HPC benchmarking of ET models with OSGEO tools

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April 11, 2013

Contents

Overview

Evapotranspiration is the largest transiting quantity in the daily hydrological cycle along with rain. It is used by scientists and managers in:

- Irrigation systems performance
- Crop water productivity
- Water accounting
- Wetlands-agriculture interface
- Basin water uses quantification
- Climate change on water cycle & users

Overview

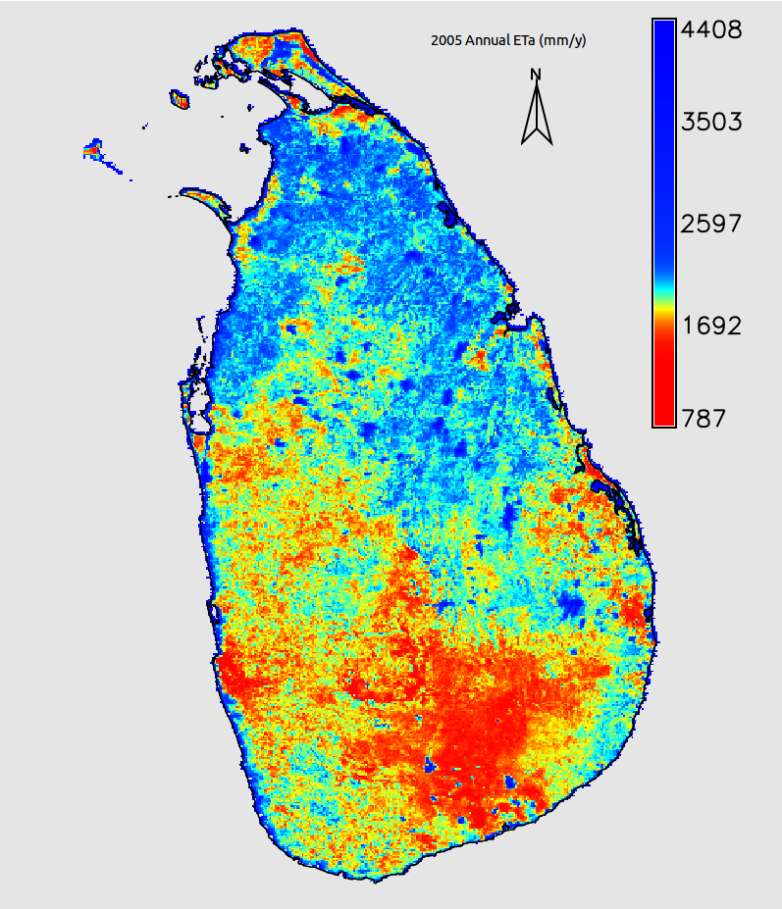
There are several types of evapotranspiration modeling methods:

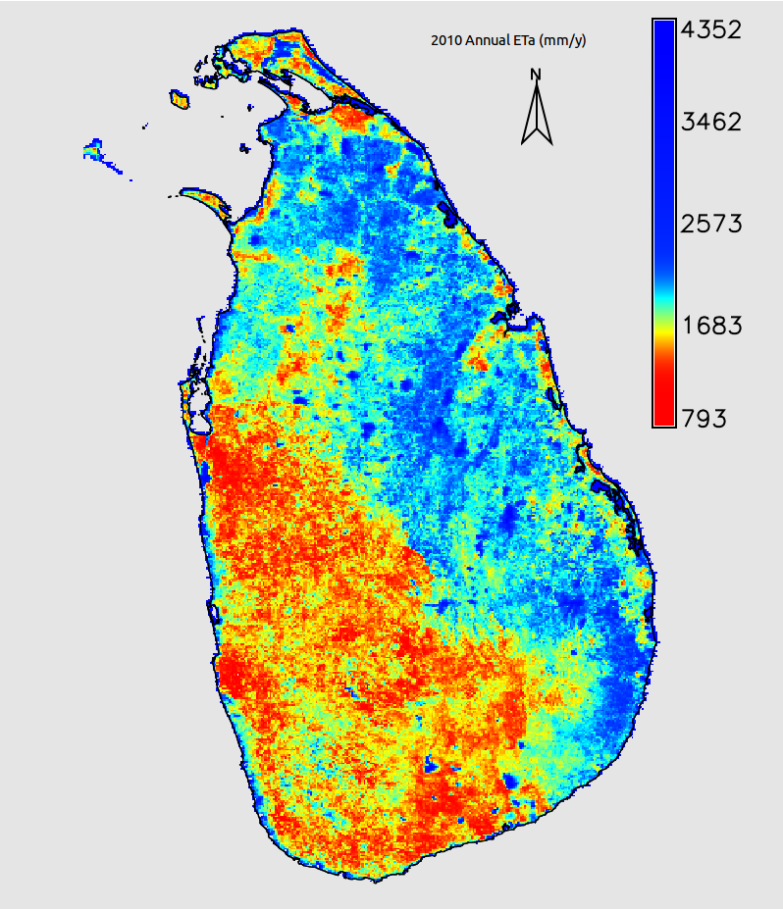
- Reference ET: Hargreaves, Penman-Monteith
- Potential ET: Priestley-Taylor, astronomical
- Actual ET: Thermodynamic/energy balance (mostly)

