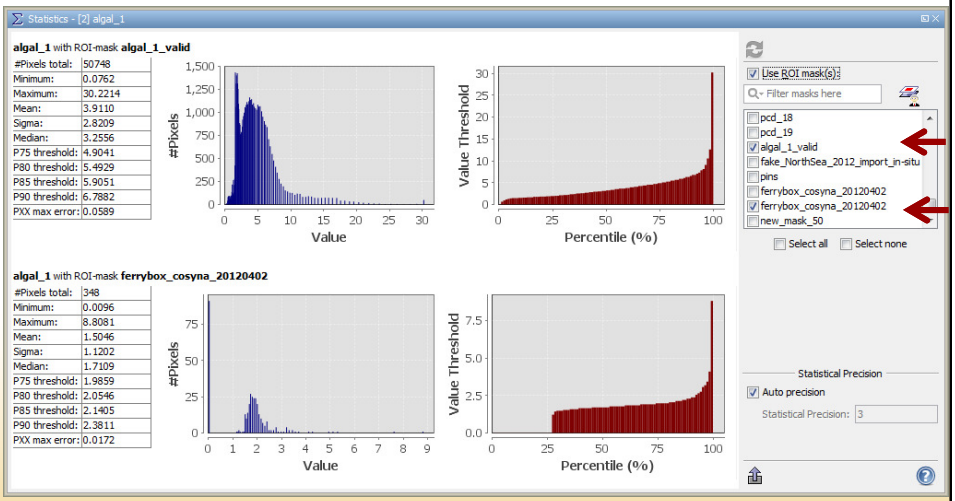
- Masks can be used as Region of Interest (ROIs) in all analysis tools



ROIs in Profile Plot

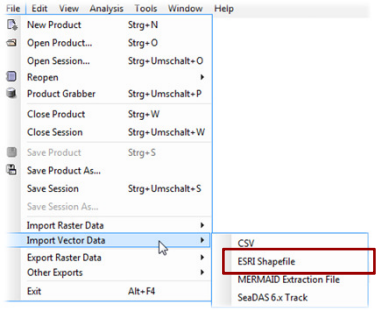


ROIs in Statistic Tool

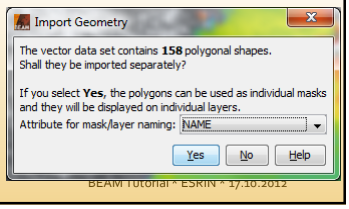


Statistics using Polygons as ROIs

- Importing Shapefiles



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

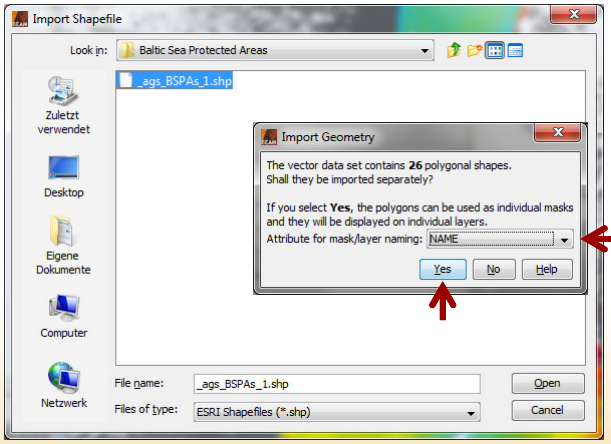


Exercise IV: Statistics for polygons from Shapefile

- Show the distribution if 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)

