Image Processing in GRASS GIS 7

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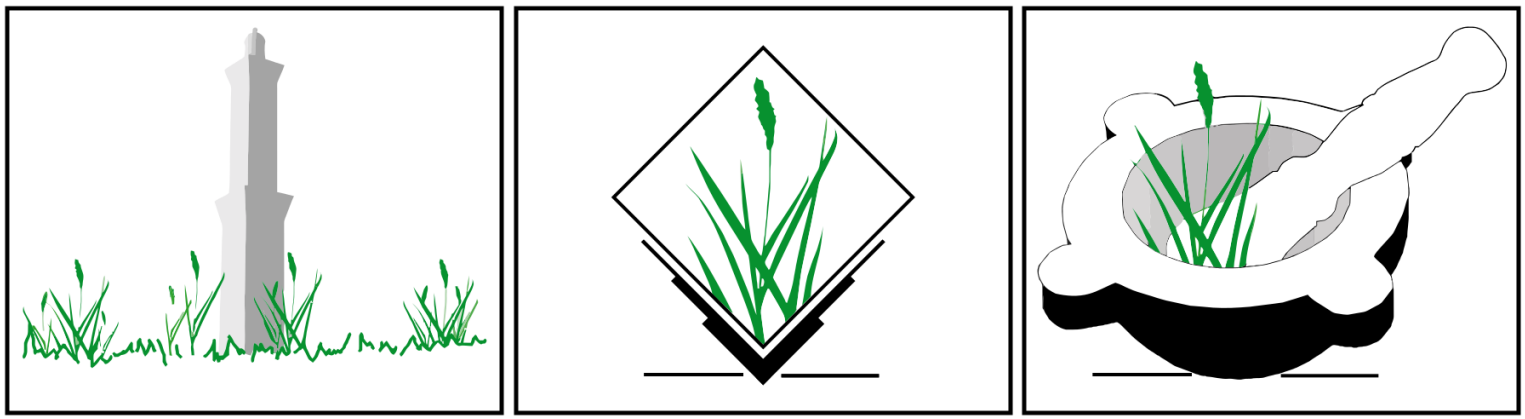

GRASS Community Sprint Genoa 2013

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Contents

Overview

Remote Sensing has been a limited topic in GRASS

- GRASS 5: Raw images (esp. aerial photos)
- 1990s Public: AVHRR (1100x1100m)
- 2000s Public: MODIS (250x250m)
- 2010s Public: Landsat (30x30m)

Rekindled strong interest from the geospatial community.

Imagery Functionality

Remote sensing preparation and product generation
Increased interest in the recent years.

- GRASS 6 (stable) has 33 imagery modules
- GRASS 7 (experimental) has 46 modules + 1
- Add-ons incubating (many!)

Modules also have development stages,
from experimental (add-ons) to stable (main).

GRASS 7 has new temporal and spatial analysis algorithms.

Imagery developments

Remanufacturing, performance improvement.

- i.ortho.photo rewritten (main)
- i.atcorr increased speed (main)
- i.atcorr more satellite configured (main)
- i.pca backward modeling implemented (main)

Preparing Landsat, Aster and MODIS datasets.

- i.landsat.toar (main), TOA reflectance correction
- i.aster.toar (main), TOA reflectance correction
- i.modis.qc (main), Quality flag interpretation

Imagery developments

Geographical and astronomic functions:

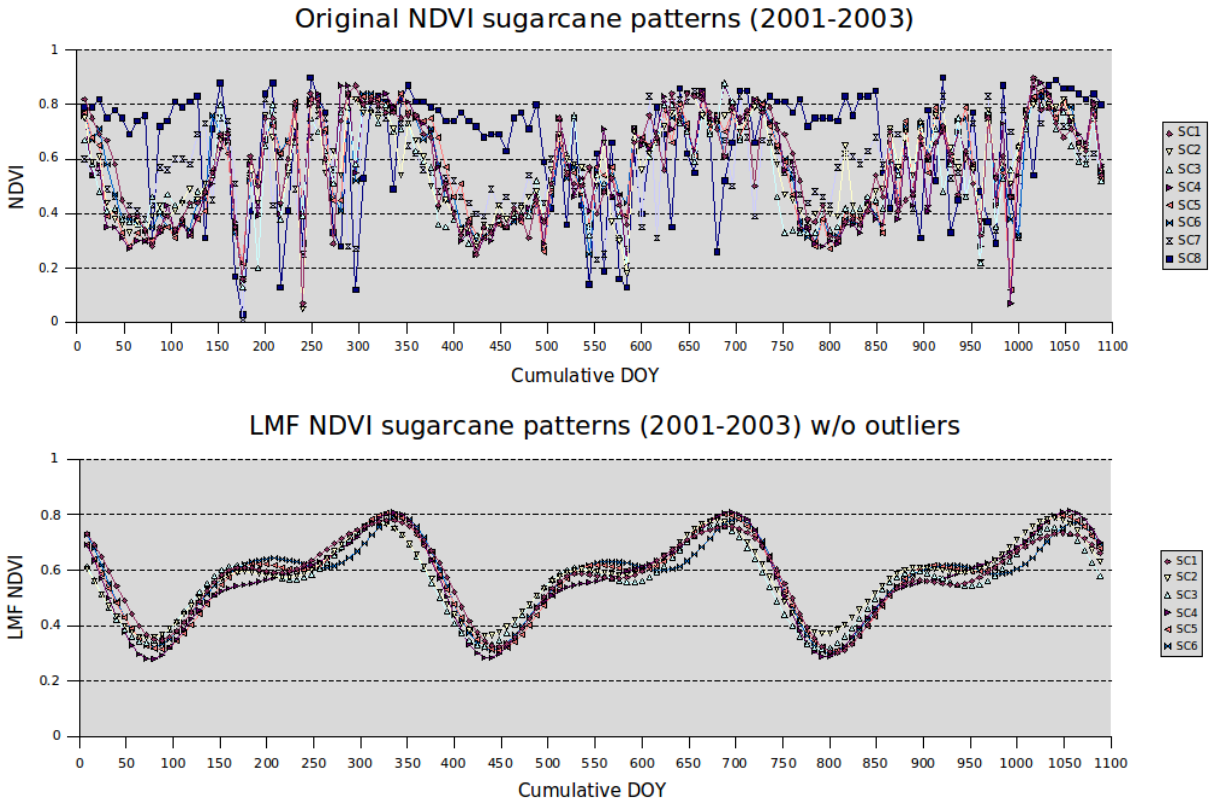
- i.latlong (main), maps latitude or longitude (dd.ddd)
- i.sunhours (main), maps diurnal hours.

RS products:

- i.vi (main), 14 vegetation indices from literature + 1
- i.albedo (main), Broadband Albedo (snow $\simeq$ 0.6-0.8, water=0.05)
- i.emissivity (main), Long wavelength λ
- i.biomass (main), biomass growth for crop yield