OSGEO tools

Evapotranspiration @ country level

Actual evapotranspiration (365 days integrated)
for water resources monitoring & management.

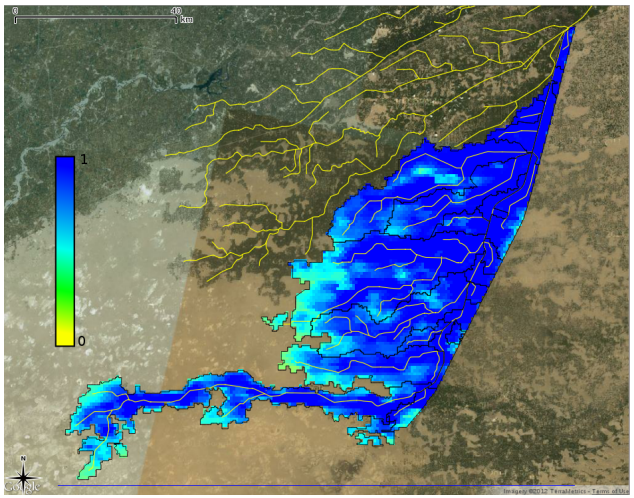


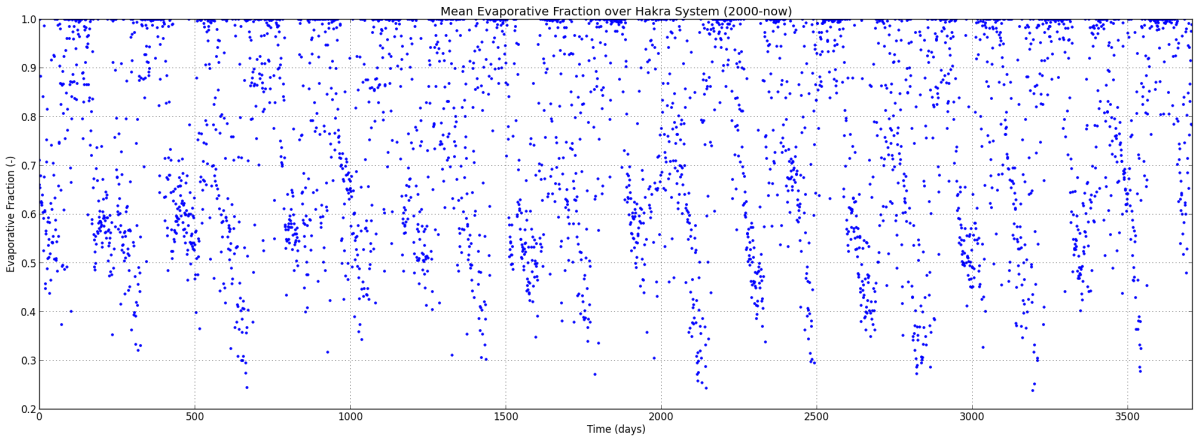


Equity of water use in irrigation systems

Irrigation water monitoring & management

