

CEOS LAND PRODUCT



SUBGROUP REPORT

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WGCV Plenary London June 2007

LPV outline



- Subgroup administrative issues
 - goals and objectives
- LPV accomplishments
 - Web site initiated and maintained
 - Report from Davos March 2007 LPV meeting
- Future
 - Preparation of a global validation exercise publication
 - Future meetings
 - Contribution to GEO/GEOSS

Products considered



- Land_cover (including change detection)
- Fire (active/ scars)
- Energy (LST/ albedo/ PAR/ SWR/ LWR)
- Vegetation (LAI/ fAPAR/ fCover/ VIs/ biomass)
- Soil (moisture, soil type ...)

Higher level products not yet considered
(Evapotranspiration, Net Primary Productivity, ...)



GODDARD SPACE FLIGHT CENTER

+ NASA Homepage

CEOS WORKING GROUP ON CALIBRATION & VALIDATION Land Product Validation Subgroup

Committee on Earth Observation Satellites

Home Landcover Biophysical Fire/Burn Surface Rad



Announcing...

- ◆ **CEOS/LPV Workshop on LAI and FAPAR Product Validation, Mar. 15, 2007, Davos, Switzerland.**
- ◆ **Review the ESDR White Papers developed for the NASA Land Measurement Team**
- ◆ **IEEE TGRS Special Issue on Land Product Validation available**
- ◆ **CEOS Publication Global Land Cover Validation: Recommendations for Evaluation and Accuracy Assessment of Global Land Cover Maps**
- ◆ **Workshop: Validation of global vegetation indices and their time series, Aug. 7, 2006.**
- ◆ **Meeting: Long term global monitoring of vegetation variables using moderate resolution satellites, Aug. 8-10, 2006.**

Subscribe!



LPV Mission

To foster quantitative validation of higher-level global land products derived from remote sensing data and to relay results so they are relevant to users

Validation is the process of assessing, by independent means, the quality of the data products derived from the system outputs

Background

The subgroup on Land Product Validation (LPV) is one of six subgroups of the Working Group on Calibration and Validation (WGCV), which itself is one of two standing working groups within the Committee on Earth Observation Satellites (CEOS, see also CEOS structure). The six WGCV subgroups are:

- ◆ Infrared and Visible Optical Sensors (IVOS)
- ◆ Atmospheric Chemistry (AC)
- ◆ Microwave Sensors (MS)

Previous workshops



- 1) [First Workshop - LAI Intercomparison](#)
7-8/6/2001 ESA Frascati, Italy
- 2) [CEOS/WGCV Land Product Validation Workshop on Surface Albedo](#)
Boston University
Boston, MA USA
10/23/2002 - 10/24/2002
- 3) [CEOS LAI Intercomparison Activity Results](#)
16/8/2004 University of Montana, Missoula, MT USA
- 4) [Global Vegetation Continuous Fields \(VCF\) Validation Workshop](#)
27-28/10/2005 Geographic Information Science Center of Excellence
Brookings, SD USA
- 5) LPV workshop on albedo
April 27-28, 2005, Vienna, EGU
Reported in NASA EOS "Earth Observer"
http://eospsso.gsfc.nasa.gov/eos_observ/pdf/May-Jun05.pdf
- 6) LPV workshop on long-term VI record
Aug 7, 2006 University of Montana, Missoula Montana
Reported in NASA EOS "Earth Observer"
http://eospsso.gsfc.nasa.gov/eos_observ/pdf/Nov-Dec06.pdf
- 7) Long term global monitoring of vegetation variables using moderate resolution satellites
Aug 8-10, 2006 University of Montana, Missoula Montana
Accepted to AGU's EOS Transactions
Presentations and posters from both meetings are posted on-line at
[//www.ntsg.umn.edu/VEGMTG/](http://www.ntsg.umn.edu/VEGMTG/)
- 8) LPV workshop on LAI and fAPAR products March07
Presentations on line at the LPV site. Report to be submitted to NASA EOS Observer

