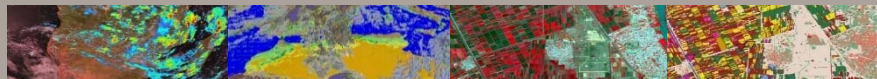
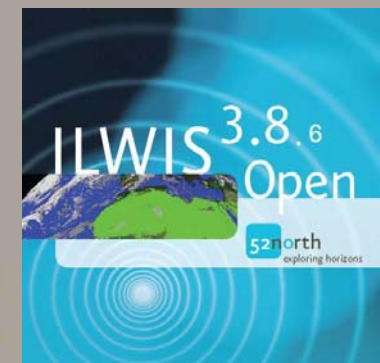
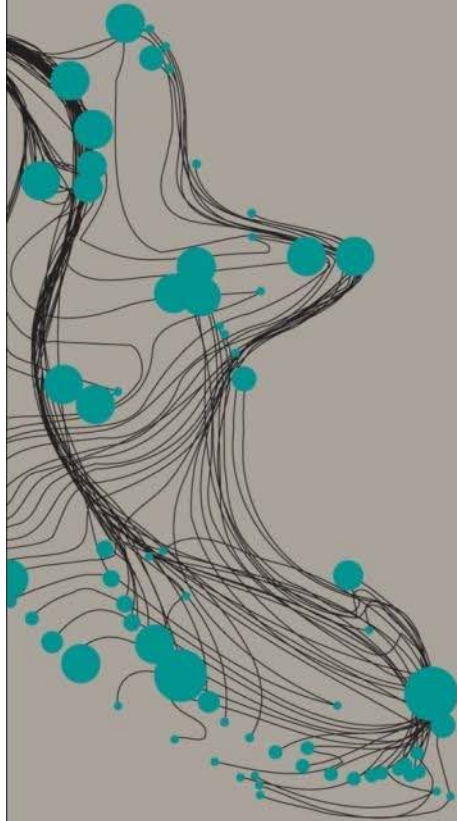


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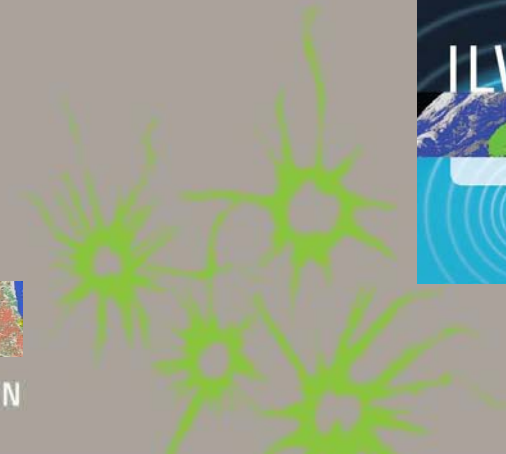


INTRODUCTION TO ILWIS AND USE OF GNC-TOOLBOX

BEN MAATHUIS / BAS RETSIOS
FACULTY ITC, UNIVERSITY TWENTE, THE
NETHERLANDS



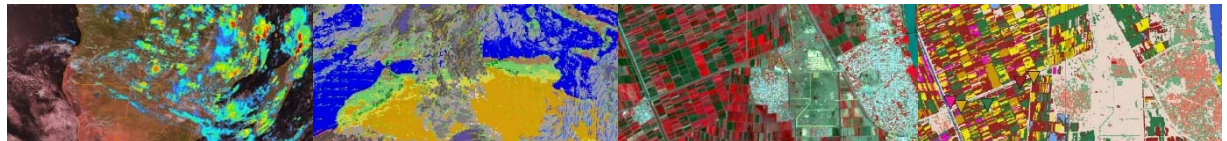
FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION





ILWIS

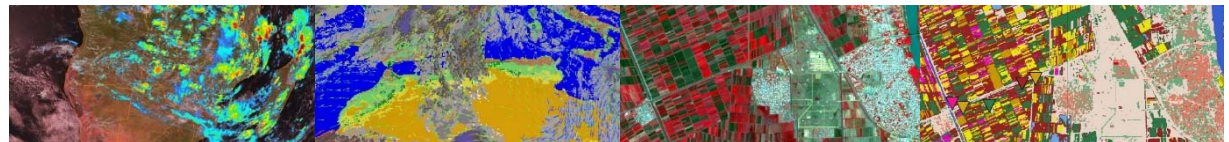
- Integrated Land and Water Information System
- Development started in 1984
- Grant from the Dutch Ministry of Foreign Affairs
- Result (1988) a Geographic Information System (GIS) for:
 - land use planning
 - watershed management studies
- Until 2007 in average 5 developers
- Commercial software until July 2007
- Since then, free and open source





FEATURES

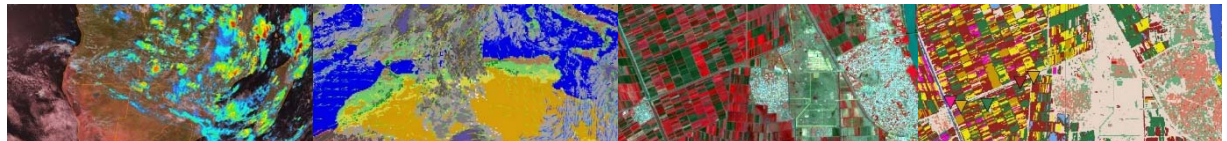
- Integrated raster and vector image analysis
- Digitizing vector images with digitizer tablet or computer screen
- Comprehensive set of image processing tools
- Orthophoto, image georeferencing, transformation, mosaicing
- Advanced modeling and spatial data analysis
- Rich projection and coordinate system library
- Geo-statistical analyses, with Kriging for improved interpolation
- Production and visualization of stereo image pairs
- Spatial Multiple Criteria Evaluation
- Operations for DEM hydrological processing
- Operations for Surface Energy Balance System
- Toolbox Plug-in (separately downloadable add-on extension)





ADVANTAGES

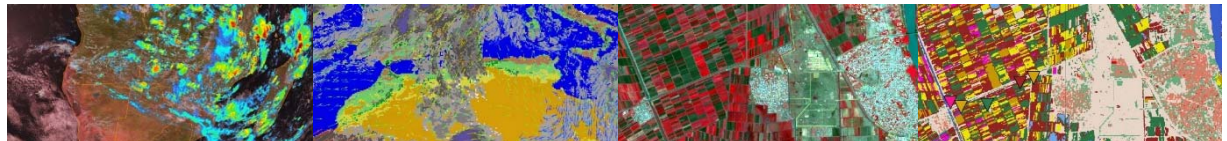
- Free and Open Source
- Compact (30 MB download)
- Zero-install (download, unzip and run)
- Integrated (all functionality is included)
- Highly optimized
- Lightweight, starts fast, responds fast
- Autosave
- Extensive Documentation
- The developers are at the ITC





ADVANTAGES – FAST MAP DISPLAY

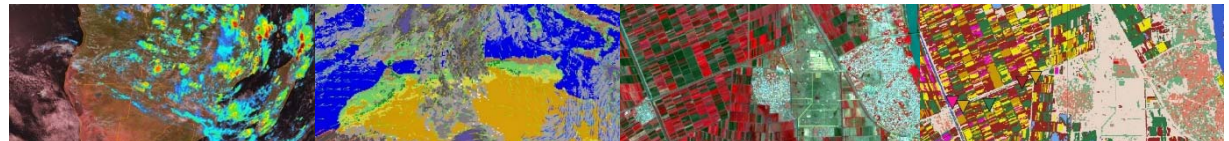
- Biggest innovation in ILWIS version 3.8.x
- Using OpenGL technology
- Full utilization of graphics-hardware
- Performance like 3D computer games
- Additional visualization possibilities
- Effortless switch from 2D to 3D
- Effortless overlay of raster images with different projections