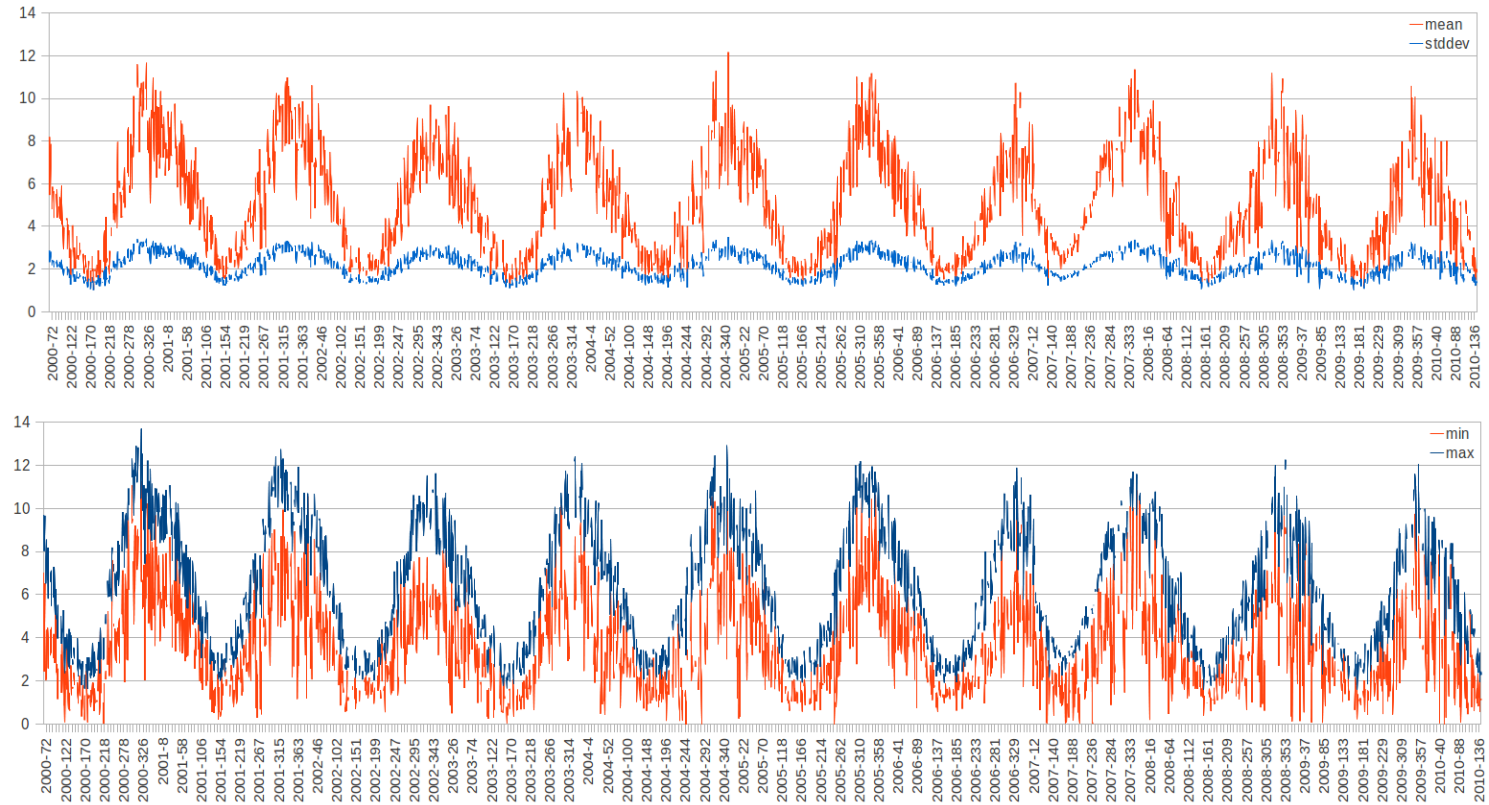
- Map: Uniform colour is equity of water distribution
- Graph: irrigation system equity in time (mm/d, daily, 12 years)





Crop water consumption in irrigation systems

Actual evapotranspiration (mm/d, daily, 11 years)
for agricultural water performance management.