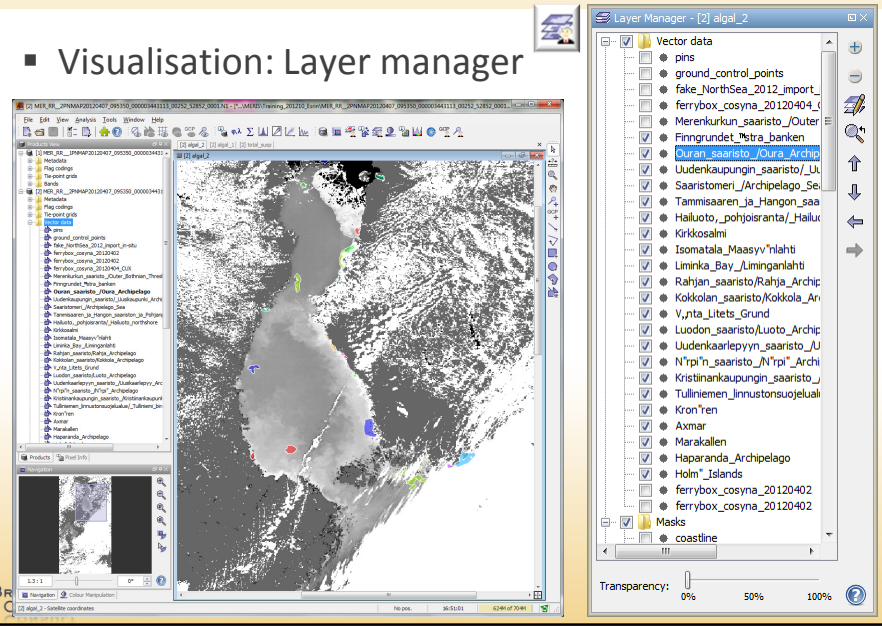
*The shapefile of Protected Areas has been downloaded from the HELCOM Maps and Data Service: http://maps.helcom.fi/website/mapservice/index.html

Importing Shapefile



Handeling Protected Areas via Layer Manager

- Visualisation: Layer manager

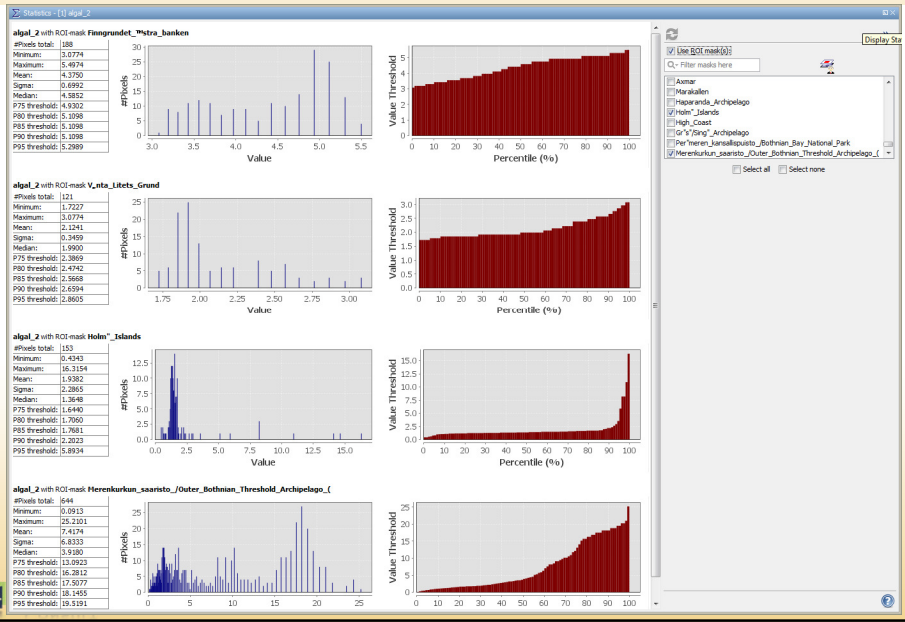


Layer Concept in BEAM VISAT

- Handling visualisation
  - Order of layers 
  - Transparency of overlays 

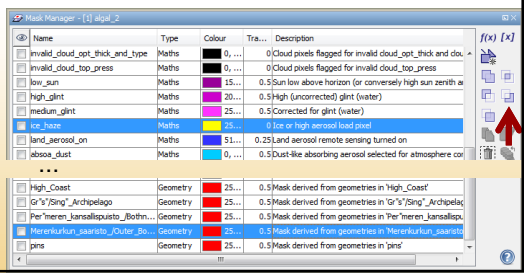
- Add and remove layers 
  - Overlay two bands
  - Overlay polygon files (visualisation only)