DISADVANTAGES

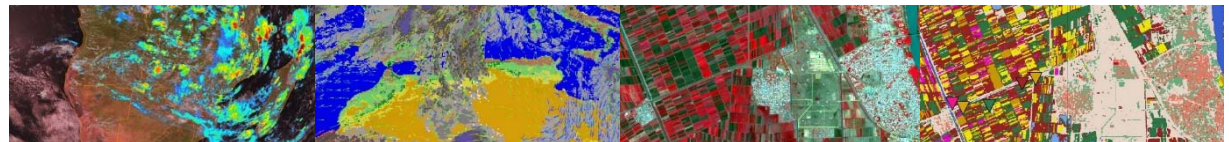
- Own file format
 - Implicates data import and export
- Some ILWIS metadata concepts to get used to
- Some ILWIS terminology to get used to (e.g. ILWIS Map = Image or Layer in other software)
- Some issues when folder names have spaces
- Traditional user interface
- Own scripting language
- Currently few developers





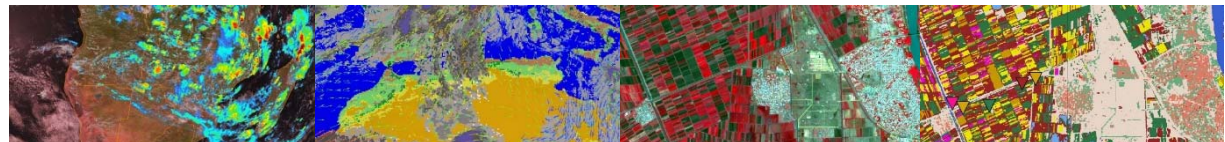
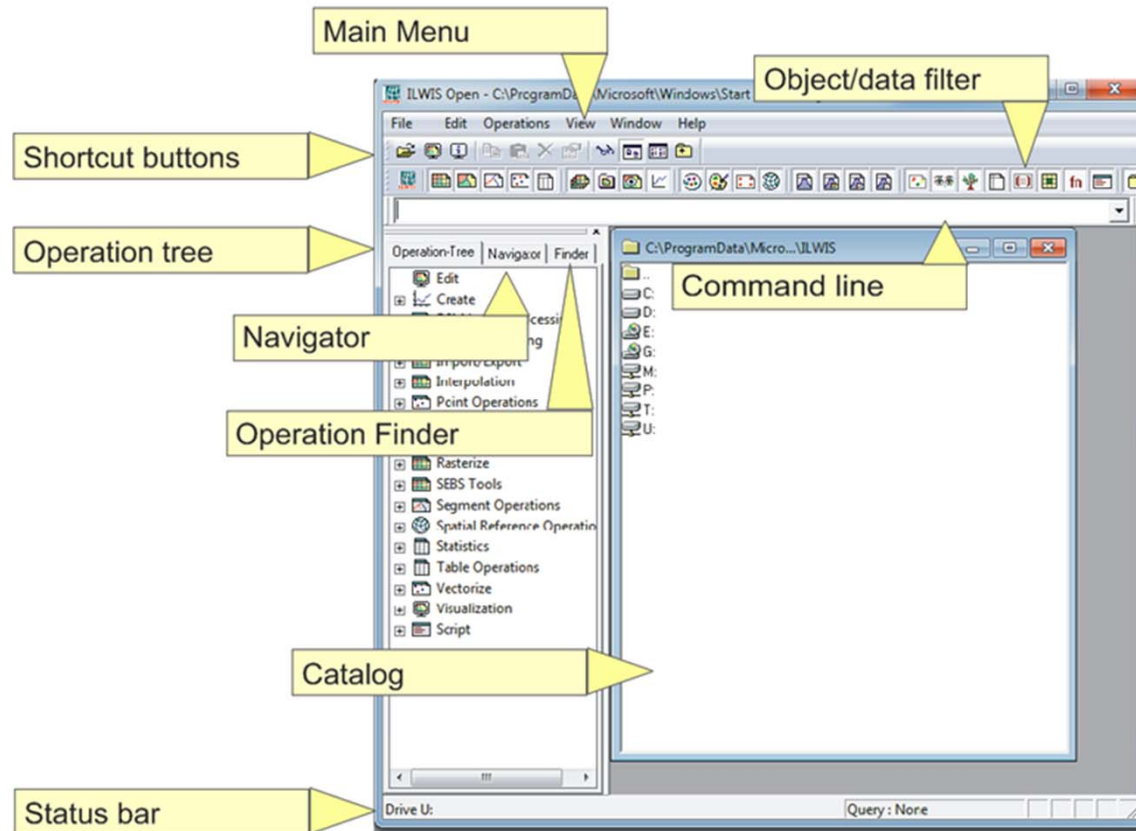
METADATA CONCEPTS

- An ILWIS Raster Image
 - has a Georeference
 - has a Domain
 - optionally has an Attribute Table
- An ILWIS Georeference
 - has a Coordinate System
- An ILWIS Vector Image
 - has a Coordinate System
 - has a Domain
 - optionally has an Attribute Table



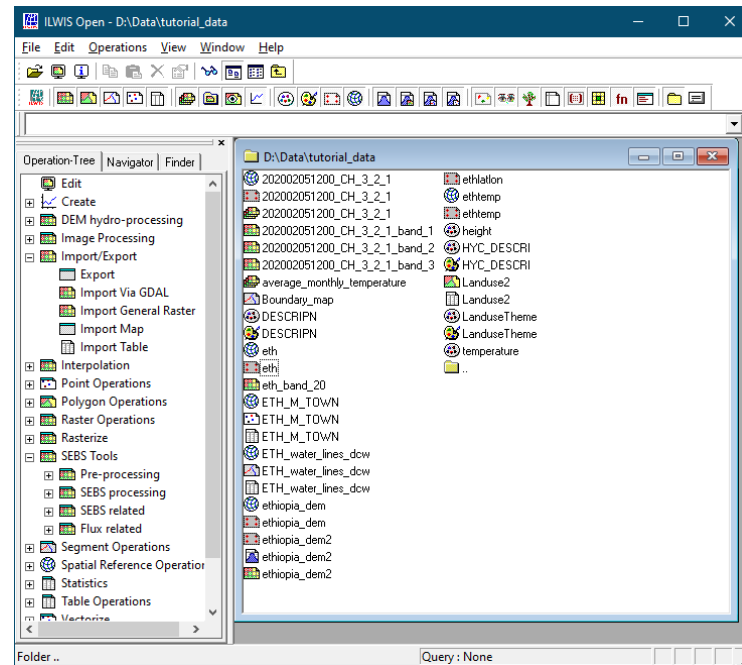
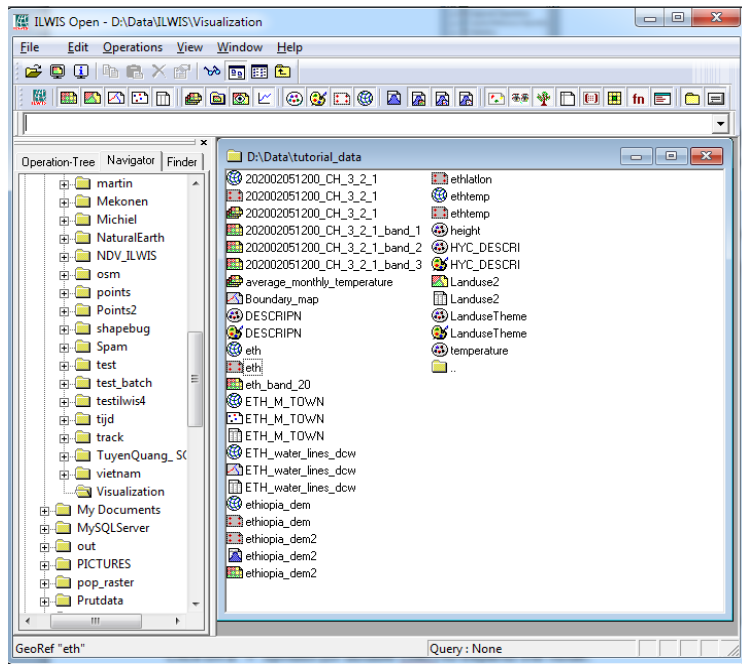


ILWIS – USER INTERFACE





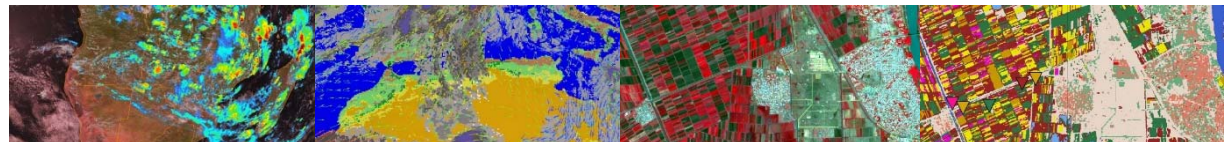
NAVIGATOR AND OPERATION TREE



Data Filter for catalog data visualization



UNIVERSITY OF TWENTE.