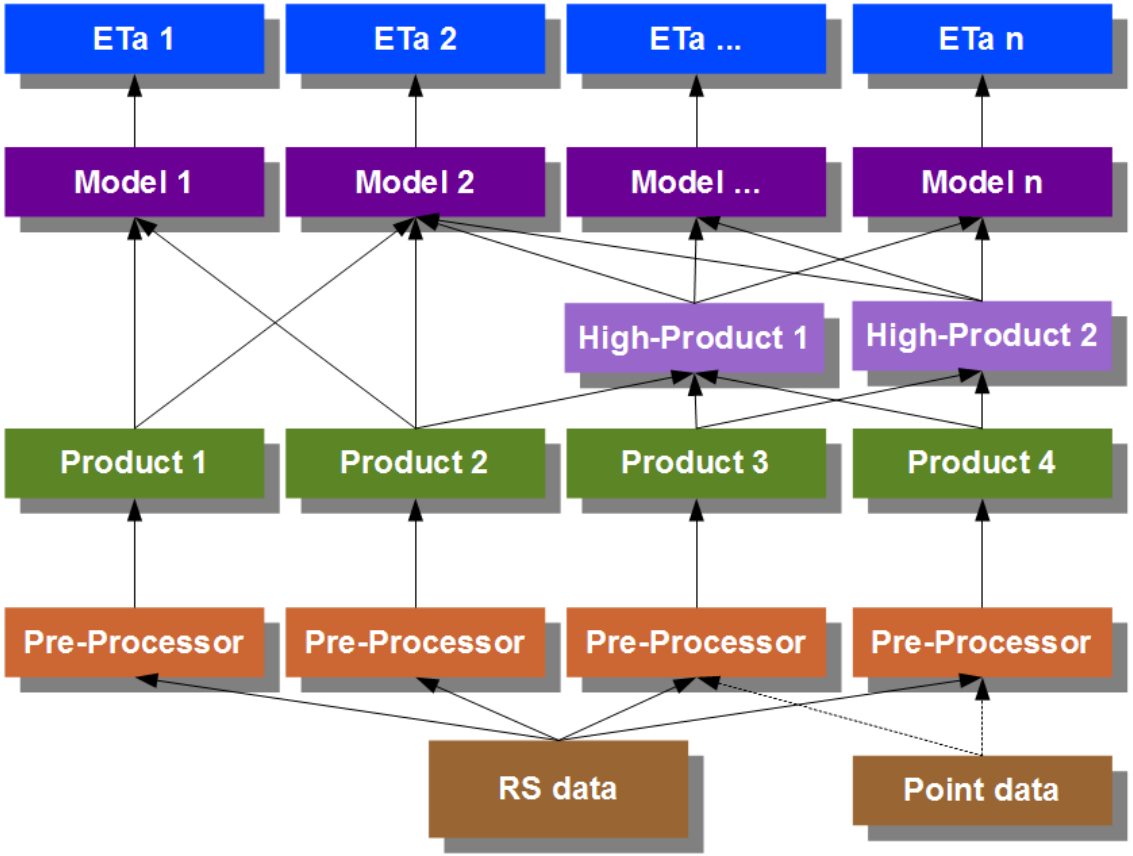


Chain processing

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