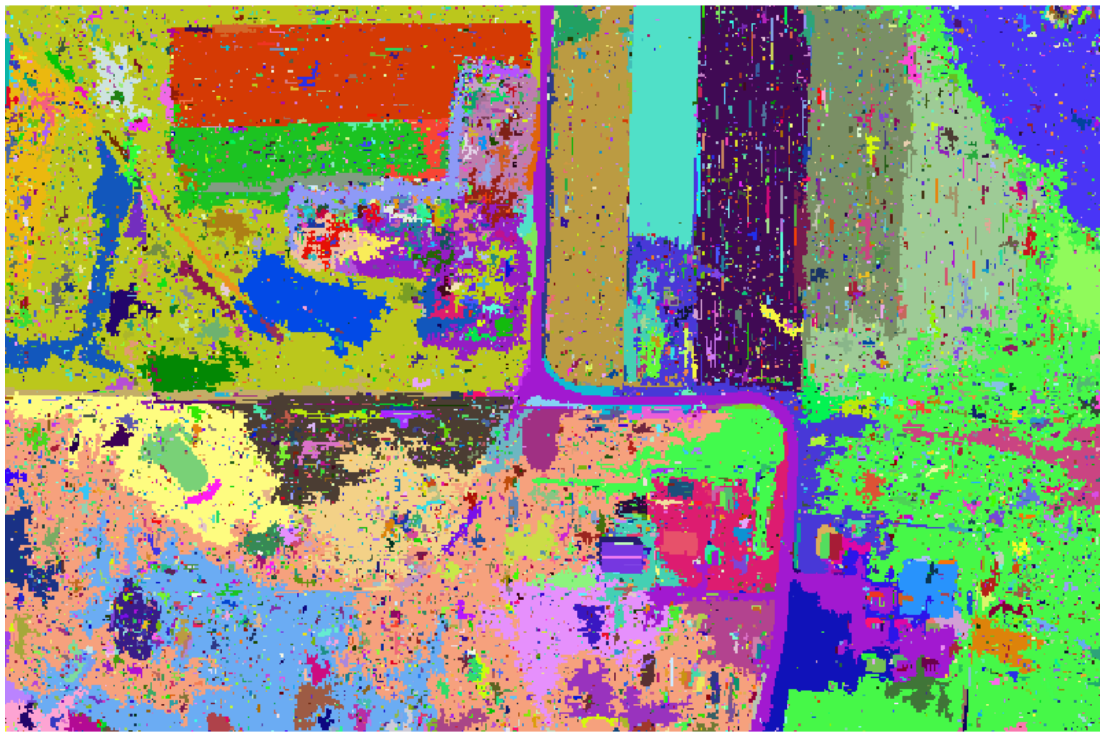
Harmonic analysis

Harmonic analysis through incomplete returned Fourier inversion.
Only long temporal wavelength return, r.hants (add-ons)
Local Maximum Fitting with Akaike Info Content, i.lmf (add-ons)



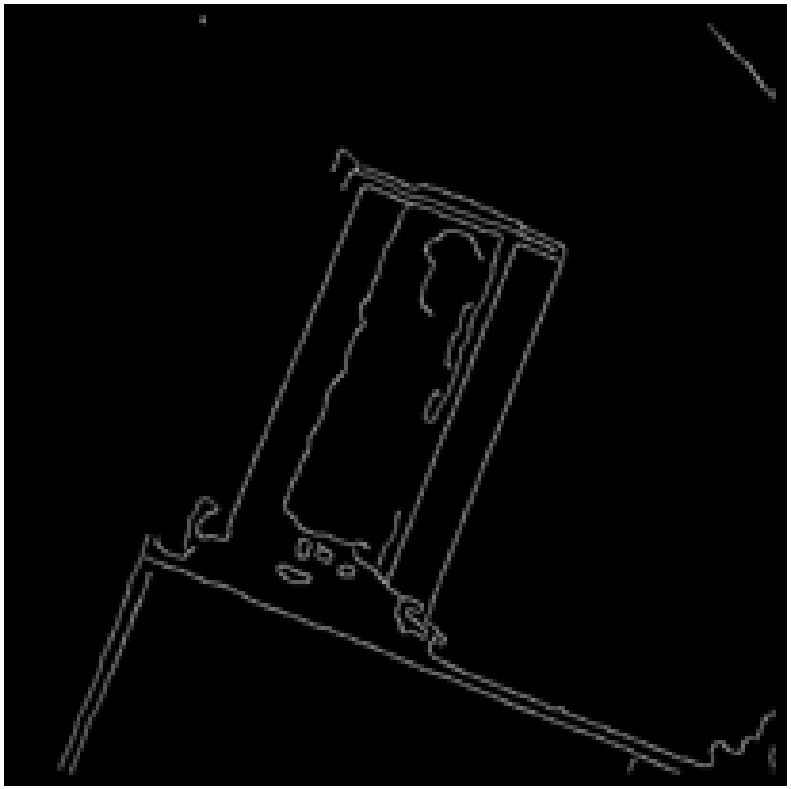
Object recognition

Segmentation of imagery by object based hierarchical tree classification, i.segment (main)



Canny

Edge detection by Canny filter (i.edge in add-ons)
Linear features extraction



Evapotranspiration

Reference/Potential ET: i.evapo.* modules (main)