MAP WINDOW

Menu

Command line

Layer Tree

Map Tools

Map View

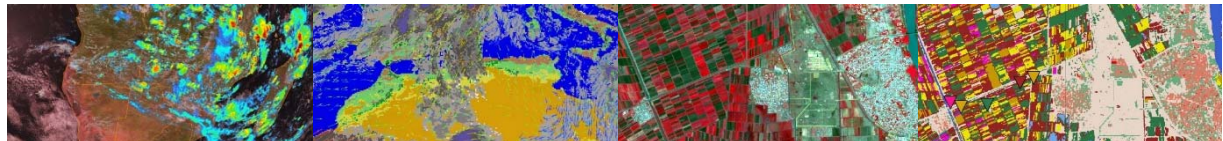
Map Info view

Status bar

- Global tools
- ethiopia_dem2 - MapSub
 - Display Tool**
 - Portrayal
 - 3D Properties
 - Annotations
 - Legend Annotation
 - Portrayal
 - Representation Legend
 - Cross Section
 - Raster Histogram
 - Hovmöller Diagram
 - Map Information
 - Interactive Representation
 - Operations
 - Interactive Stretching
 - Track Profile**
 - Transparency
 - Stretch
 - Transpar
- Operations
- Properties
- Background

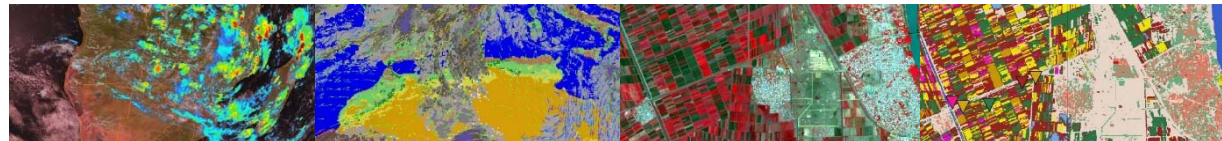
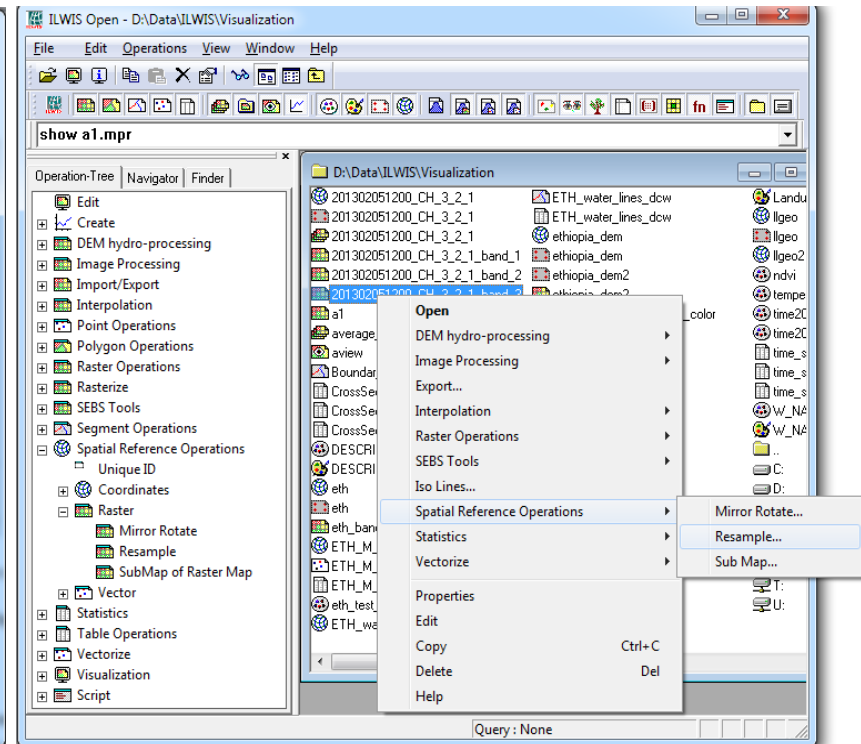
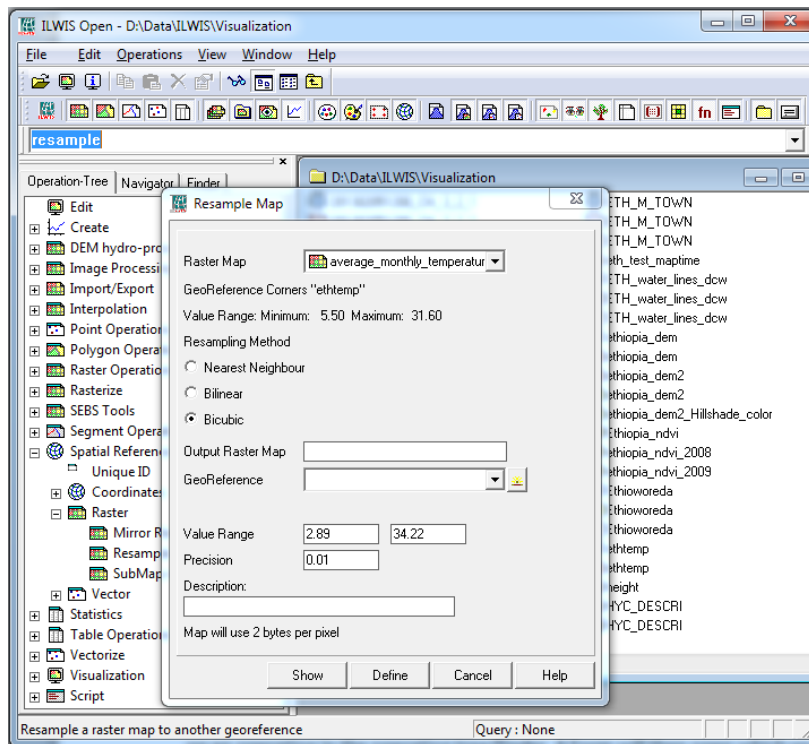


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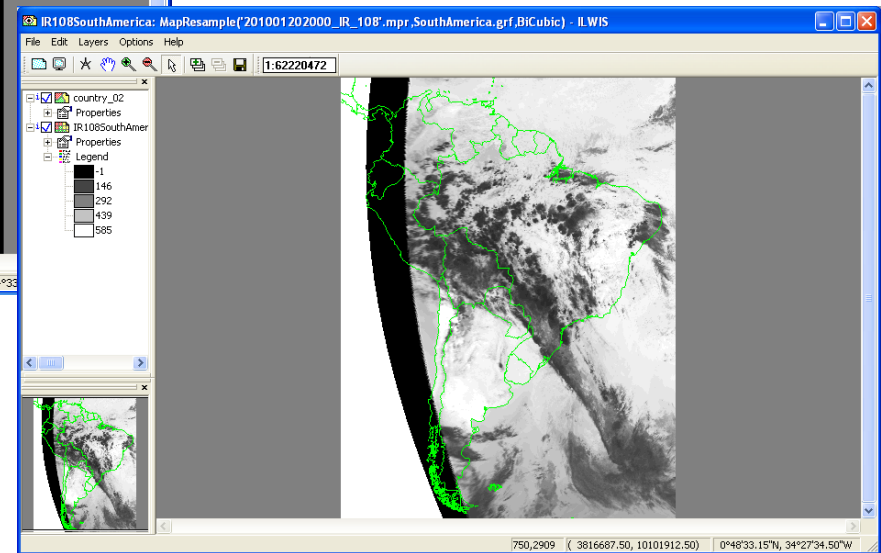
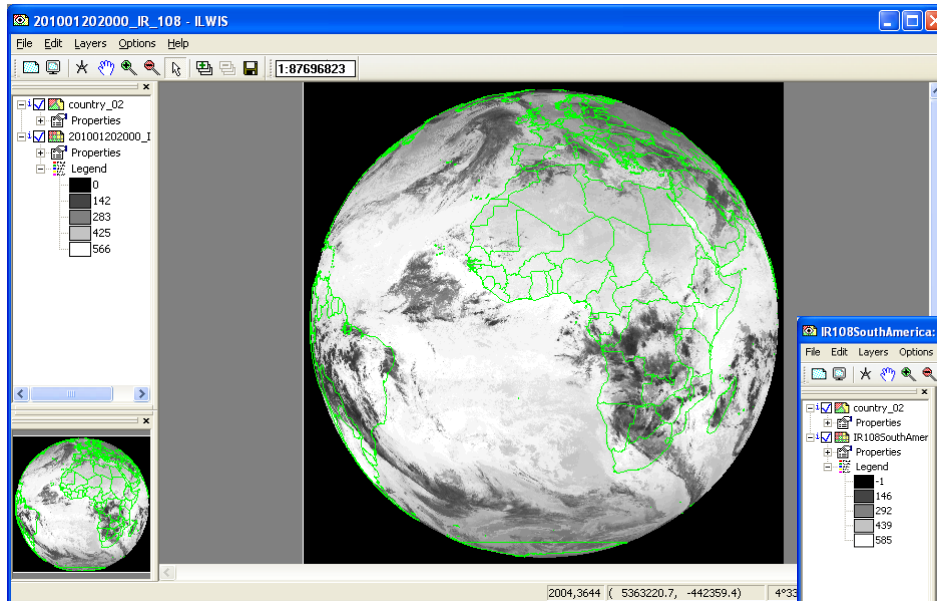


