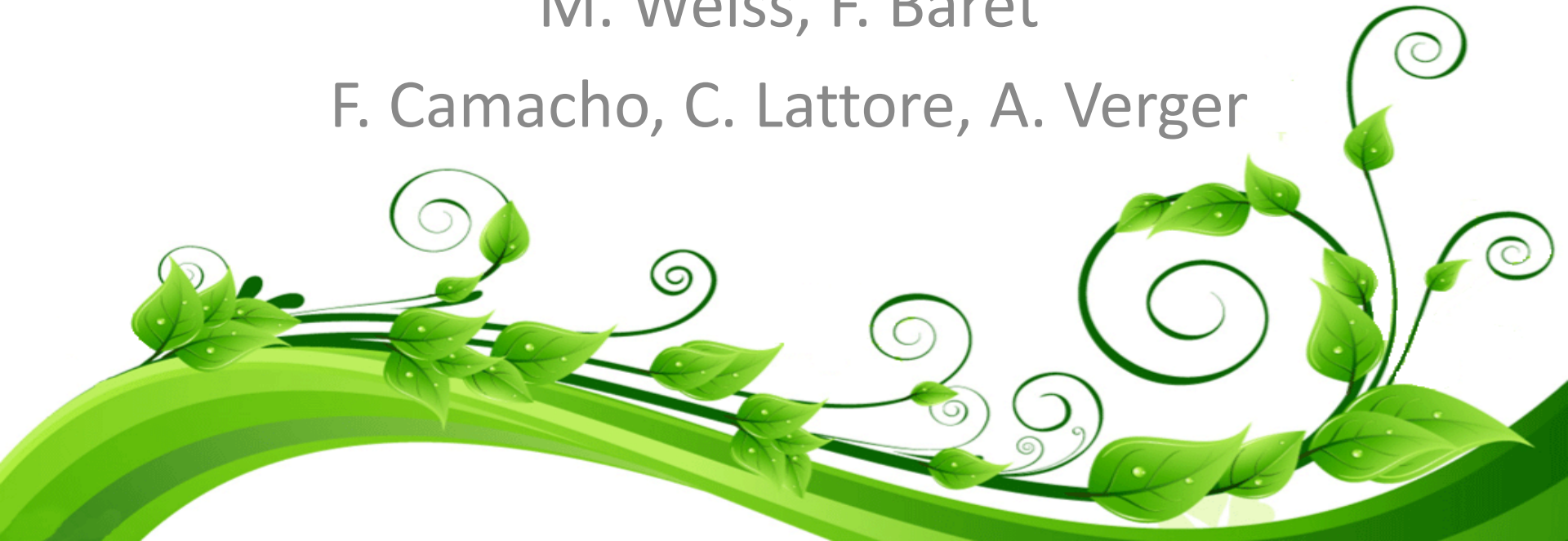# BELMANIP2:

Enhancement of CEOS BELMANIP ensemble of sites used for global land product validation

M. Weiss, F. Baret

F. Camacho, C. Lattore, A. Verger
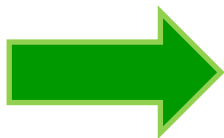
What is validation?

"the process of assessing, by independent means, the quality of the data products derived from the system outputs" (CEOS-LPV)

Ultimate goal :

- **Evaluate product accuracy (confidence intervals)**

- **Everywhere: continental surfaces ≈ 3.10^8 pixels per date**

- **At any time: 8-10 days revisit frequency**

➡ **Sampling strategy required**

Validation in the real world

Ground Truth Validation DIRECT	Product Inter-comparison BELMANIP
Poor spatial sampling Poor temporal sampling	No limitation on spatial sampling Same temporal sampling as the product

Accuracy Estimation
    Accuracy of ground measurement?
    Spatial footprint?
	Consistency estimation
	    Spatial patterns
	    Vegetation cycle
	    No error quantification