LPV Davos meeting: Report

The workshop was attached to the ISPMSRS,
Davos 12-14 March 2007

The LPV workshop on LAI and fAPAR products

Ms	Anne	Schmidt	Alterra	Centre for Geo-Information	Netherlands
Mr	Philippe	Rossello	INRA	Climat, Sol et Environnement	France
Ms	Miina	Rautiainen	Tartu Observatory	--	Estonia
Mr	Jose A.	SOBRINO	UNIVERSITY OF VALENCIA	Earth Physics and Thermodynamics	Spain
Mr	Michael	STEVEN	University of Nottingham	School of Geography	United Kingdom
Mr	Jean-Luc	WIDLOWSKI	Joint Research Centre	IES/GEM	Italy
Mr	Jan-Peter	Muller	University College London	Space and Climate Physics	United Kingdom
Mr	G�rard	Dedieu	CNES	CESBIO	France
Mr	Bernard	Pinty	JRC	IES- GEM unit	Italy
Mr	Richard	Fernandez	Natural Resources Canada/ Govt. of Canada	Canada Centre for Remote Sensing	Canada
Mr	Frank	Veroustraete	Flemish Institute for Technological Research	Centre for Remote Sensing and Earth Observation	Belgium
Mr	Allard	de Wit	Wageningen-UR	Centre for Geo-information	Netherlands
Mrs	Gabriela	Schaepman-Strub	Wageningen UR	Nature Conservation and Plant Ecology	Netherlands
Mr	Fr�d�ric	Baret	INRA	INRA-CSE, UMR1114	France
Mr	Christoph	Borel	Christoph Borel	Advanced Geospatial Intelligence group	United States
Mr	Edward	Milton	University of Southampton	School of Geography	United Kingdom
Mr	Alemu	Gonsamu	university of helsinki	geography	Finland
Mr	Jan	Pisek	University of Toronto	Department of Geography and Program in Planning	Canada
Mrs	Yuan	Zeng	Wageningen University and Research Center	Center for Geo-Information	Netherlands
Mr	Raul	Zurita-Milla	Wageningen University	Centre for Geo-Information	Netherlands
Mr	Jochem	Vernelst	Wageningen University	Centre for Geo-Information, Wageningen University	Netherlands
Ms	Lucie	Homolova	Academy of Sciences of the Czech Republic	Institute of Systems Biology and Ecology	Czech Republic
Mr	Kai	MA	INRA d'Avignon,France	Unit� Climat, Sol et Environnement (CSE)	France

23 participants from different countries...

... but missing asian actors

Agenda

Ongoing direct validation activities

VALERI activities at the Järvelja test site

Ground validation activities and processing within VALERI (Part I)

LAI and fAPAR validation under CEOS/LPV-VALERI

M. Rautianen
P. Rossello
F. Veroustraete

Sample results from direct validation activities

Validation of fAPAR products derived from optical sensors: method and results

A proposed method for products validation

From validation to calibration from ground measurements

Assessment of FVC and LAI ground measurement's uncertainties and estimation of reference maps for the validation of LSA SAF products over the Barrax cropland area

B. Pinty
F. Baret
R. Fernandes
A. Verger

Methodological aspects: Ground measurements

Definition of LAI and fAPAR variables

Sample results for LAI estimates from Hemiphotos and CAN_EYE

Minimum footprint size for fAPAR measurements

PAR@METER devices for LAI and fAPAR measurements

Field activities in VALENCIA Anchor Station, July 2006

Report of the NCAVEO VALERI campaign, June 2006

Discussion on the main issues in ground measurements

- The clumping problem
- Woody element problem
- Understory problem
- Setting up a benchmark for indirect measurements?

F. Baret
F. Baret
J-L. Widlowski
F. Baret
A. Verger
T. Milton

Methodological aspects: Transfer functions and upscaling

Selection of transfer functions in VALERI processing and sampling scheme (Part II)

Estimating the product PSF

Global mapping of foliage clumping index using POLDER-1, POLDER-3 multi-angle satellite data

Discussion on the main issues in ground measurement

- Accounting for uncertainties
- Temporal interpolation
- Evaluation of uncertainties

General discussion

- Contribution to GEO/GEOSS task
- Getting closer to the carbon community in a synergistic way
- Funding of activities
- Organization and dissemination of the data

P. Rossello
F. Baret
J. Pisek

Current Validation activities



Estonia : (Jarvelsja, mixed forest): Estonia, Finland, VALERI

VALERI: (Africa (2) Europe (2) South america (1)

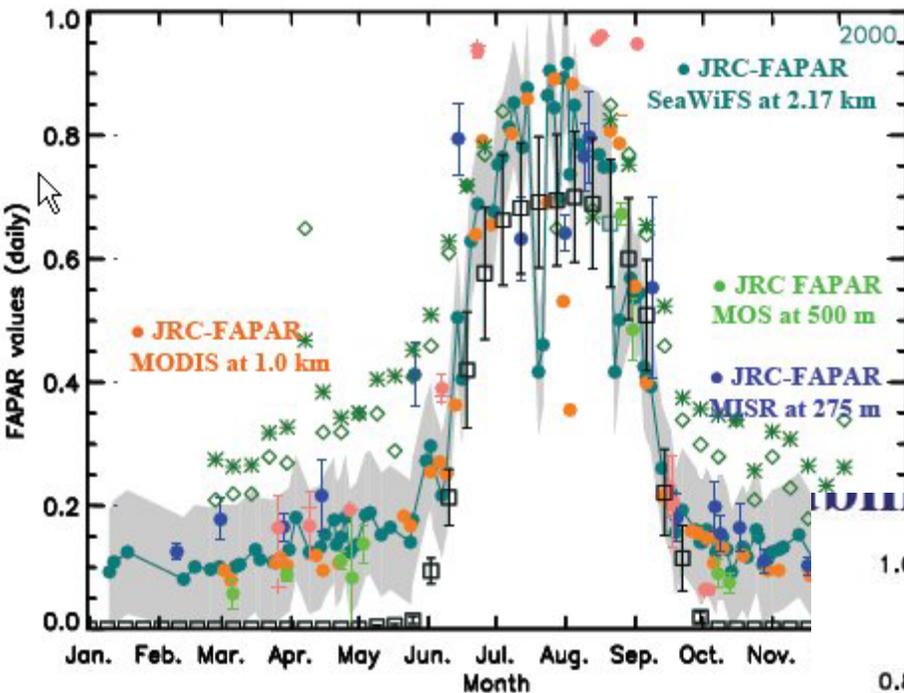
China: (2 sites: belgium (VITO)-China)