ILWIS RESAMPLE COMMAND

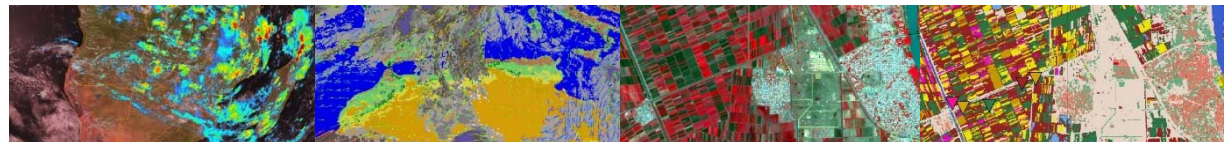




MAP WINDOWS SHOWING ORIGINAL MSG AND RESAMPLED MSG IMAGE

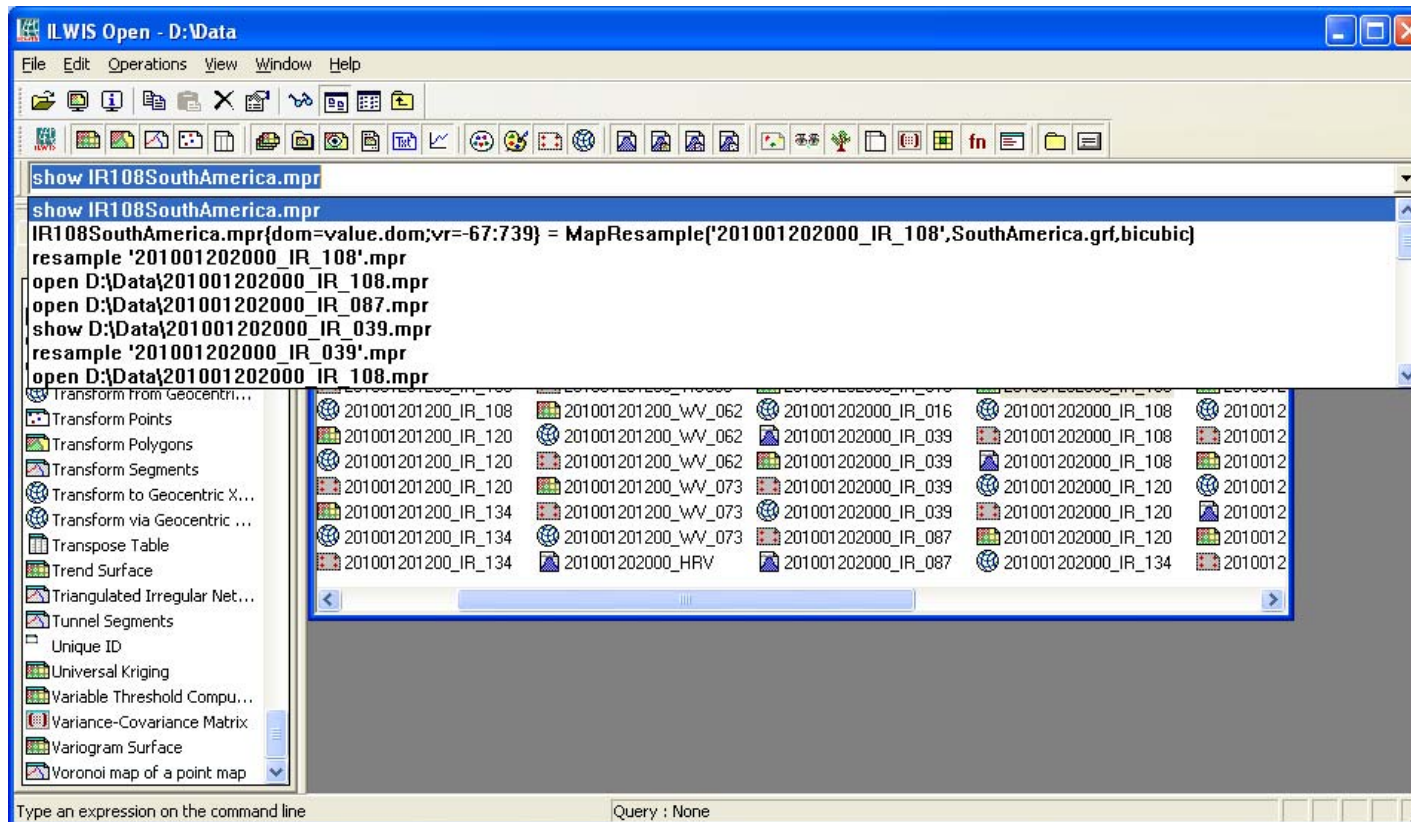


UNIVERSITY OF TWENTE.

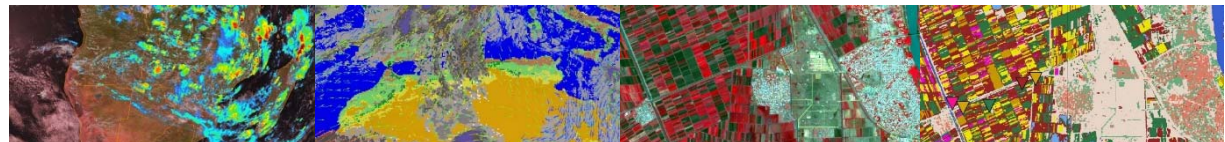




ILWIS COMMAND LINE



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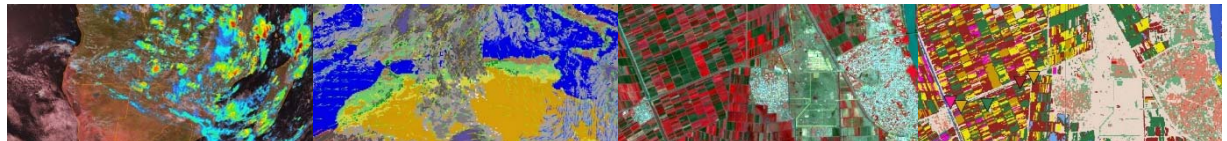




ILWIS COMMANDS

```
IR108SouthAmerica.mpr =  
MapResample  
(  
    '201001202000_IR_108',  
    SouthAmerica.grf,  
    bicubic  
)
```

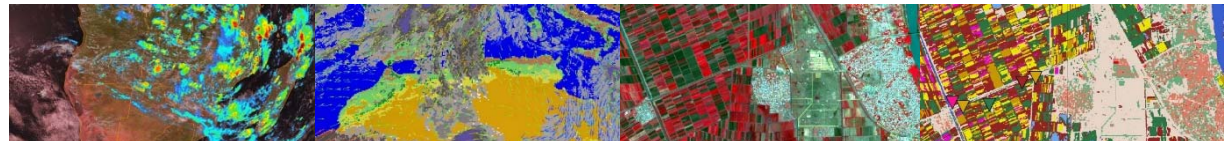
- Input map remains untouched
- A new output map is generated