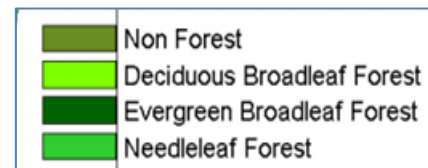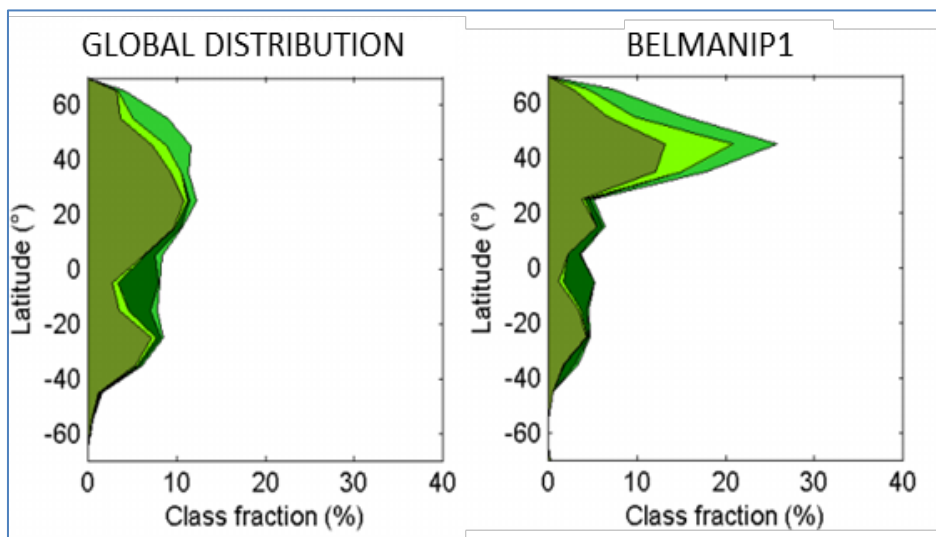**Both are required to optimize the validation process**

BELMANIP History

**BEnchmark Land Multisite ANalysis
and Intercomparison of Products**

🍃 **Baret et al, 2006: BELMANIP1, 3x3km^2**

- 🍂 **Gathered sites from other initiatives: FLUXNET, AERONET, DIRECT validation (295 sites)**

- 🍂 **Completed by manual selection (76 sites) using the ECOCLIMAP land cover (Masson et al, 2003)**

BELMANIP1 Drawbacks

- **Some sites inadequate**
  - AERONET: sites very close to large urban areas
  - FLUXNET: sites with topography, not always homogeneous at 3km by 3km
- **Over-representation of high latitudes**
- **Under-sampling of grasslands and evergreen broadleaf forests**

BELMANIP2 requirements

- **Large enough to represent the Earth surface in terms of product variability**
  - **Vegetation type**
  - **Climatic conditions**

- **Limited number of sites (make the result analysis possible)**

- **No topographic effects (flat sites)**

- **Minimize the presence of urban areas and water bodies**

BELMANIP2 requirements

Site size

- Small enough to be homogeneous (at the km scale) and large enough to take into account PSF and geometric inacurracies (scatterplots)

- Large enough to compute statistics (missing data, temporal smoothness, stability)

  3 considered sizes: 3x3km², 10x10km², 49x49km²

Lessons learned from first validation exercises

- Noisy data for EBF => number of EBF sites increased
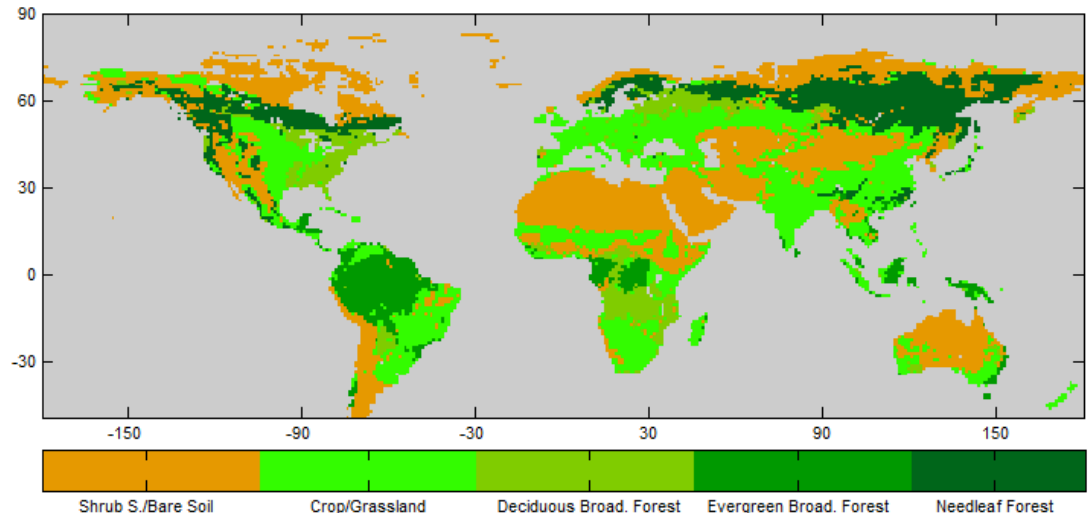- High range of bare soils => increase the number of bare oils