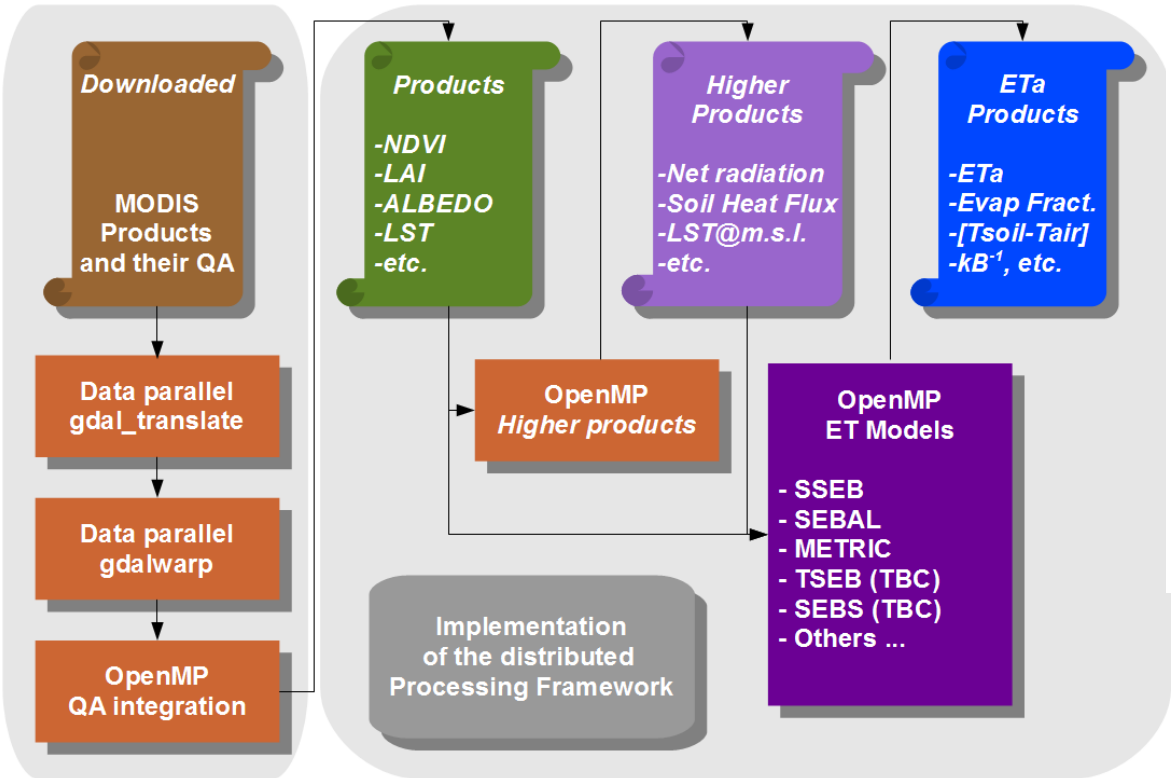
Blueprint



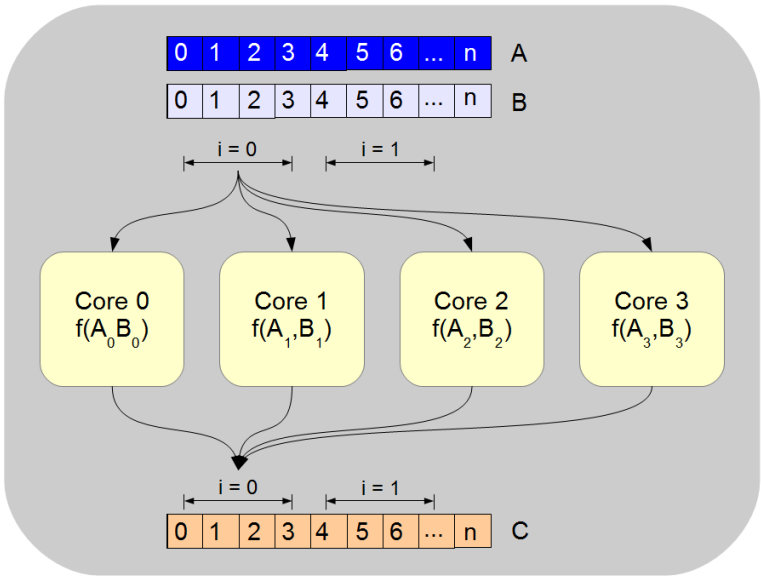
- GDAL+[C+OpenMP]
- GRASSGIS+pyGRASS+[C+OpenMP]