ILWIS – COMMANDS / MAPCALC

- $\text{mapC} = \text{mapA} + \text{mapB}$
- $\text{mapC} = \text{mapA} * \text{mapB} - \text{mapA} / \text{mapD}$
- $\text{mapC} = \exp(\text{mapA}) * \cos(\text{mapB})$
- $\text{ndvi} = (\text{NIR} - \text{VIS}) / (\text{NIR} + \text{VIS})$





ILWIS SCRIPTS

- Script = a collection of commands that are executed in order
- All non-interactive ILWIS commands can be scripted

The screenshot shows the ILWIS Script Editor window titled "Script 'dattutdut' - ILWIS". The window has a menu bar (File, Edit, View, Help) and a toolbar. Below the toolbar are tabs for "Script", "Parameters", and "Default Values". The "Script" tab is active, displaying the following script code:

```
copy %5.mpr %5%2.mpr

// begincomment
lati%2(dom=VALUE.dom,vr=-180.0000:180.0000:0.00001)=if(%5%2.crdy(transform(mapcrd(%5%2),latlon)),0)
long%2(dom=VALUE.dom,vr=-180.0000:180.0000:0.00001)=if(%5%2.crdx(transform(mapcrd(%5%2),latlon)),0)
// endcomment

om%2ega(dom=VALUE.dom,vr=-180.0000:180.0000:0.00001)=[12:(%4)+long%2/15+et(da%2)/60]^15
co%2zen(dom=VALUE.dom,vr=-1.0000:1.0000:0.00001)=sin(da%2)/57.29577951*sin(lati%2/57.29577951)+cos(da%2)/57.29577951*cos(lati%2/57.29577951)*cos(om%2ega/57.29577951)
i%2toa(dom=VALUE.dom,vr=-500000.0000:500000.0000:0.00001)=1367*eo(da%2)*co%2zen

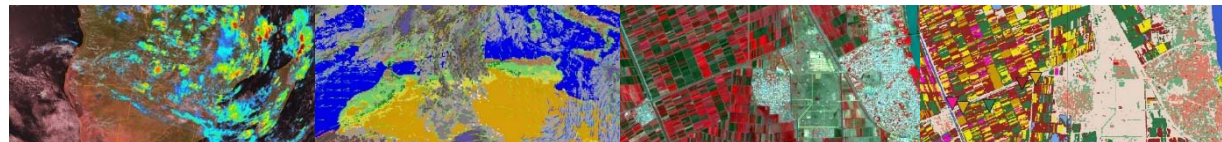
// Calculati%2on of the net radiation albedo map - instantaneous
// %2n.mpr(dom=VALUE.dom,vr=-5000.00000:5000.00000:0.00001)=0.85*0.75*ir%2toa+0.8^5.6697E-8*(%1)^4+0.95^5.6697E-8*(%5%2)^4
%2n.mpr(dom=VALUE.dom,vr=-5000.00000:5000.00000:0.00001)=[1-(0.05+(%5%2-%1)/(%3-%1)^0.2)]*0.7*ir%2toa+0.8^5.6697E-8*(%1)^4-1.0^5.6697E-8*(%5%2)^4

// Calculati%2on of the soil heat flux map - instantaneous
g%2s.mpr(dom=VALUE.dom,vr=-5000.00000:5000.00000:0.00001)=[0.05+(%5%2-%1)/(%3-%1)^0.4]^r%2n

// Calculati%2on of turbulent fluxes
h%2=if(%5%2<%1,0,if(%5%2>%3,r%2n-g%2s,(r%2n-g%2s)*(%5%2-%1)/(%3-%1))
le%2=r%2n-g%2s+h%2

// Daily values:
lambda%2.mpr(dom=VALUE.dom,vr=-1.00000:1.00000:0.00001)=le%2/(le%2+h%2)
```

Overlaid on the right side of the script editor is a dialog box titled "Script 'dattutdut'". It contains several input fields: "Tmin", "DOY", "Tmax", "UTC" (with the value "12.000" entered), and "inputmap" (with a dropdown arrow). At the bottom of the dialog are "OK" and "Cancel" buttons.

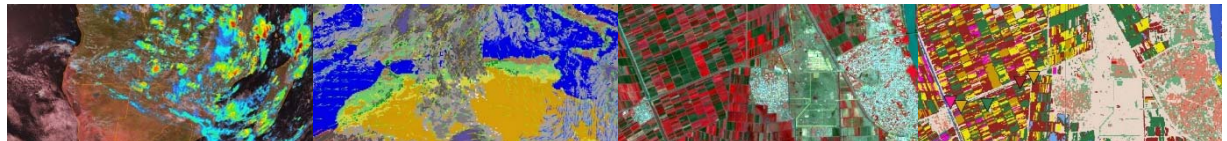




SCRIPTS - BENEFIT

SCRIPTS COMBINE ILWIS ALGORITHMS, MODELS AND COMMANDS TO:

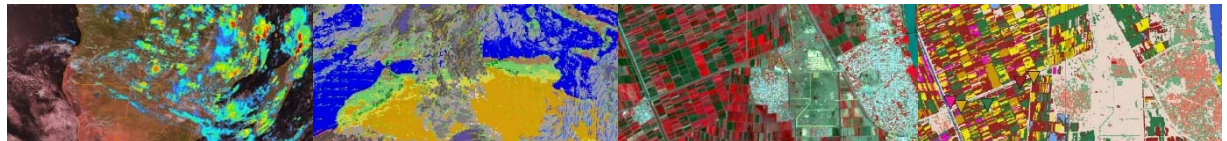
- Create new models/algorithms
- Automate tasks
- Connect different tools together





EXECUTING ILWIS COMMANDS FROM OTHER PROGRAMS

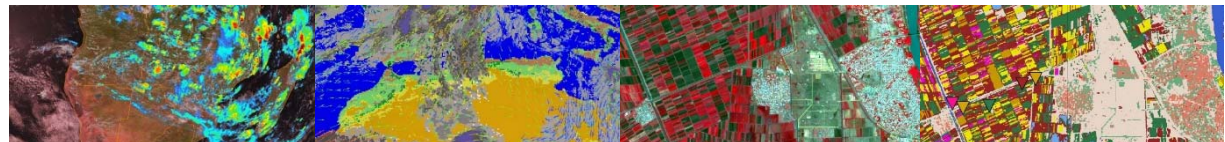
- ILWIS commands can be executed from MS-DOS
- Syntax:
`ILWIS.exe -C <command>`
- Example:
`ILWIS.exe -C mapC = mapA + mapB`





EXECUTING ILWIS COMMANDS FROM OTHER PROGRAMS

- ILWIS commands can be called from other programs:
 - MS-DOS Command-Prompt
 - MS-DOS batch (.bat) files
 - Excel
 - Visual Basic
 - ArcGis
 - Java/C#/C++/Python
 - Any program that can execute MS-DOS commands



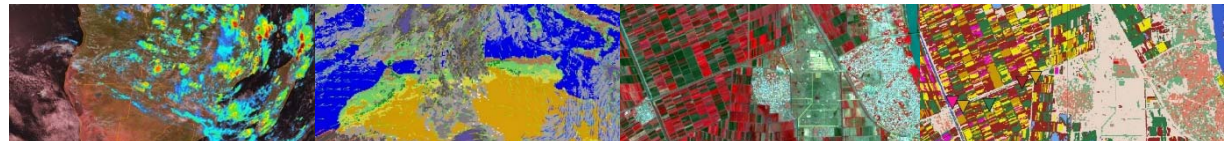


EXECUTING ILWIS COMMANDS FROM MS-DOS .BAT FILES

- MS-DOS batch files = text files with extension **.bat**
- Each line must be a valid MS-DOS command
- The commands are executed in order

D:

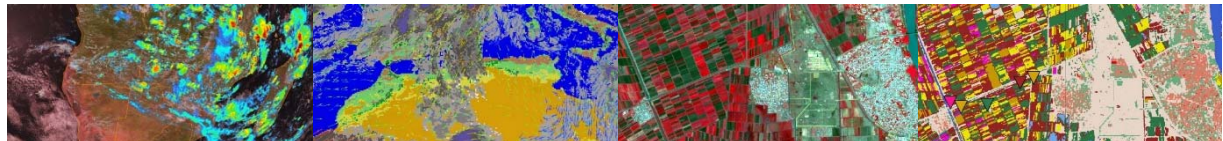
```
cd \geonetcast_workshop\data  
del *
```