Building BELMANIP2

GLC-2000 classification: 22 classes reduced to 7

- **Forests: evergreen broadleaf forests (EBF), evergreen needleleaf forest (ENF), deciduous broadleaf forests (DBF)**
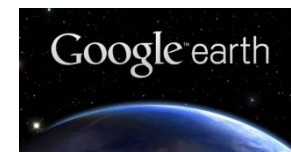
- **Crops, grasslands**

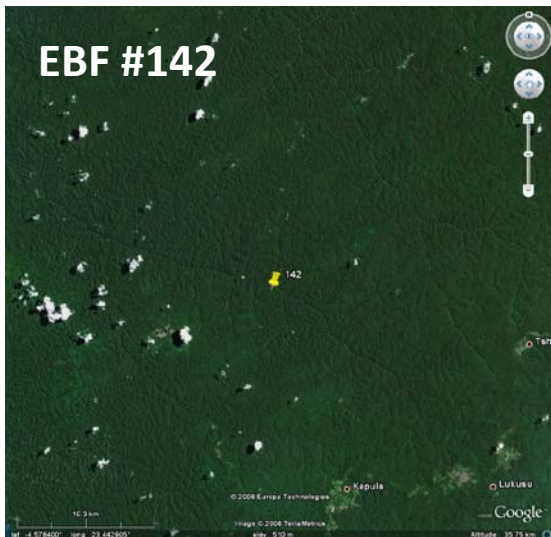- **Shrublands, bare soils**

- **Other (urban area, water)**

Building BELMANIP2

🍃 **Divide the globe into**

    🍂 **3 latitudinal bands**

    🍂 **14 longitudinal bands**

🍃 **Randomly Select 10 « homogeneous » sites (biome type) per cell (10kmx10km)**

🍃 **Manual check each site using**

(homogeneity, urban & water, topography)