- ETo Hargreaves
- ETo Penman-Monteith
- ETpot Priestley-Taylor

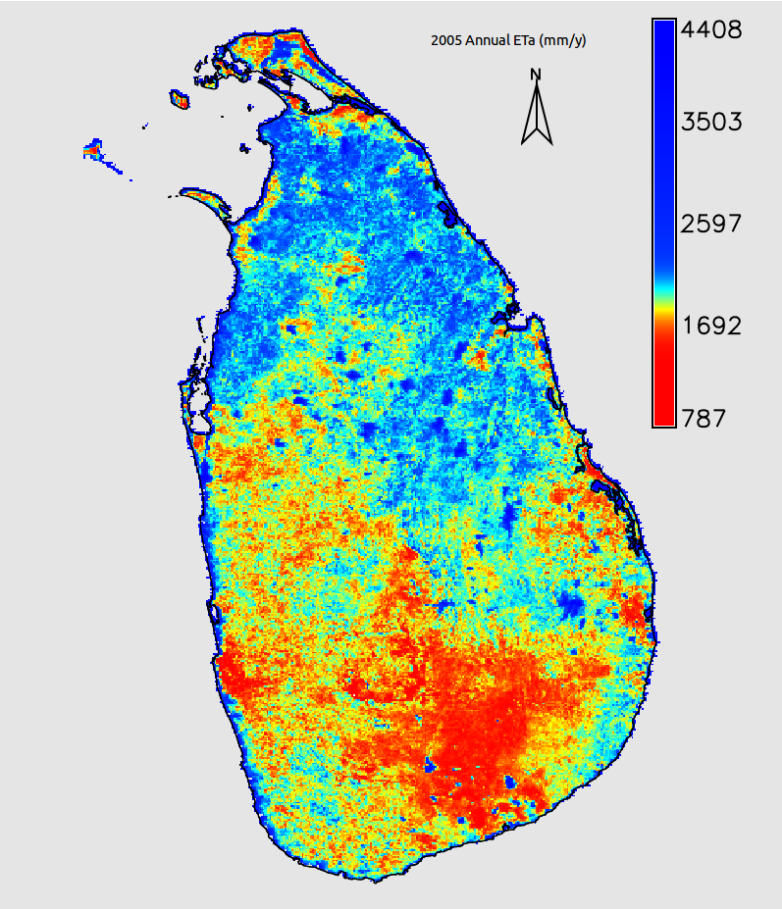
Actual ET: i.eb.* modules (main) using thermodynamic heat flux modeling,

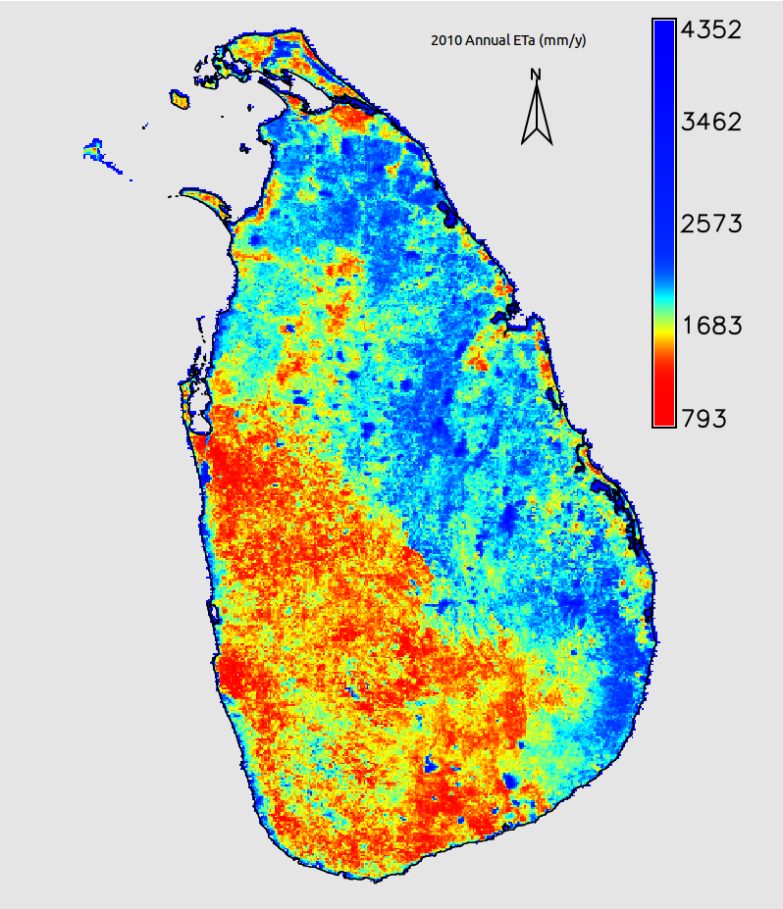
$$\Lambda = \frac{Rn - G - H}{Rn - G} \tag{1}$$