England: NCAVEO (crops)

Spain: (Valencia Anchor station, Univ. Valencia, EOLAB) crops

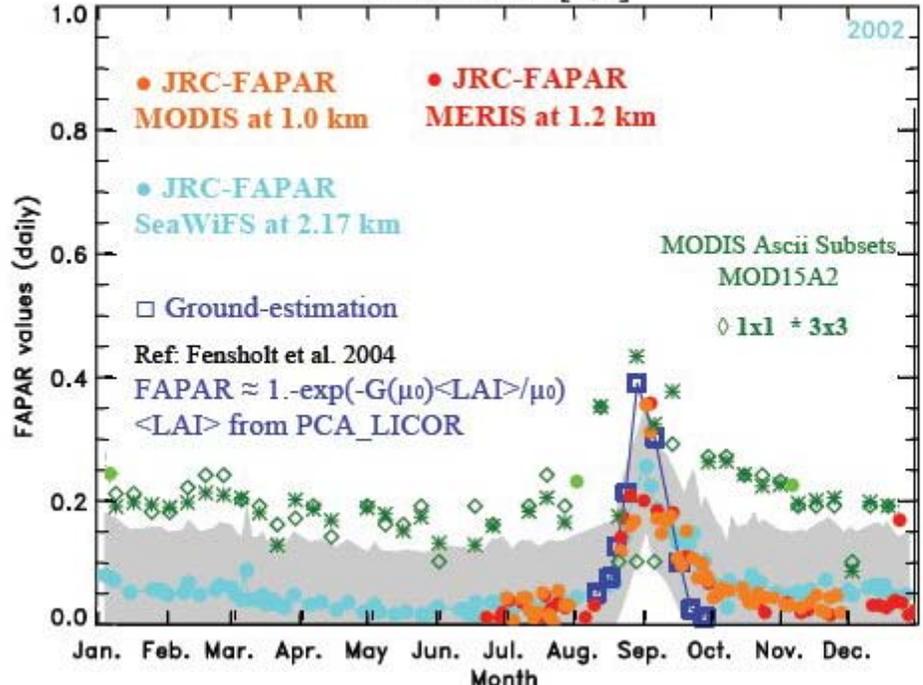
Canada: (CCRS: boreal forest, crops)

Sample results: JRC



2000

Dahra_North [1,1] F06_0019



Sample results: JRC



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Conclusions

A multi-faceted **protocol for validation** has been applied to the JRC-FAPAR products using various medium resolution optical sensors (MERIS, MODIS, MISR and SeaWiFS).

- Assessment of the **verisimilitude** of the products based on multi-year time series
- performance of the physics of the algorithm which gives **quite similar results from various sensors**.
- Comparison against **ground-based estimations**

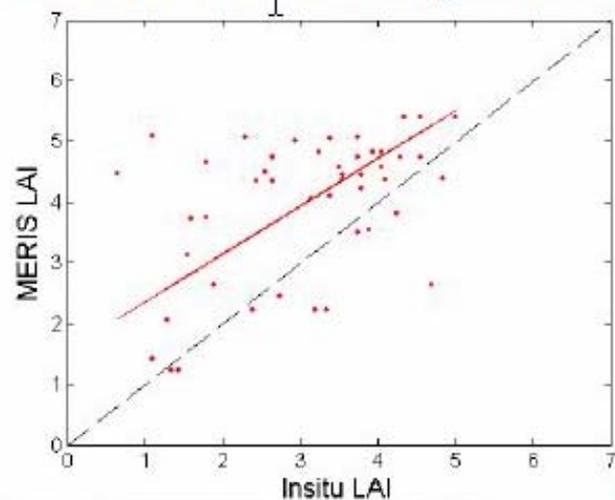
Joint Research Centre

Sample results: CCRS

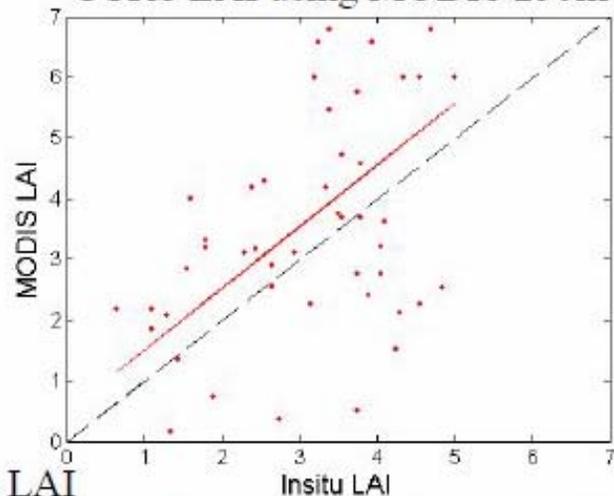
Reducing Canada's vulnerability to climate change - ESS