Building BELMANIP2

Grassland #265 · Bare Soil #361 · Crops #403 · EBF #142 · ENF #96 · DBF #145

Representativity (Biome,3x3km²)
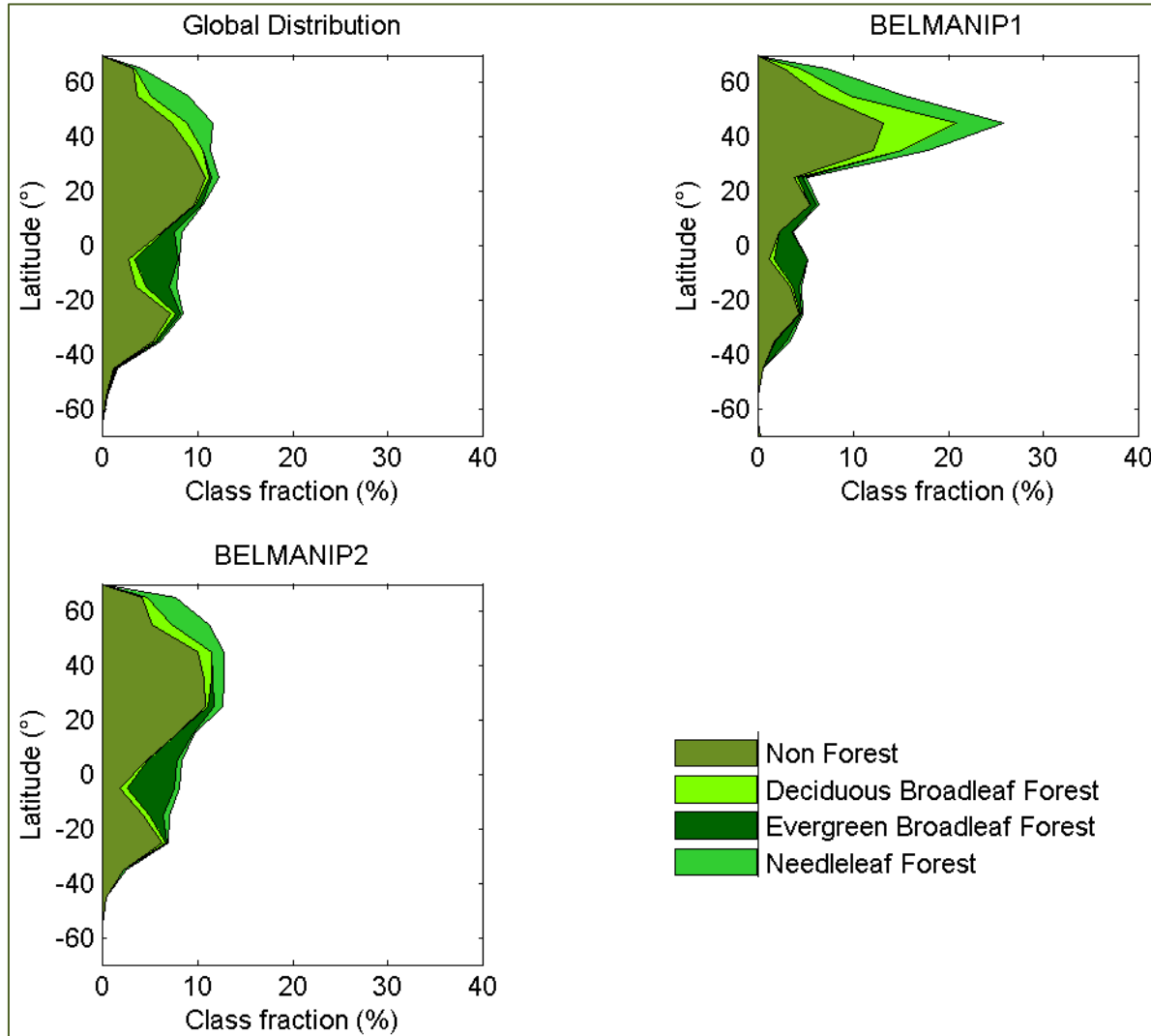
Significant improvement with BELMANIP2