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 statistsics for
    - „Merenkurkun_“
    - „Valid_Merenkurkun_“



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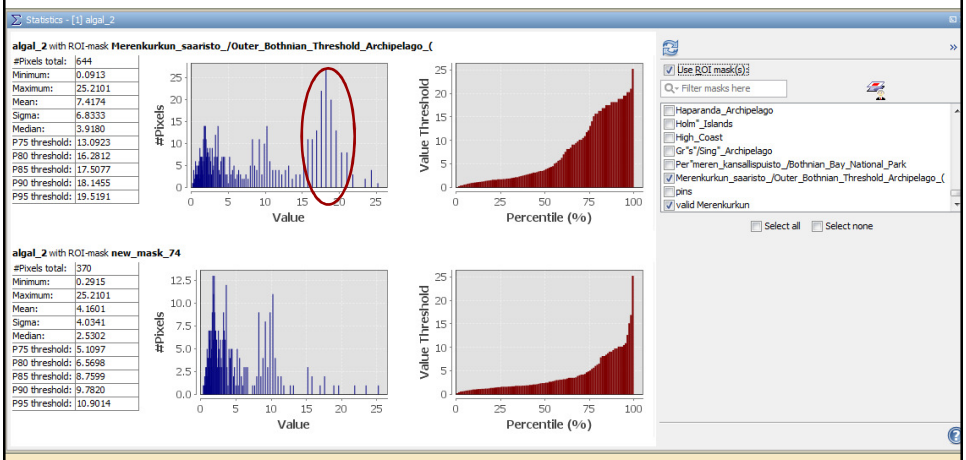

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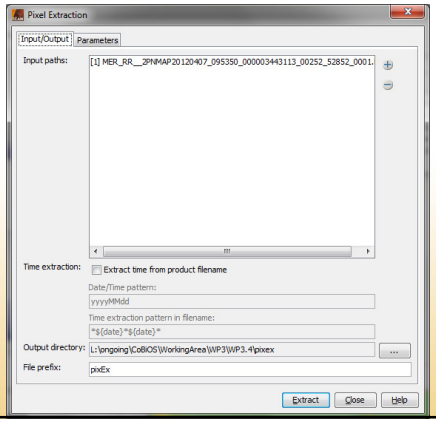
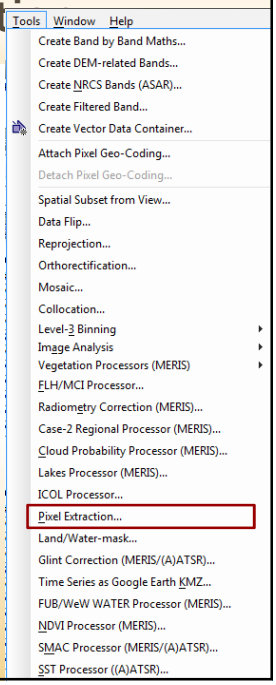
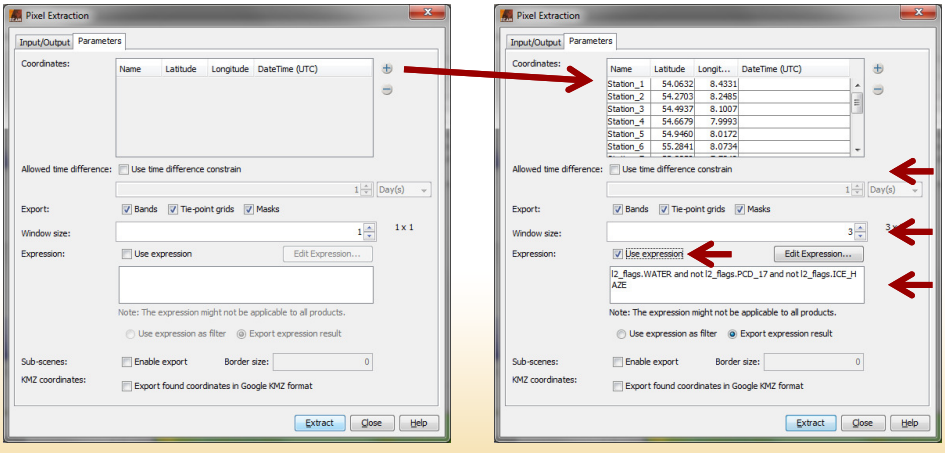
A3 - Extraction of Pixel informati