GDAL framework

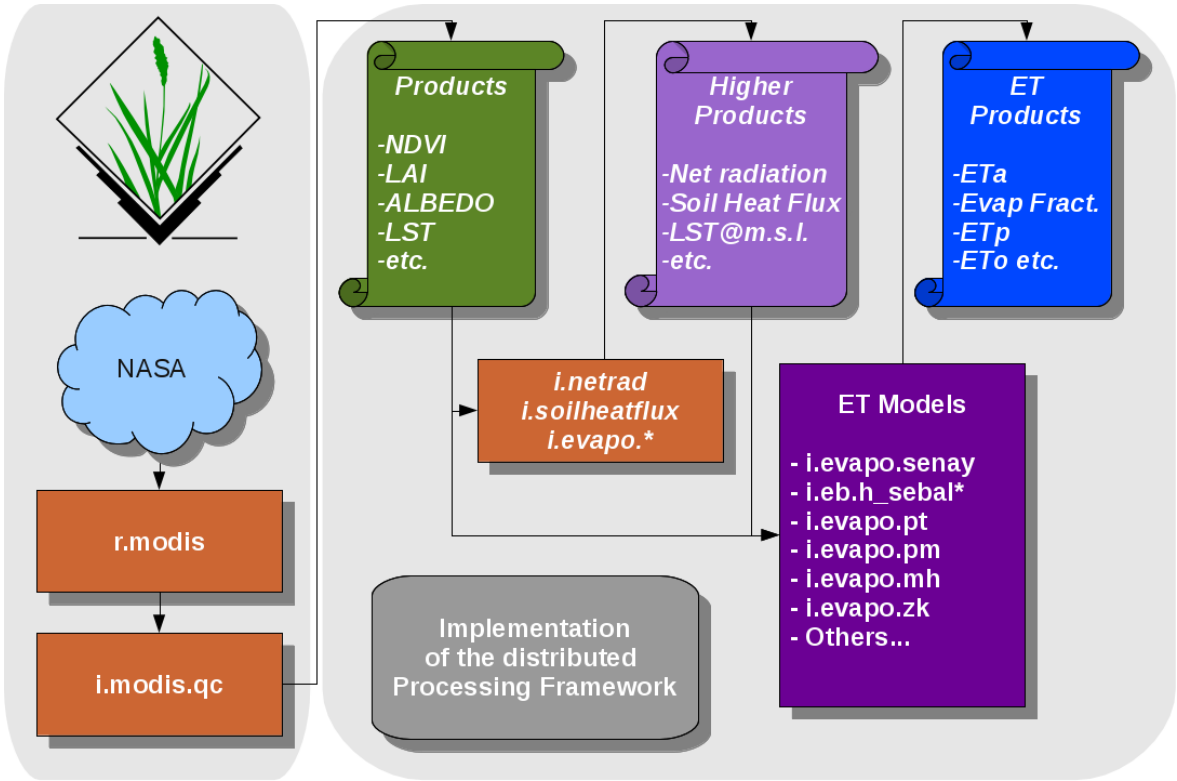
GDAL+[C+OpenMP]