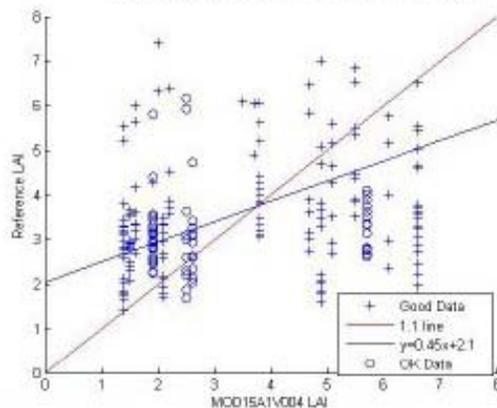
CYCLOPES LAI using MERIS FR



CCRS LAI using MODIS 250m



MOD15A1 V004 LAI

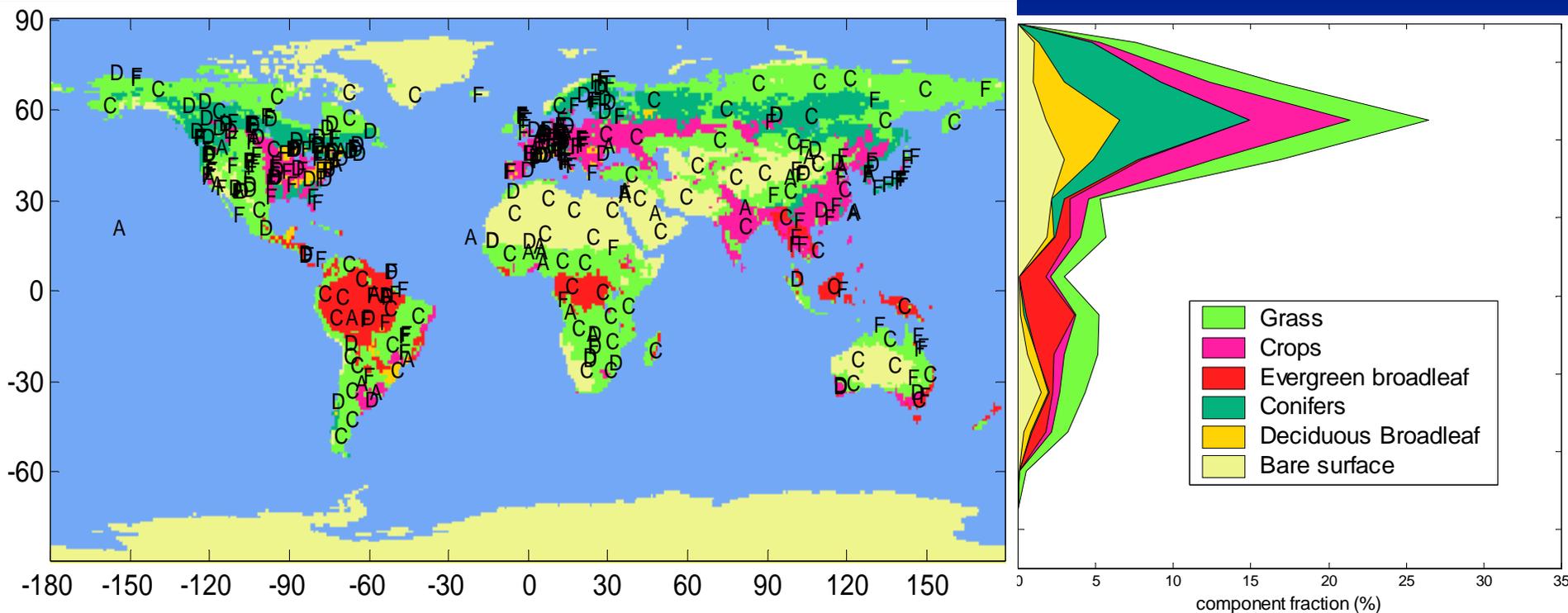


Proposed method



- **Indirect validation:** self consistency and comparison with other products
 - Temporal continuity (and spatial!)
 - Temporal consistency
 - Statistical distributions
 - Scatterplots
 - Transects, Maps....
- **Direct validation:** comparison with ground measurements