Representativity (LAI)
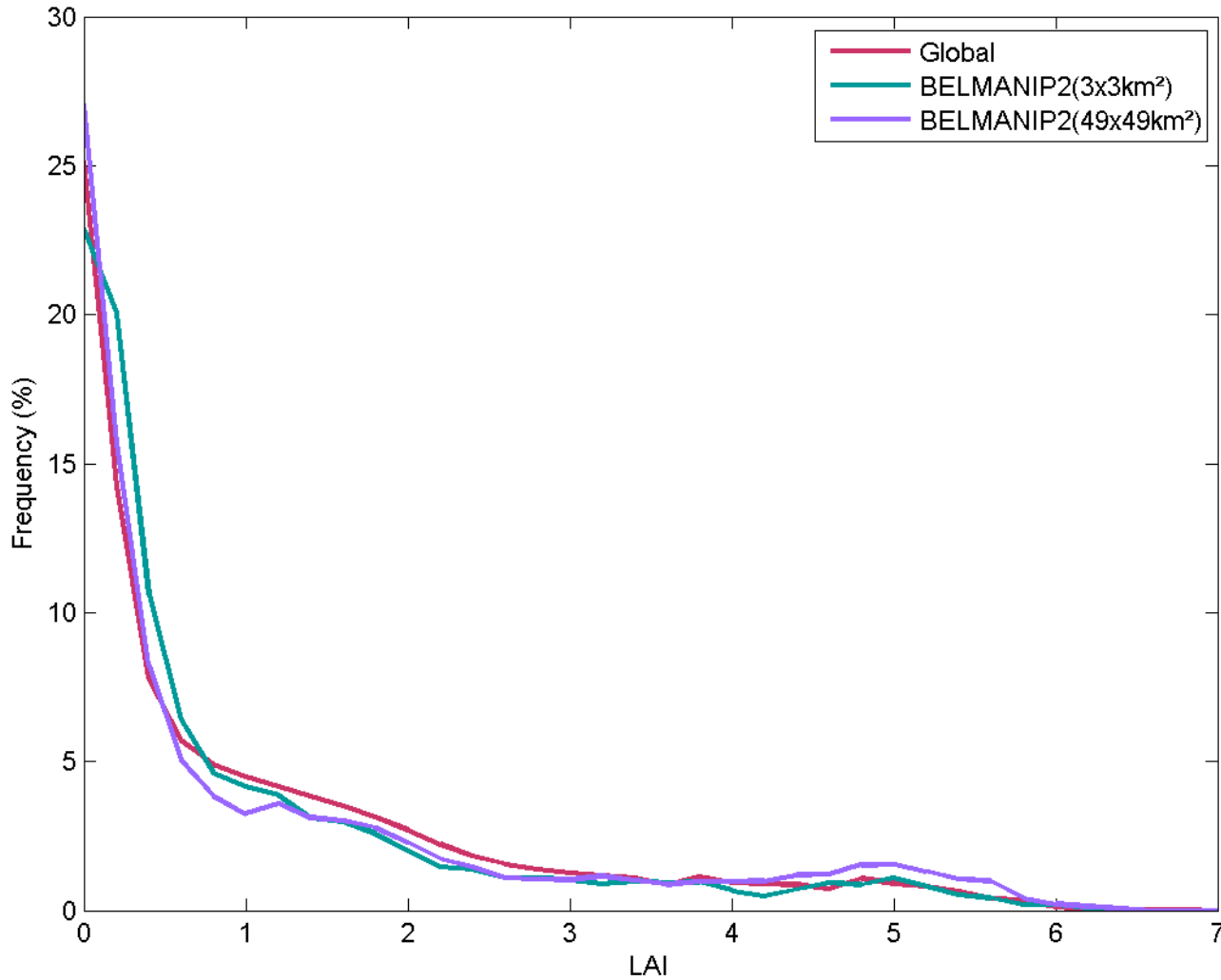
GEOLAND product
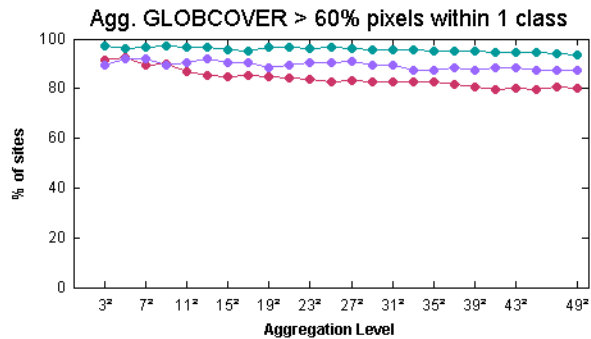Year 2004