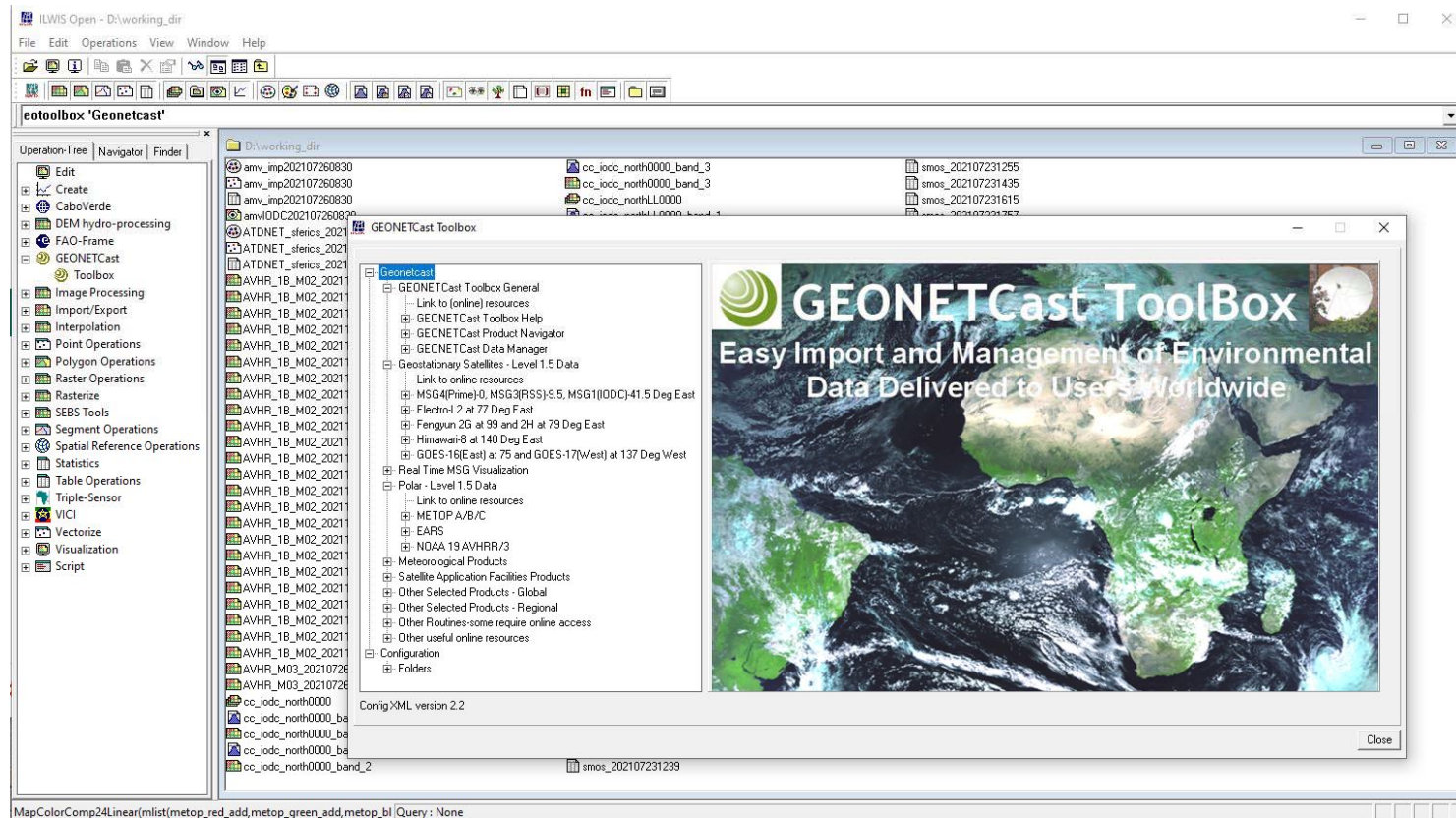
GEONETCAST TOOLBOX

- The Geonetcast Toolbox combines:
 - ILWIS scripts
 - MS-DOS batch files
 - Other programs, e.g.:
 - `7z.exe`
 - `gdal_translate.exe`, etc
- All scripts and batch files are located at `Extensions\Geonetcast-Toolbox`

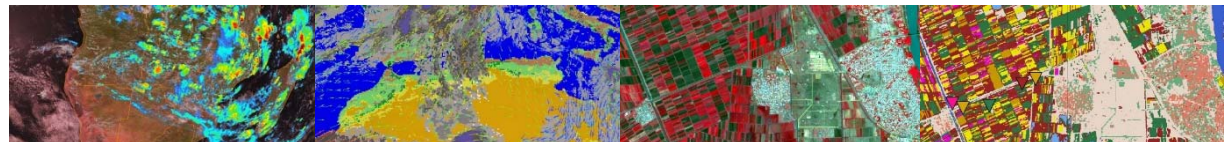




GEONETCAST TOOLBOX - MENU



UNIVERSITY OF TWENTE.

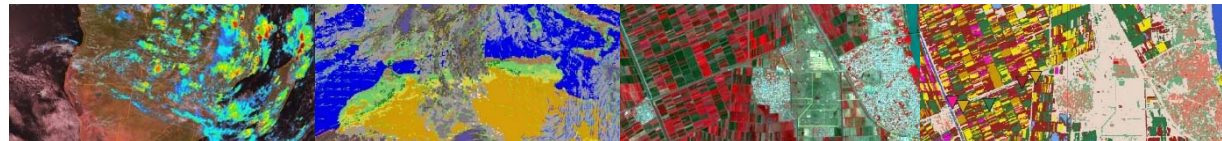




GEONETCAST TOOLBOX - MENU

Menu is constructed based on “Config.XML”