The BELMANIP network of sites



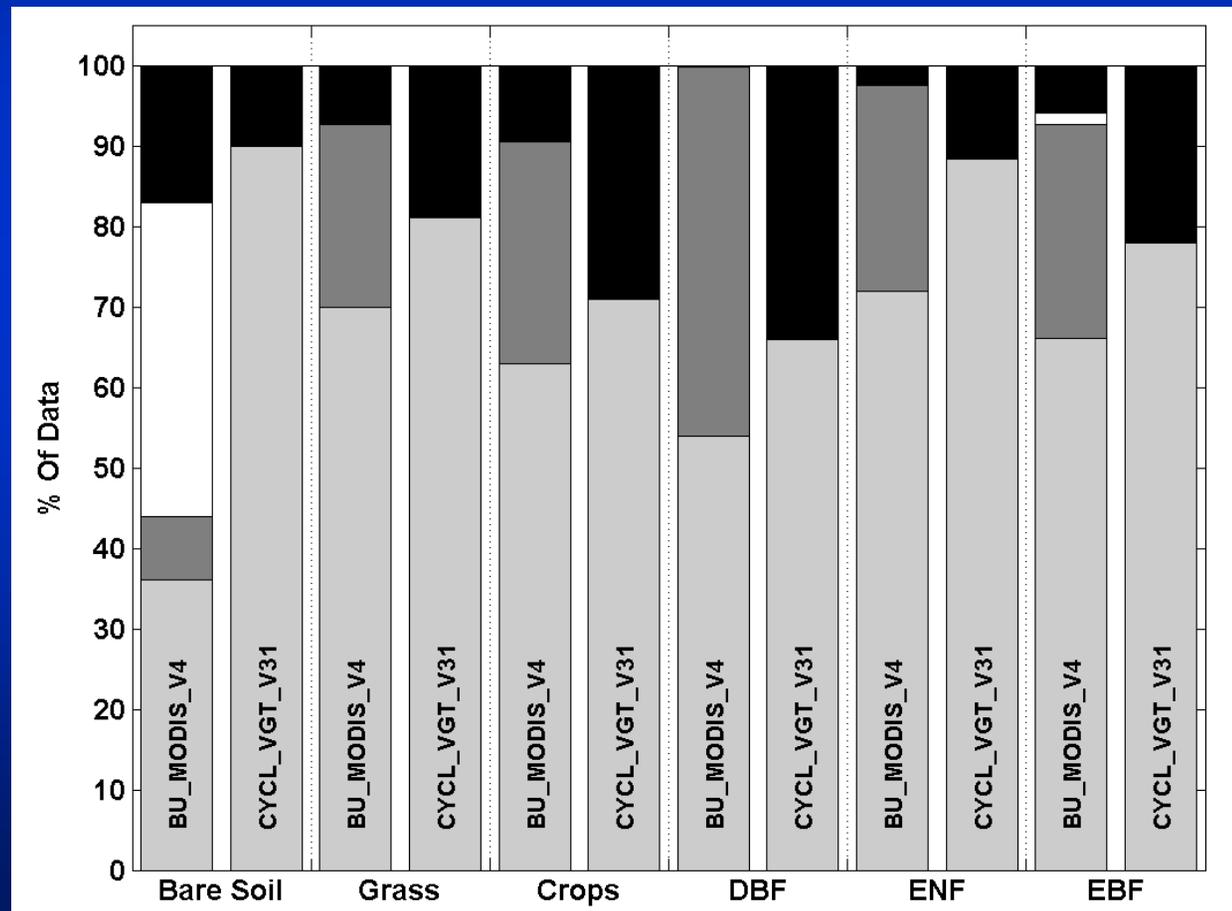
397 sites representing the variability over surface types and latitudes



Baret, F. et al., 2006. Evaluation of the representativeness of networks of sites for the global validation and inter-comparison of land biophysical products. Proposition of the CEOS-BELMANIP. IEEE Transactions on Geoscience and Remote Sensing, 44(7: special issue on global land product validation): 1794-1803.