$$ET_a = \Lambda \, ET_{potential} \tag{2}$$

Evapotranspiration

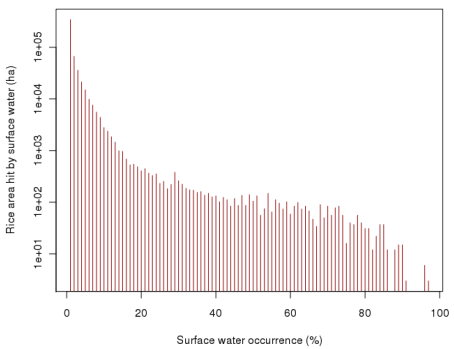
Actual evapotranspiration for water/agriculture monitoring and management.

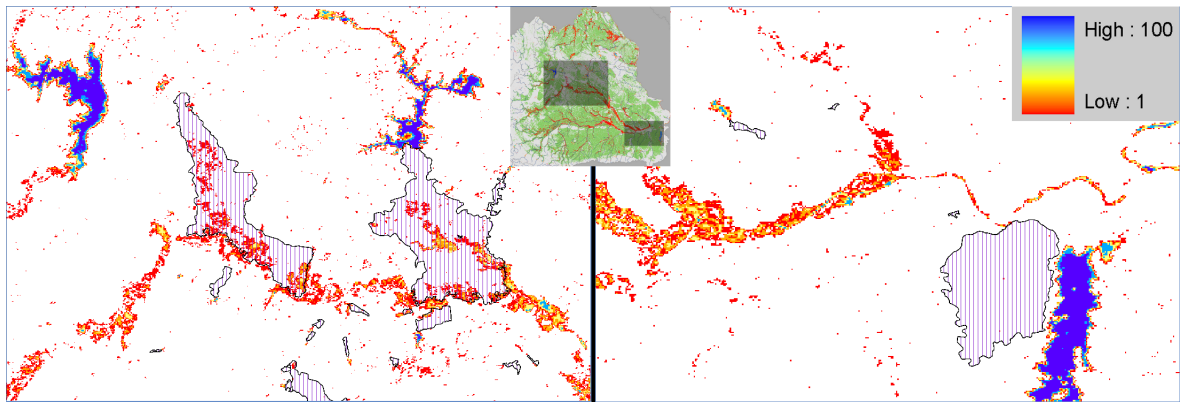




Water mapping

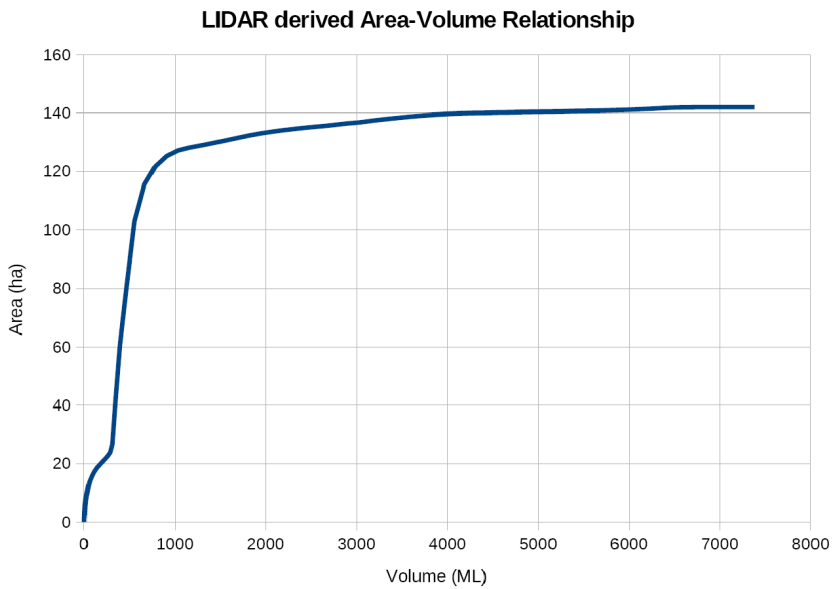
Repetitive open water mapping (i.wi, add-ons).
Probability of flood destruction on rice crop area in Thailand.