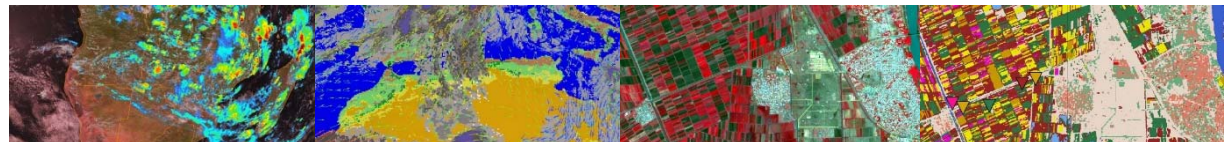
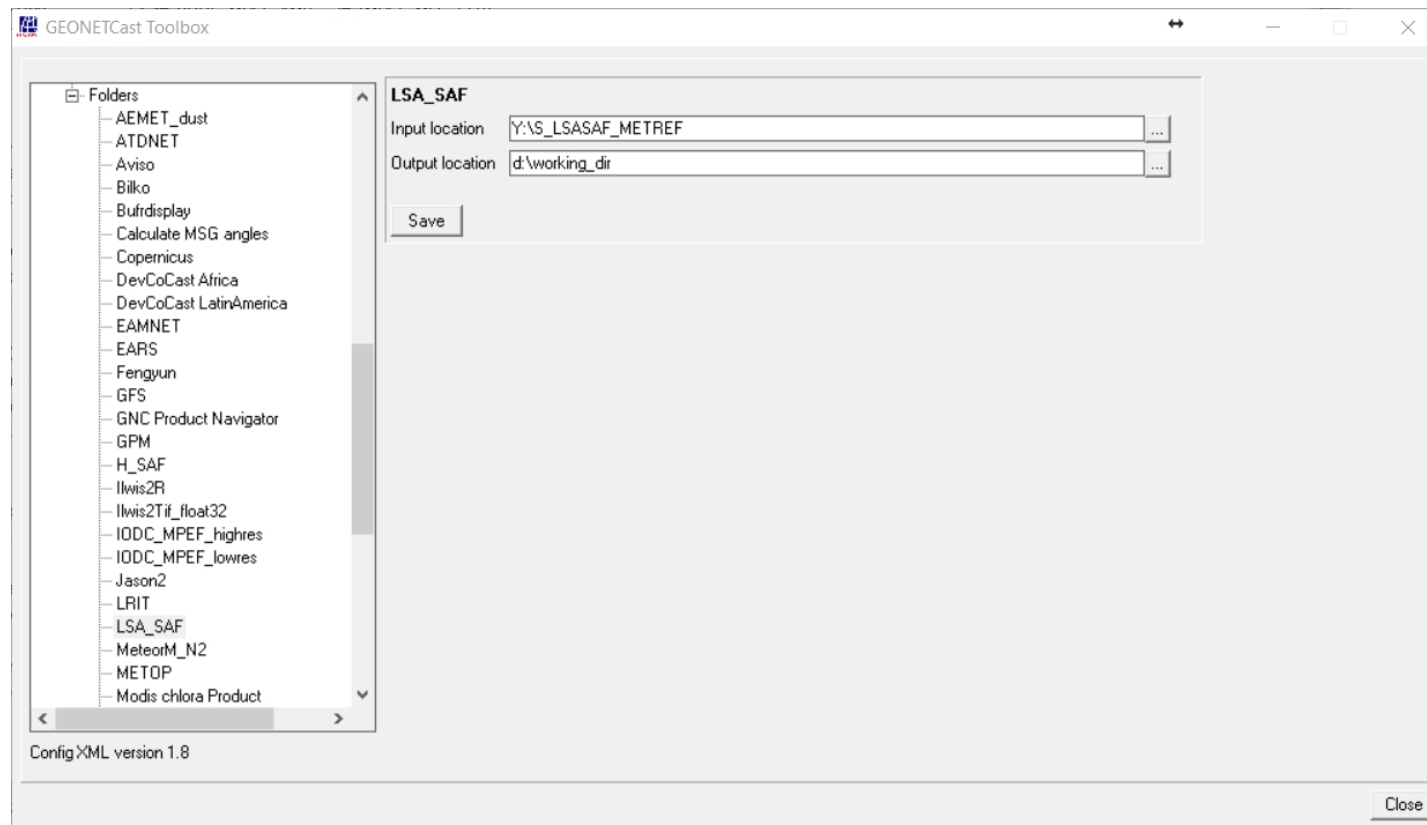
```
config.xml - Notepad
File Edit Format View Help
<Geonetcast>
  <Version id="1.8" finder="false"/>
  <UIInfo icon="GNC" menu="GEONETCast..Toolbox" title="GEONETCast Toolbox"/>
  <Path value="Extensions\Geonetcast-Toolbox" inifile="geonetcast.ini" />
  <Level1 value="GEONETCast Toolbox Help" >
    <Product value="ReadMe" script="toolbox_startscript\help\readme.isl" format="" type="Last24Hr" folderid=":input:output" />
    <Product value="Change Log Version 1.6" script="toolbox_startscript\help\start_changeLog16.isl" format="" type="Last24Hr" folderid=":input:output" />
    <Product value="Installation and User Manual Version 1.6" script="toolbox_startscript\help\start_GNCmanual.isl" format="" type="Last24Hr" folderid=":input:output" />
  </Level1>
  <Level1 value="GEONETCast Product Navigator" >
    <Product value="GEONETCast Product Navigator" script="GNC_productnavigator\start_GNC_PN.bat" format="" type="Last24Hr" folderid=":input:output" />
  </Level1>
  <Level1 value="GEONETCast Data Manager" >
    <Product value="Installation and User Manual" script="DataManager\start_DMmanual.isl" format="" type="Last24Hr" folderid=":input:output" />
    <Product value="GEONETCast Data Manager" script="" format="" type="DataManager" folderid=":input:output" />
  </Level1>
  <Level1 value="MSG-HRIT" >
    <Product value="MSG Data Retriever" script="" format="" type="MSGDataRetriever" folderid="MSG Data Retriever" />
  </Level1>
  <Level1 value="Calculate MSG angles" >
    <Product value="Calculate solar and satellite azimuth angle maps for MSG Field of View" script="toolbox_startscript\MSG_angles\startMSG_angles.bat" format="" type="Last24Hr" folderid=":input:output" />
    <Product value="Calculate solar and satellite zenith angle maps for MSG Field of View" script="toolbox_startscript\MSG_angles\startMSG_angles.bat" format="" type="Last24Hr" folderid=":input:output" />
  </Level1>
  <Level1 value="Geostationary-LRIT" id="GST-LRIT">
    <Product value="Fengyun 2E High" script="toolbox_startscript\GEOSTATIONARY\LRIT_Fenyung2ehigh.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="Fengyun 2E Low" script="toolbox_startscript\GEOSTATIONARY\LRIT_Fenyung2elow.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="Fengyun 2G High" script="toolbox_startscript\GEOSTATIONARY\LRIT_Fenyung2ghigh.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="Fengyun 2G Low" script="toolbox_startscript\GEOSTATIONARY\LRIT_Fenyung2glow.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="GOES13 (EAST)" script="toolbox_startscript\GEOSTATIONARY\LRIT_GOES_EAST.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="GOES15 (WEST)" script="toolbox_startscript\GEOSTATIONARY\LRIT_GOES_WESTnew.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Product value="MET7" script="toolbox_startscript\GEOSTATIONARY\LRIT_MET7.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    <Level2 value="Himawari-8" id="MPEF">
      <Product value="Himawari-8 Visible" script="toolbox_startscript\GEOSTATIONARY\LRIT_Himawari8vis.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
      <Product value="Himawari-8 IR1-4" script="toolbox_startscript\GEOSTATIONARY\LRIT_Himawari8IR.isl" format="yyyyymmddhhmm" type="Last24Hr" folderid=":input:output" />
    </Level2>
  </Level1>
</Geonetcast>
```





GEONETCAST TOOLBOX - MENU

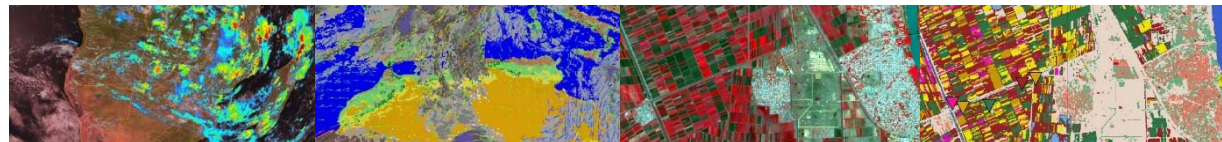
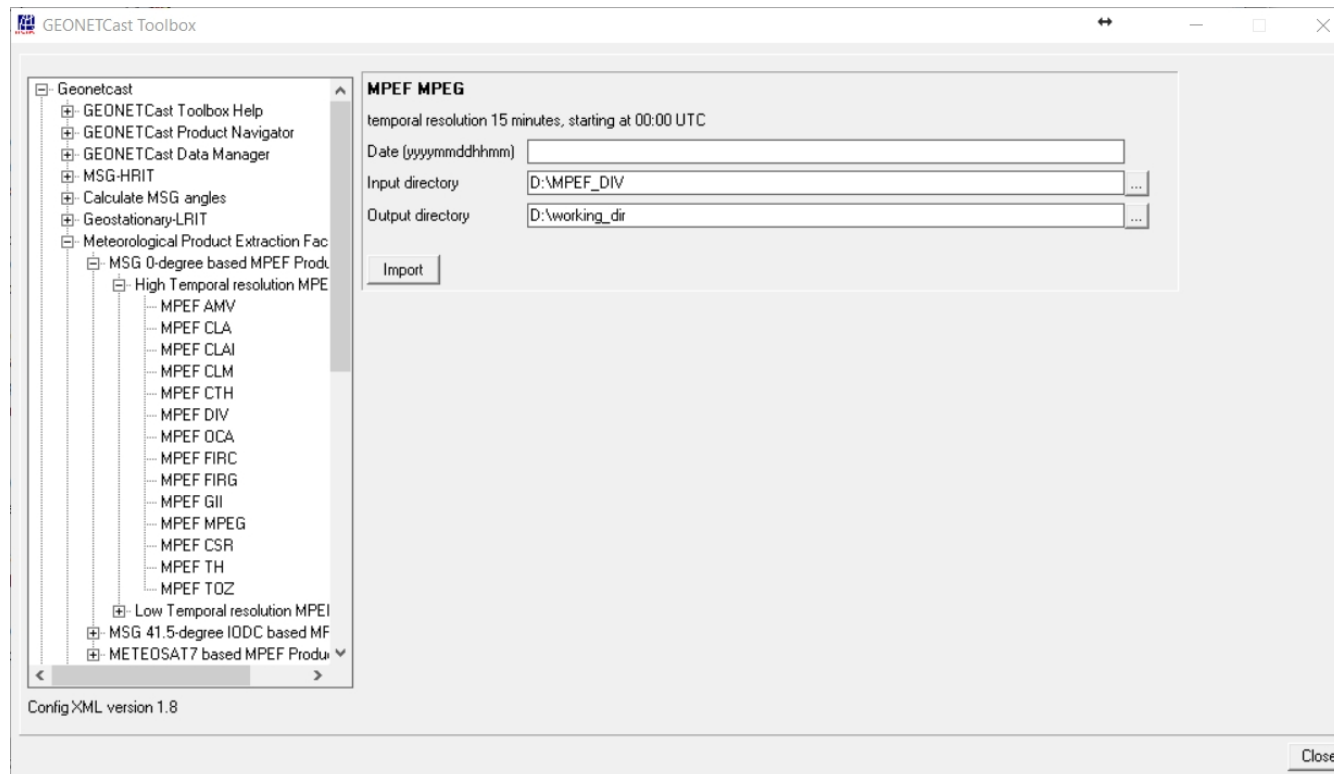
The menu item “folderid” defines link to the input and output folder settings