- For extraction of
  - Match ups
  - Time series







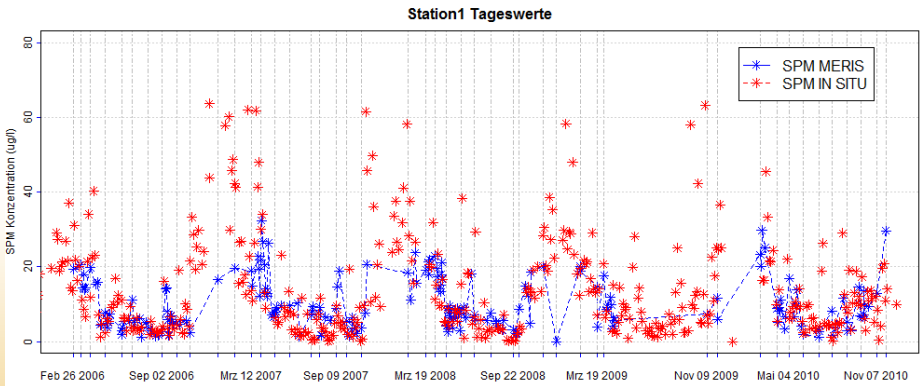
Pixel Extraction - Output

- 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
```

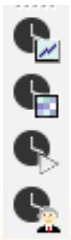

Time Series EO – in-situ

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

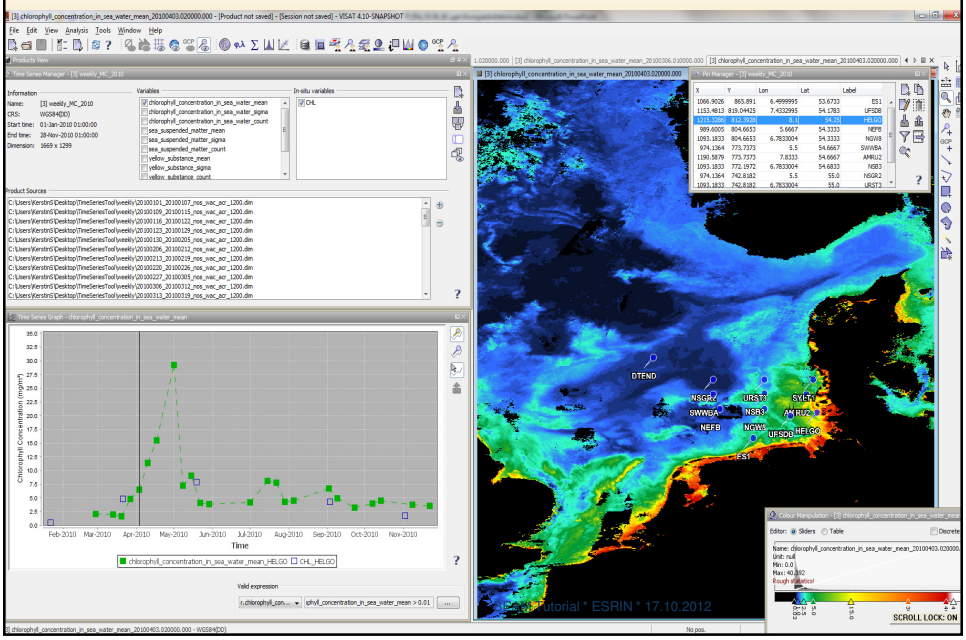


Time Series Tool

- 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)