OpenMP distribution



GRASS GIS framework

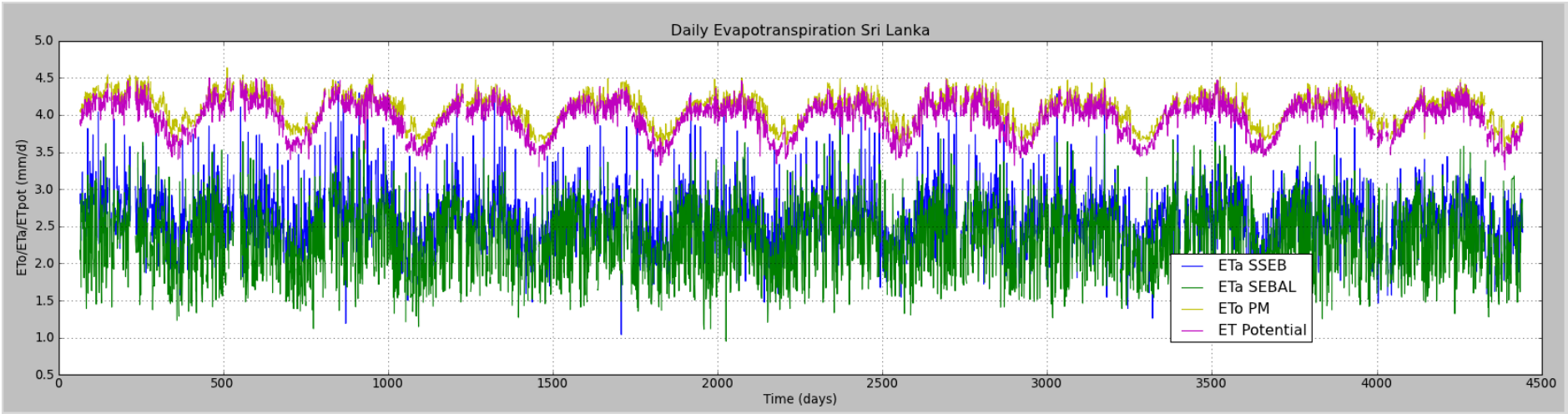


metaModule concept

pyGRASS: vertical integration of GRASS GIS modules
GRASS GIS modules: [C+OpenMP]

Initial results

Average ET for Sri Lanka, Daily 2000-2012 (mm/d, daily, 12.3 years)



Comparison

- ETo & ETpot (rad) are similar, expected.
- ETa models are not so similar, expected.
- ETo & ETpot (rad) are higher than ETa models, expected.

Conclusions

Distributed ET models benchmarking setup with OSGEO tools

- **GDAL:** C+OpenMP, core-based scaling
- **GRASS GIS:** pyGRASS for metaModule, C+OpenMP inside modules
- **Targets (1):** MODIS (Terra/Aqua), Landsat (all), Aster
- Points of comparisons are internal and main outputs

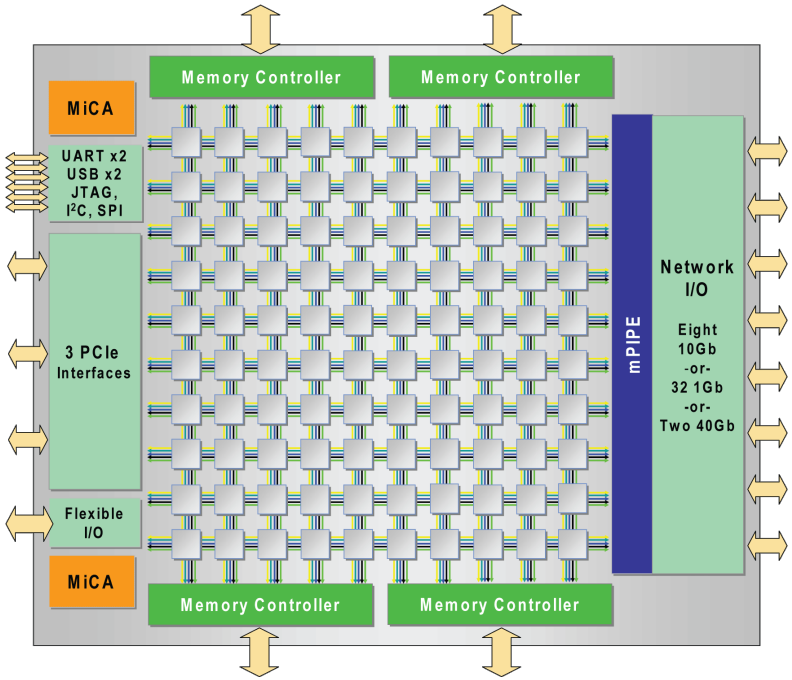
Thank You

Outlooks

- **Crunch (1):** Multi-GPU distribution (OpenCL, CUDA)
- **Crunch (2):** Multi-CPU distribution (MPI)
- **Think (1):** TSEB to test/fix
- **Think (2):** SEBS to complete
- **More (1):** ETLook to digest and code
- **More (2):** MODIS and Landsat archives under close pipe distance?

128-cores Tilera

64-core Tile-GX



Dual Tile-GX on 1/2 rack board