GEONETCAST TOOLBOX - MENU

- The menu item “type” defines the import pop-up screen



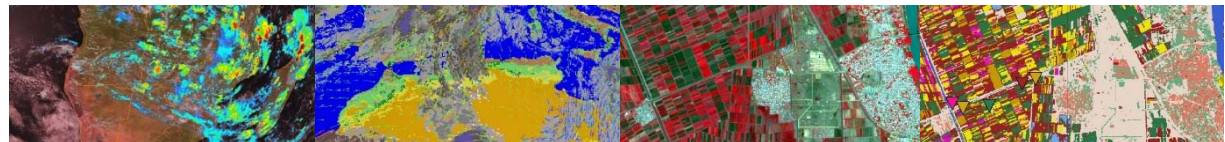


GEONETCAST TOOLBOX - SCRIPT

- During import of product a script is executed setting all required parameters, see ILWIS command line



```
!C:\Ilwis386\Extensions\Geonetcast-Toolbox\toolbox_batchroutines\MPEF_
mpegimport.bat 201901021200 D: MPEF_DIV D: working_dir
C:\Ilwis386\Extensions\Geonetcast-Toolbox\GDAL\bin
C:\other_software\Ilwis386 C:\Ilwis386\Extensions\Geonetcast-Toolbox\util
```





GEONETCAST TOOLBOX - BATCH

- During import the script is calling a batch file, here “MPEF_mpegimport.bat”

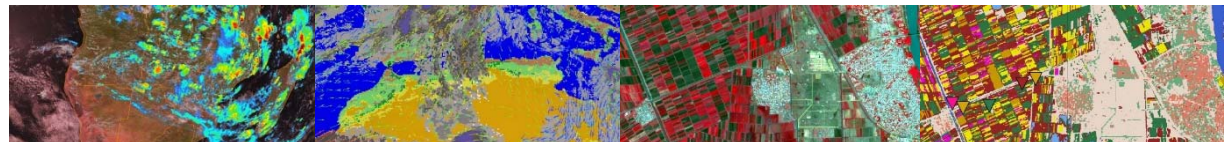
```
MPEF_mpegimport.bat - Notepad
File Edit Format View Help
@echo off
echo MPEF MPEG-import
echo Output is a value map in mm/hr

set longfilename=%1
set shortfilename1=%longfilename:~0,12%
set InputDrive=%2
set InputDir=%3
set OutputDrive=%4
set OutputDir=%5
set gdalDir=%6
set IlwDir=%7
set UtilDir=%8

cd\
%OutputDrive%
cd %OutputDir%

set MSG_number=2

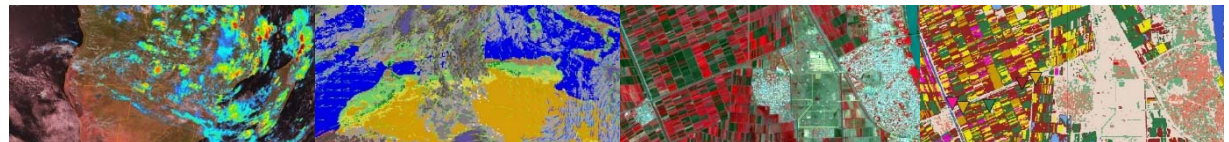
copy "%InputDrive%\%InputDir%\L-000-MSG?__-MPEF_____-MPEG_____-00000?__-%shortfilename1%-_*. *"
if exist "%OutputDrive%\%OutputDir%\L-000-MSG2__-MPEF_____-MPEG_____-00000?__-%shortfilename1%-_*. *" GOTO START1
```





GEONETCAST TOOLBOX – ONGOING DEVELOPMENTS

- Change / extend:
 - Toolbox batch files
 - Toolbox scripts
 - Toolbox menu
- Keep checking for updates





ILWIS – WEB MAPPING SERVICE

- EUMETVIEW (<https://view.eumetsat.int/>)

ILWIS Open - WMSCollection "ew_eumetsat_int"

File Edit Operations View Window Help

open D:\eumetview\msg_ir039.mpr

Operation-Time | Navigator | Finder

D:\eumetview

WMSCollection "ew_eumetsat_int"

msg_fes_ir108_202111020930 - ILWIS

File Layers Options Help

index : 1

Global tools

- msg_fes_h03b
- country_boundaries - All
- msg_fes_ir108_202111020
- openstreetmap
- Background

Continuous

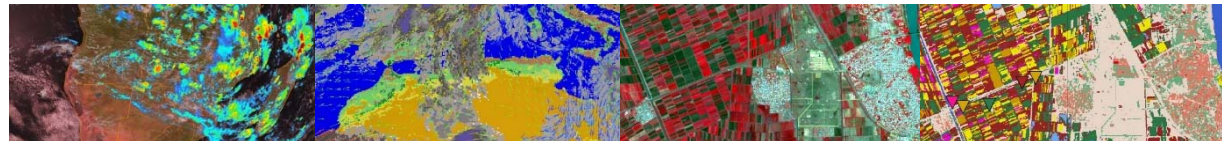
Coordinate	42°53'5
msg_fes_ir	222, 724
msg_fes_h0	
openstreet	368, 493
country_bo	Boundary

59.741799 42°53'56.0"N, 34°26'07.16"E 42°53'56.02"N, 34°26'07.16"E

Create animation of different layers
Add local data



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GEONETCAST: MULTI TEMPORAL DATA HANDLING

- Batch “*looping*” routines:

- Start:

```
multi_lst_start.bat - Notepad
File Edit Format View Help
for %%j in (*.LSASAF_MSG_LST_Same*) do bzip2-104-x86-win32.exe -d %%j
for %%j in (*.LSASAF_MSG_LST_Same*) do multiSame_lstimport1.bat %%j
```

- Data import

```
multiSame_lstimport1.bat - Notepad
File Edit Format View Help
@echo off
echo rem: LST South America in degree Celcius
echo rem: sample file name = S-LSA_-HDF5_LSASAF_MSG_LST_Same_201005200000

set longfilename=%1
set shortfilename1=%longfilename:~32,12%

"C:\ilwis371_gnc\Extensions\Geonetcast-Toolbox\GDAL\bin\gdal_translate.exe" -of ilwis
hdf5:"S-LSA_-HDF5_LSASAF_MSG_LST_Same_%shortfilename1%"://lst same_%shortfilename1%

"C:\ilwis371_gnc\ilwis.exe" -C setgrf same_%shortfilename1%.mpr lsta_same

"C:\ilwis371_gnc\ilwis.exe" -C lst_same%shortfilename1%.mpr:=iff(same_%shortfilename1% gt
-7000,same_%shortfilename1%/100,?)

del S-LSA_-HDF5_LSASAF_MSG_LST_Same_%shortfilename1%
del same_%shortfilename1%.aux.xml
del same_%shortfilename1%.mpr*
del same_%shortfilename1%.csy
```