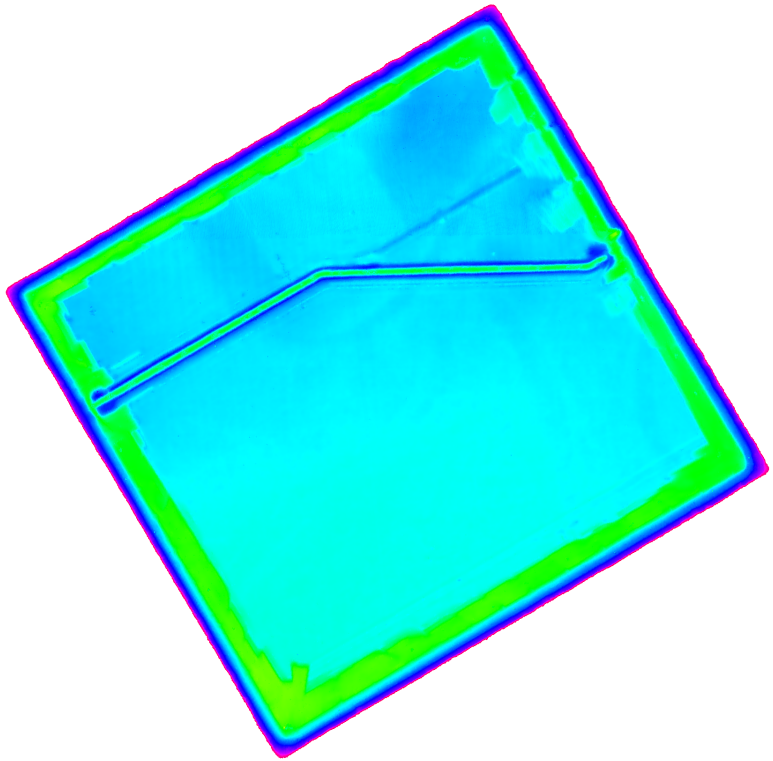




Lidar

Lidar reading library permits import into GRASS.
On-Farm-Water-Storage Lidar survey and Depth-Volume-Area surveying.





Chain processing

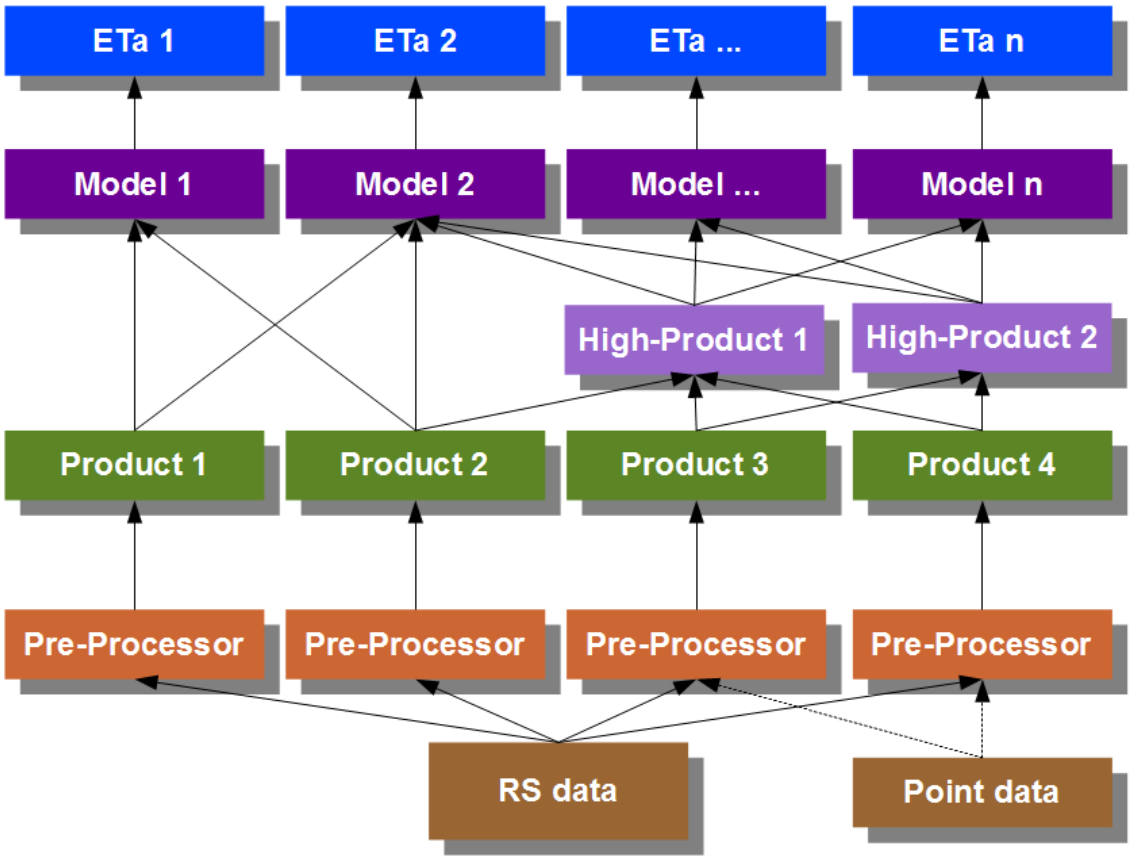
Chain processing has a fundamental impact on remote sensing work:

- Standardization limits bugs
- Less prone to human error
- Simpler parameterization access
- Permits to apply any number of modules to all target images
- Ensures maximum quality of generated images

Concept: META Module

Chain processing

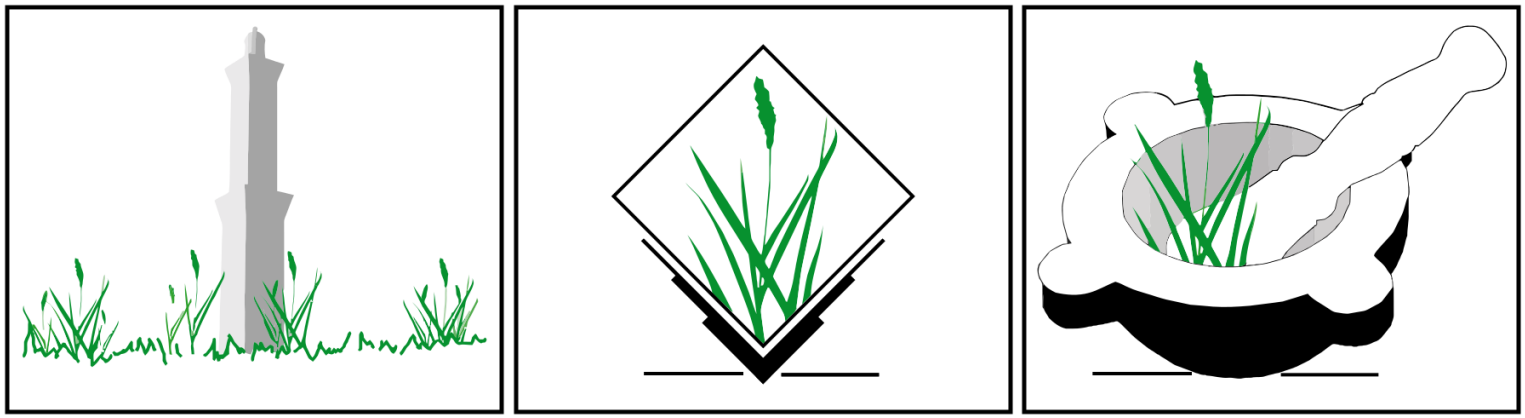
The development of pyGRASS is maturing,
Python and pyGRASS combined can generate META Modules.



Other related modules

- r.texture (main) for texture based statistic extraction
- r.flip (add-ons) for flipping images (i.e. netcdf climate grids)
- i.pansharpen (main) for spatial/spectral fusion
- i.evapo.* (add-ons) 3 models waiting for integration
- i.gravity (add-ons) for GRACE, GOCE, GRAIL (yesterday)

Thank You



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