LAI distribution
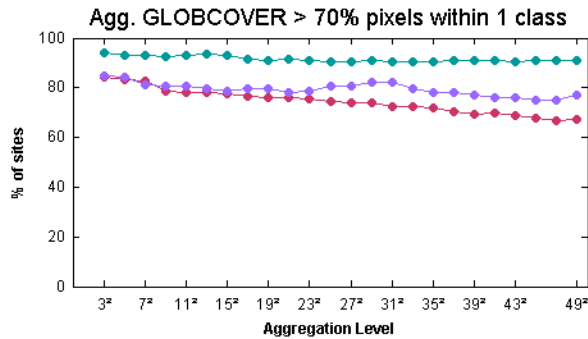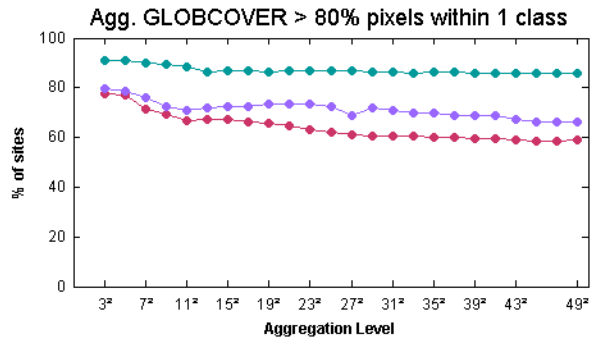respected
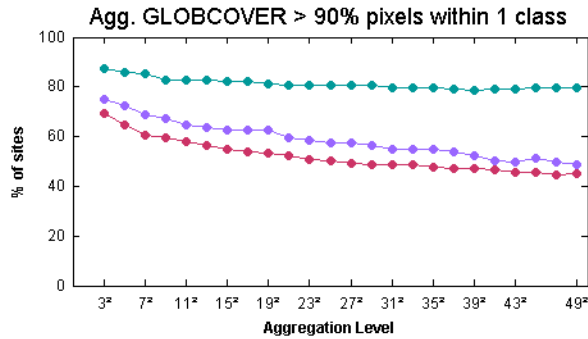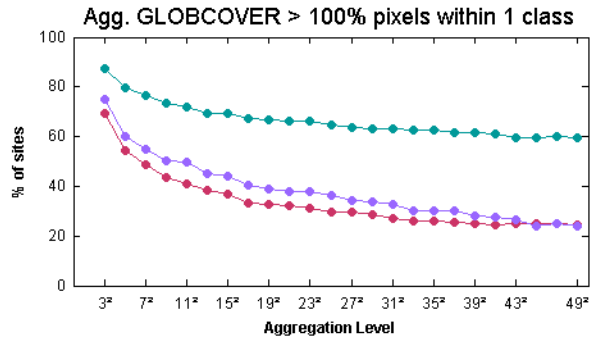
Site homogeneity (land cover)