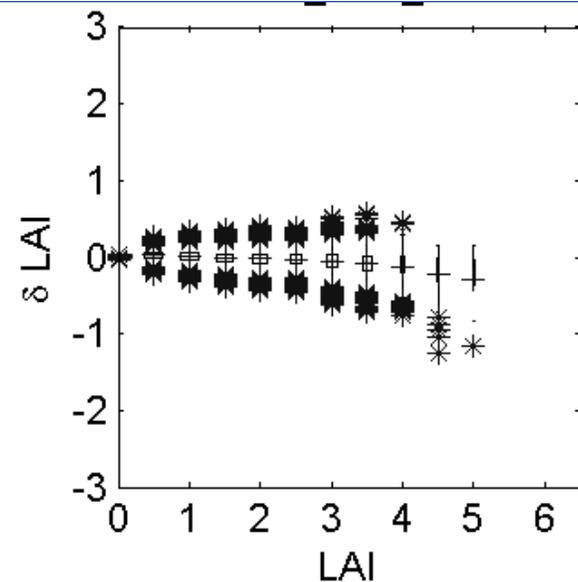
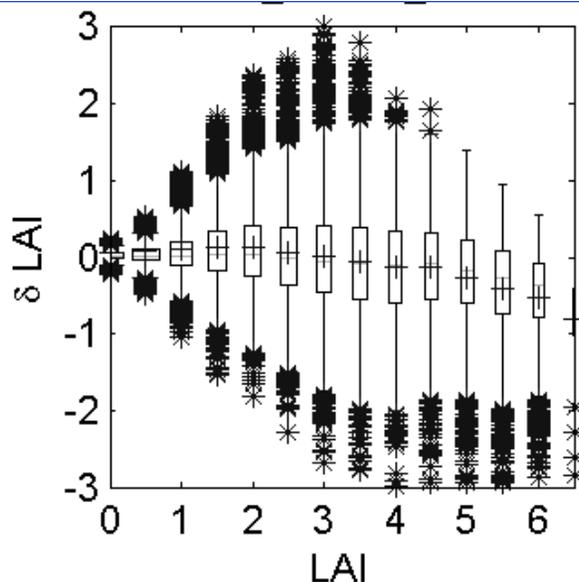
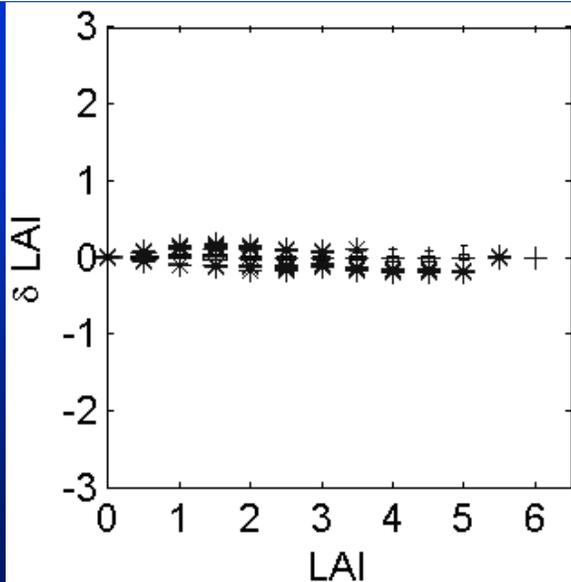
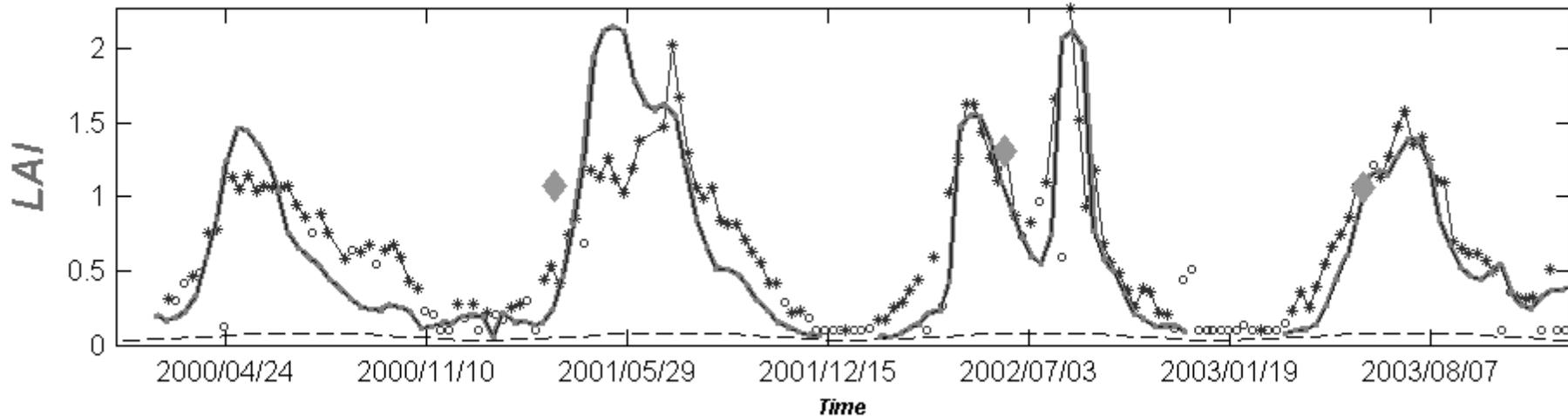
Temporal continuity