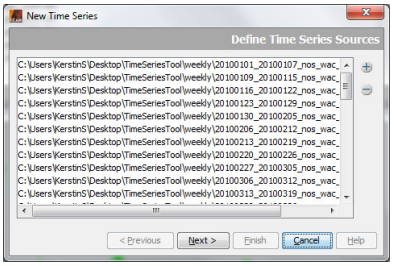


Time Series Tools

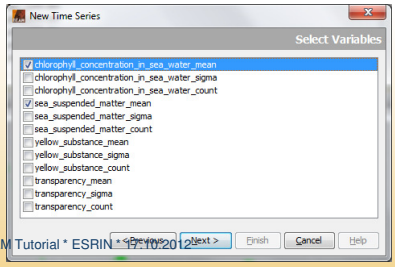


Define the time series

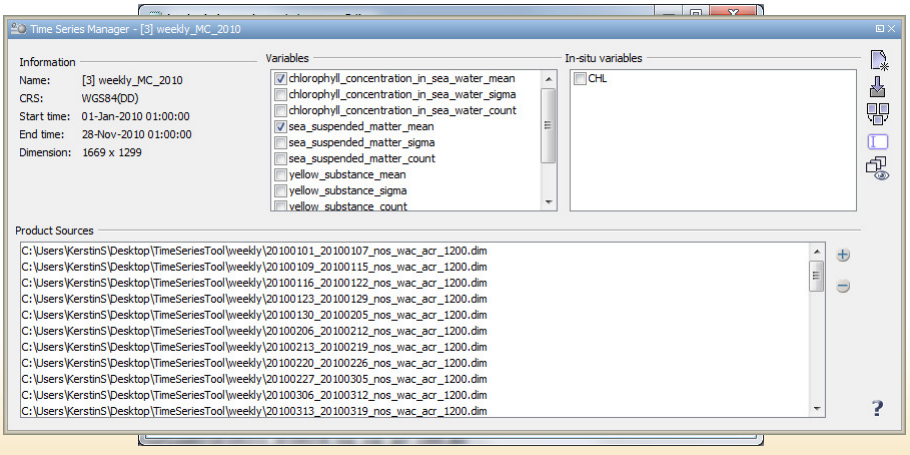
- Select input products
  - geolocation
  - Time stamp or timecode in the name



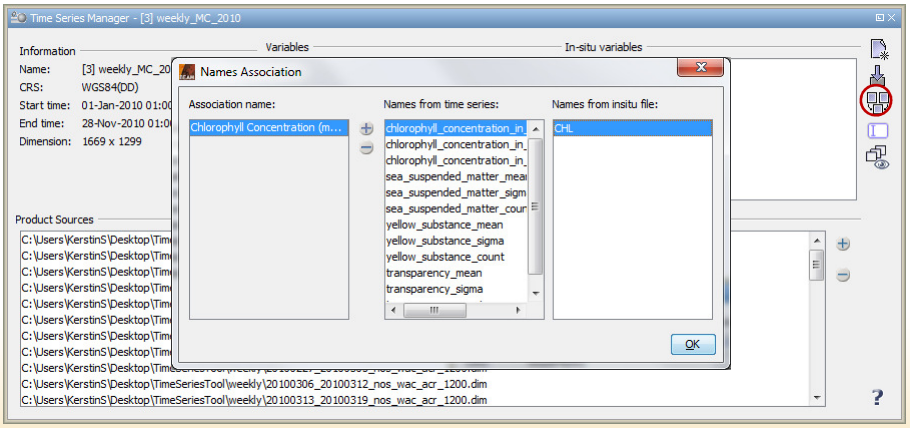
- Select parameter
  - Bands that are common in all products
  - Can be changed later