🍃 **Evaluation with GLOBCOVER (300m)**

🍂 **22 initial classes aggregated in 6**

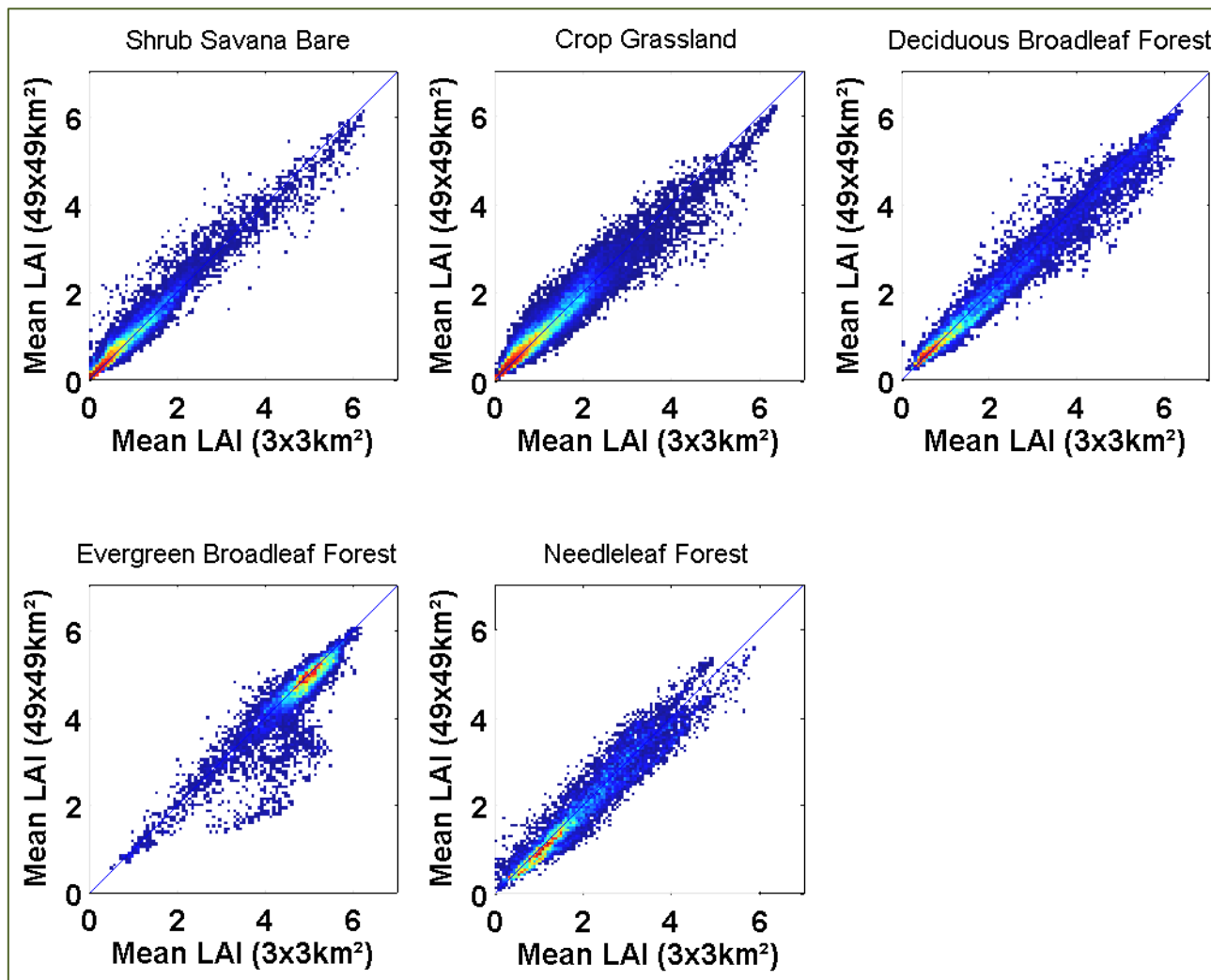🍂 **Degree of homogeneity = % pixels belonging to the main class**
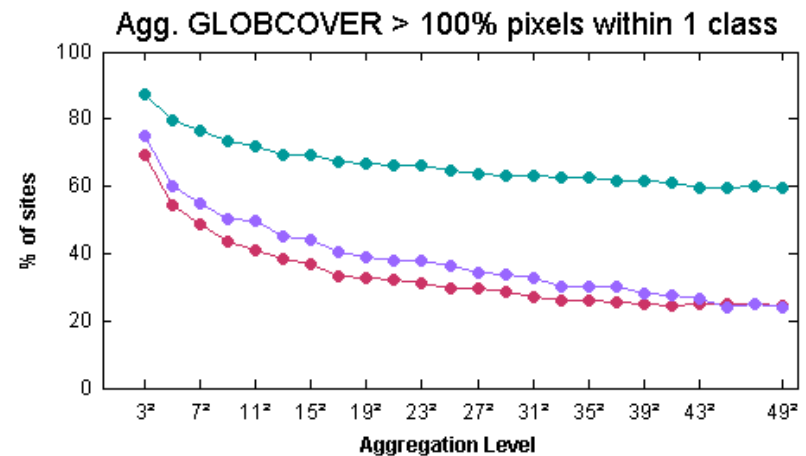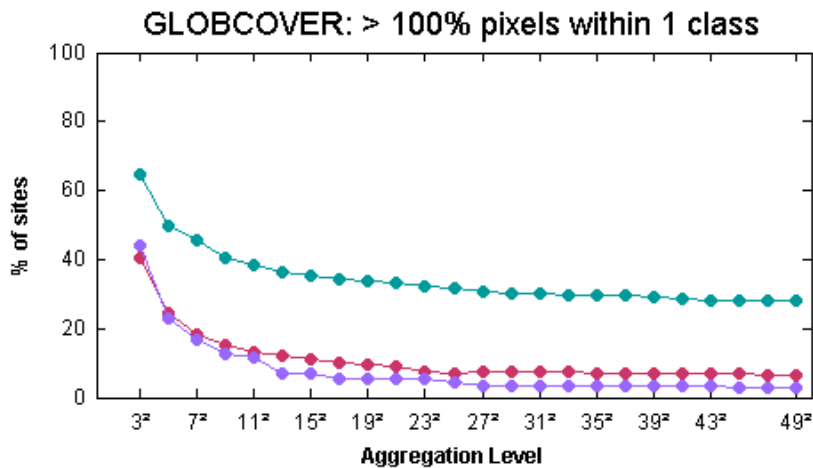
Site homogeneity (land cover)
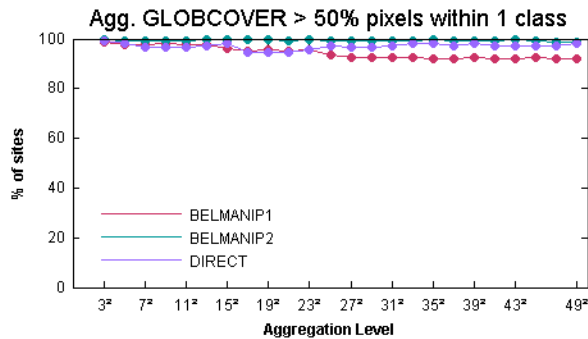
Better performances for BELMANIP2