- Fraction of 'usable'/missing data



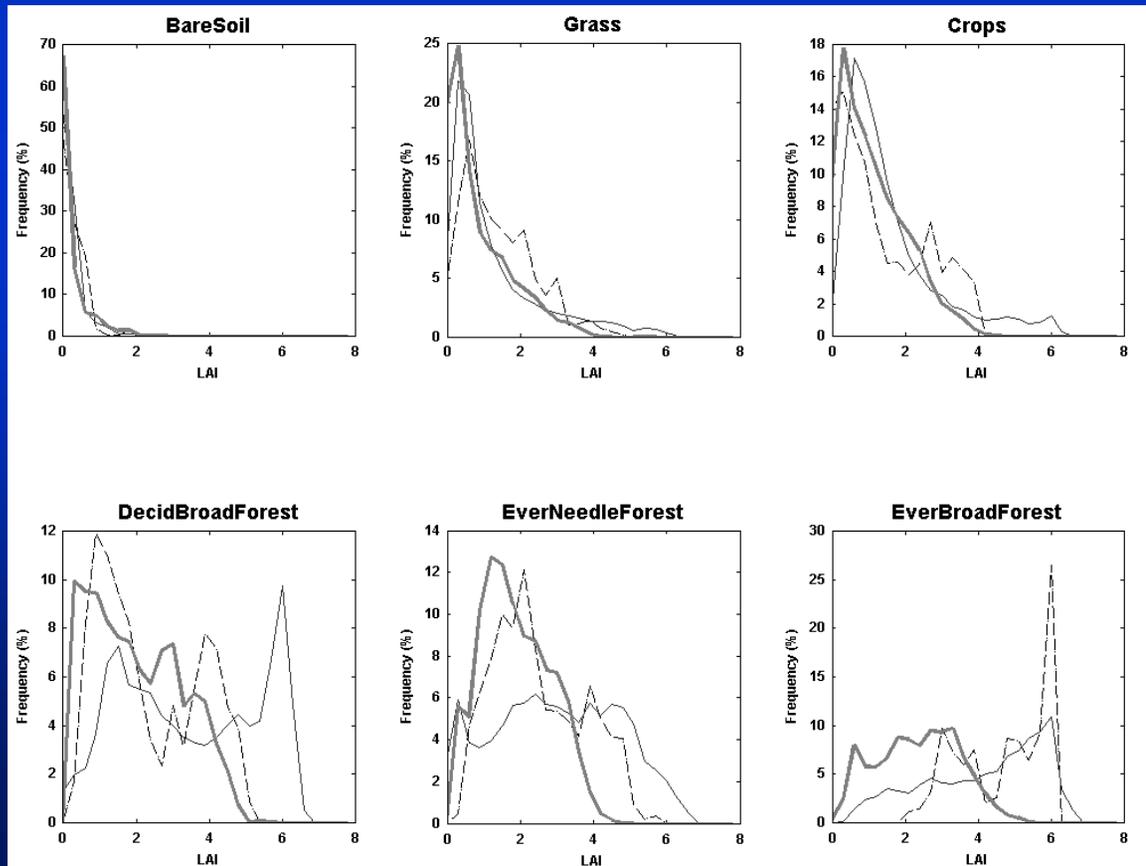
Temporal consistency: sample results

FUNDULEA (lat 44.41, lon 26.58, Crops)



Statistical distributions

- need similar spatial support
- Projection system that keeps the area about equal
- Original temporal sampling
- Per surface type (at least!)



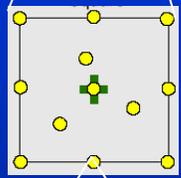
Direct validation: Comparison with ground measurements: bottom-up approach



50-100 sites



20-100 ESUs/site



10-100 measurements/ESU



Global validation

Scatter plot

Medium resolution products to be validated

Value(s) at the site level

Transfer function

High spatial resolution image (SPOT/TM/ASTER ...)