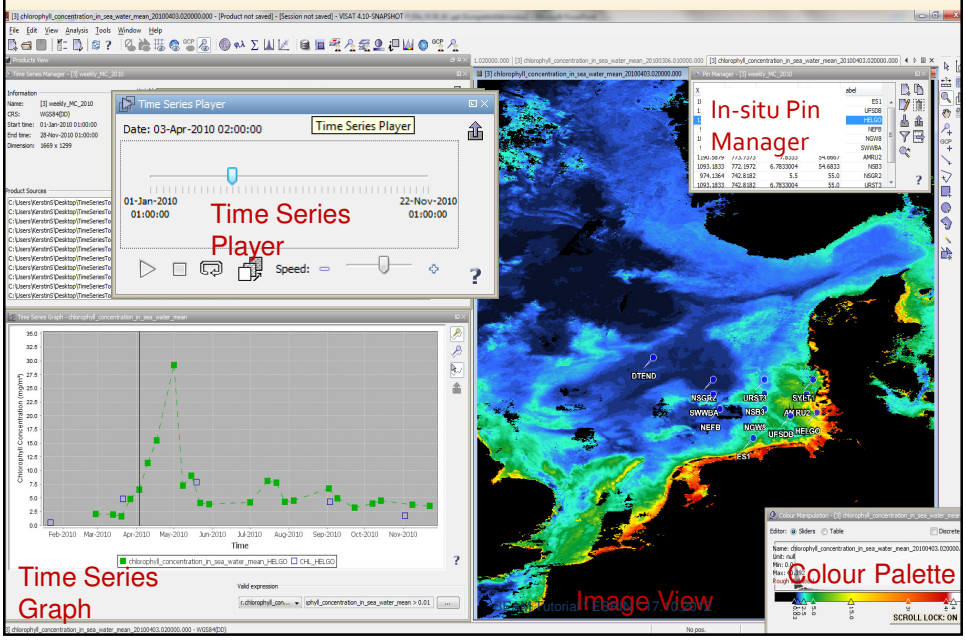
Time Series Manager



Time Series Manager

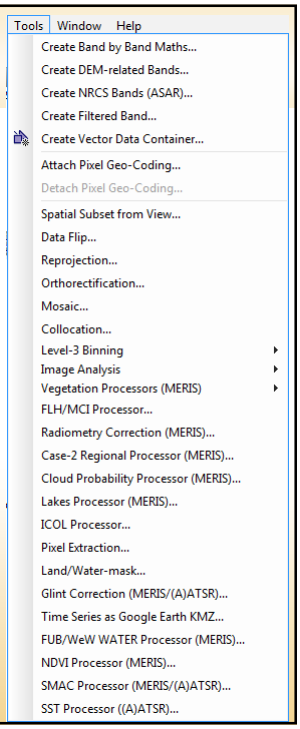


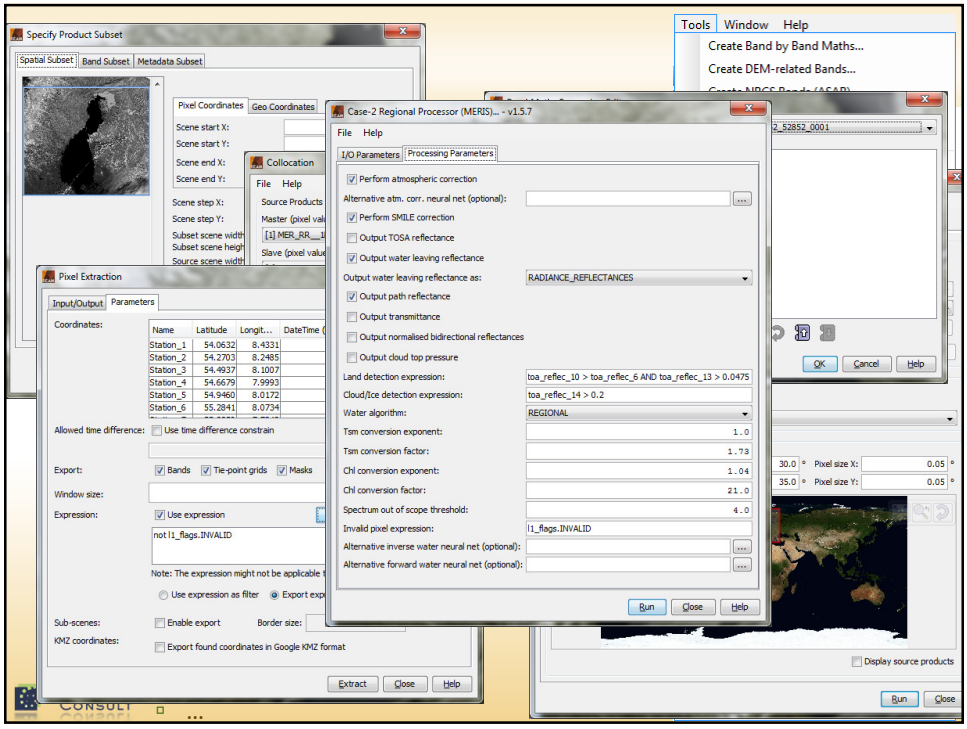
Time Series Tools



A4 - Processors

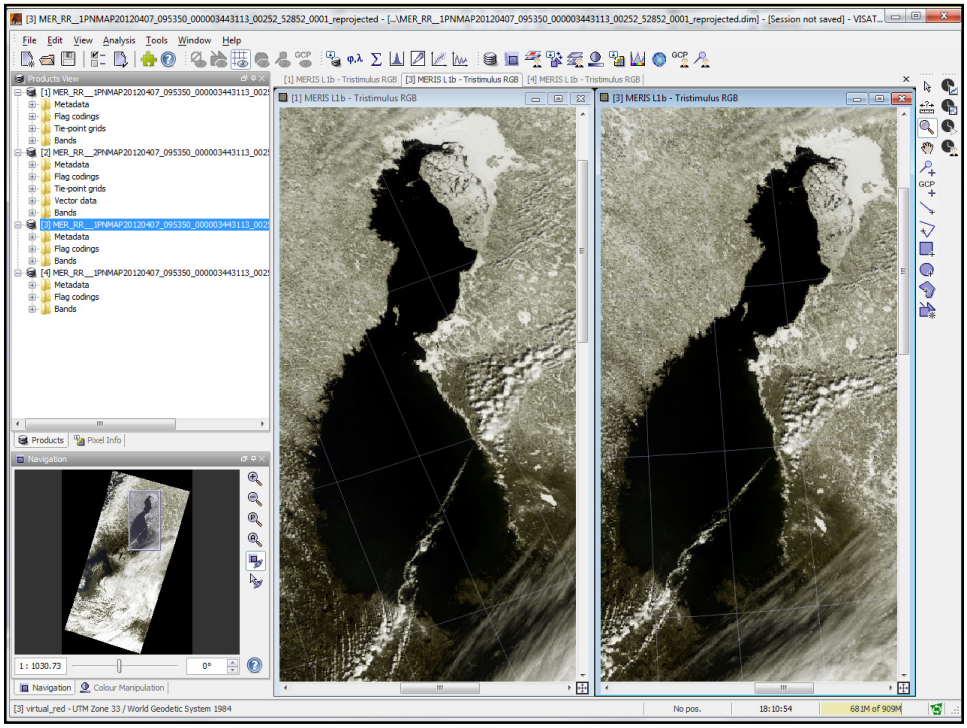
- Generic Processors
  - Cluster Analyses
  - Reprojection / Orthorectification
  - Mosaic
  - Collocation
  - Level-3 Binning
  - Pixel Extraction
  - …