Site homogeneity (LAI)

1998-2012

GEOLAND (V1)

Conclusion

- BELMANIP2 improved
  - Biome representativity
  - Site Homogenity

- BELMANIP2 implemented in validation exercises
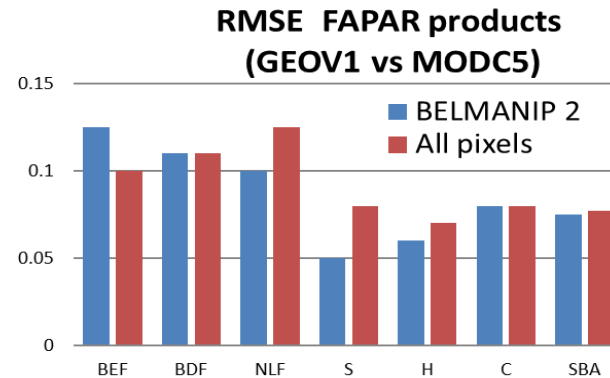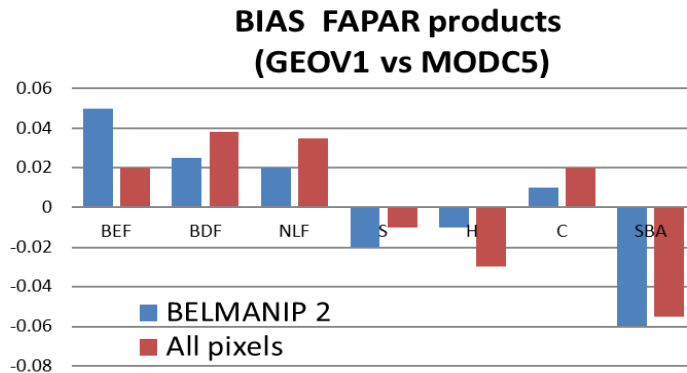 - CEOS-LPV initiative:
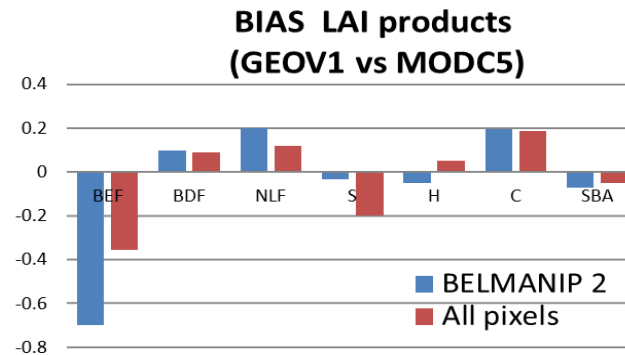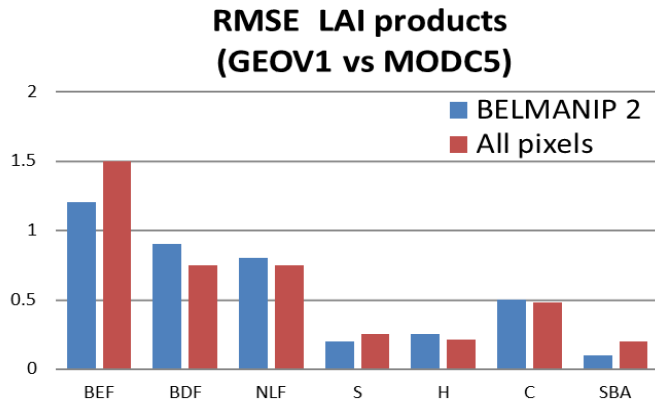   OLIVE/calvalportal.ceos.org/web/olive/
    Weiss et al, 2014 (Remote Sensing)

  - Imagine geo2land

Conclusion

Inter-comparison exercise: globe vs BELMANIP2

BELMANIP2 dataset