- Dedicated Processors
  - Radiometric Correction
  - Case-2 Regioal Processor
  - ICOL Processor
  - FUB/WeW Water Processor
  - MERIS Case-2 Waters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

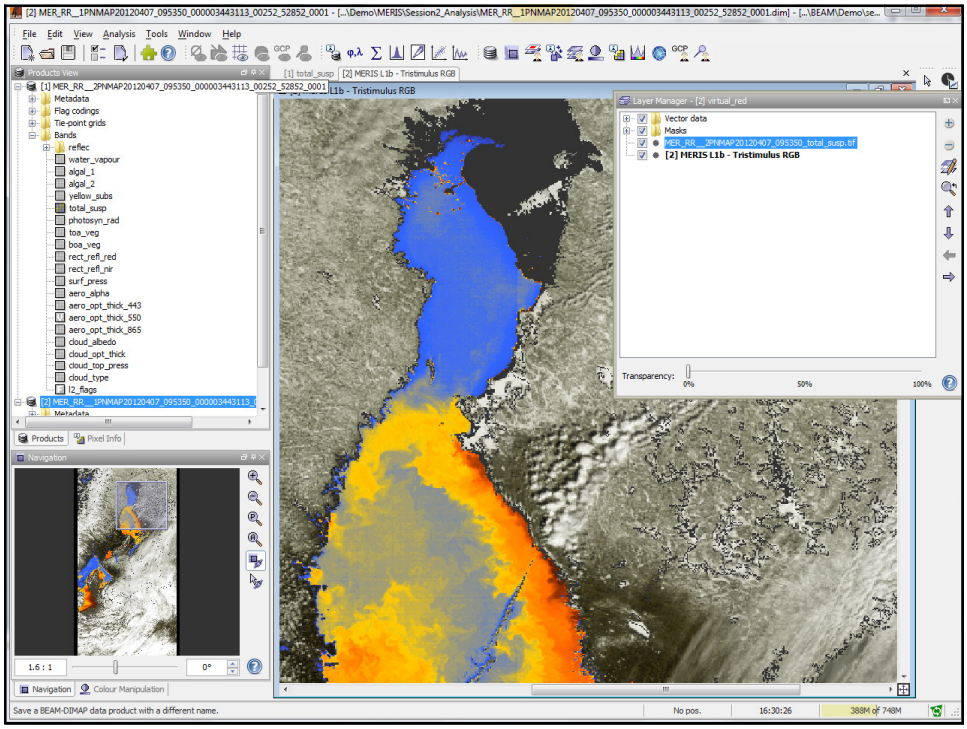




Spatial processing of raster data sets

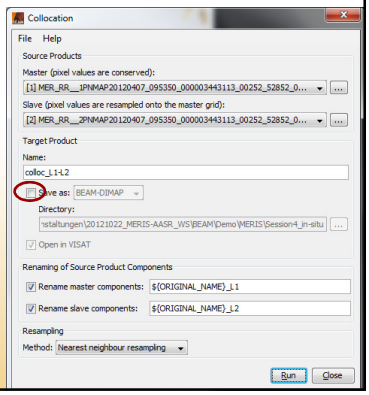
- Geo-processing
  - Subsetting
  - Reprojection
  - Collocation of products
- L3 binning
  - Temporal and spatial aggregation
  - Statistics per bin cell
  - Definition of output boundary and bin cell size
- Mosaiking





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



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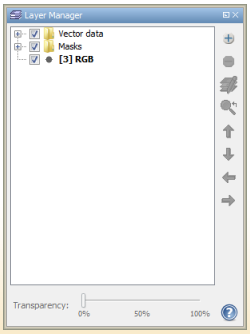
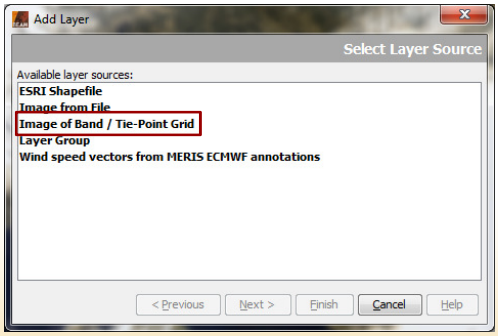
Exersice V (cont.)

- 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)