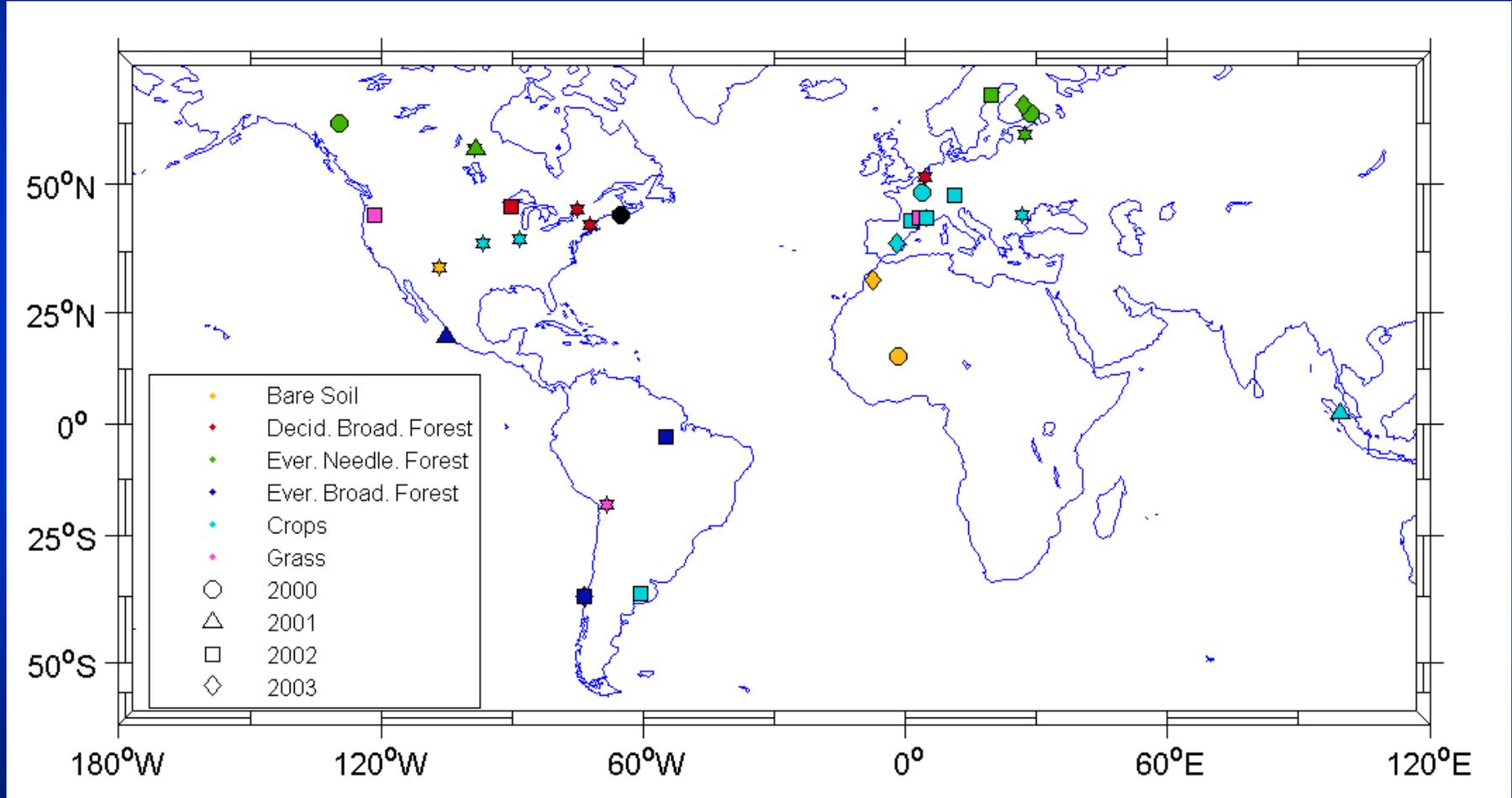
Value at the ESU level

Averaging

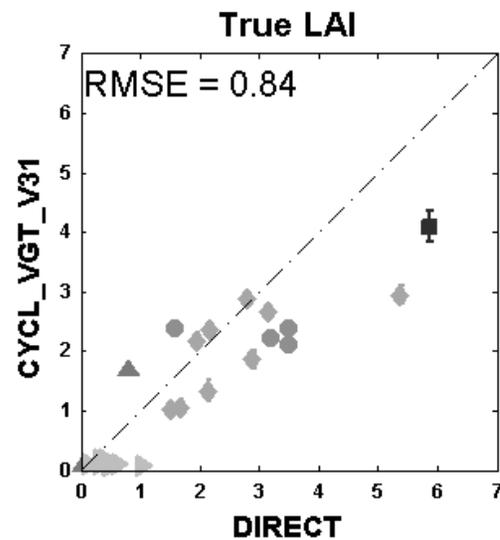
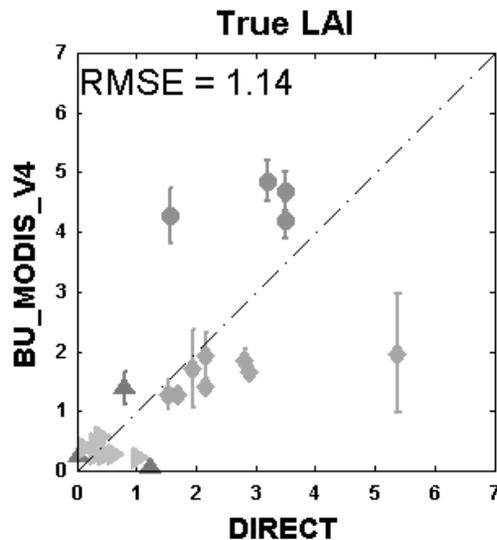
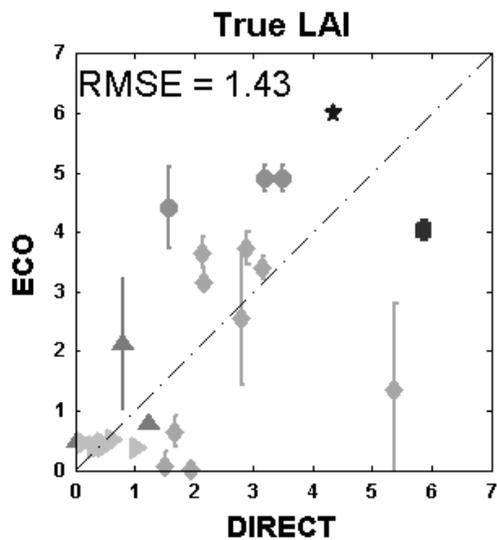
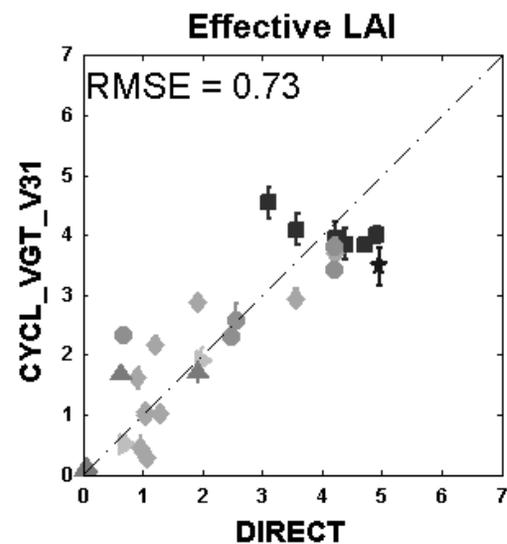
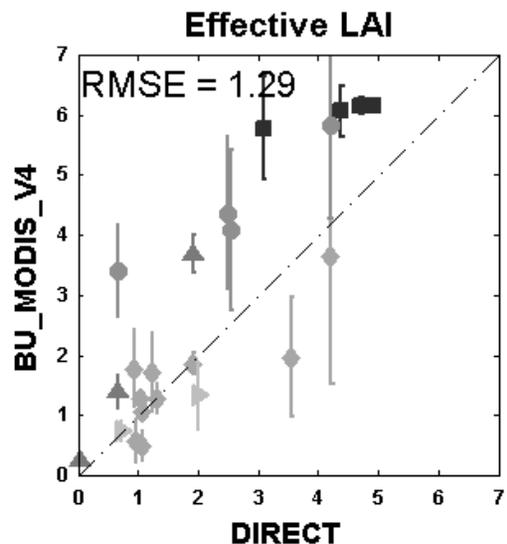
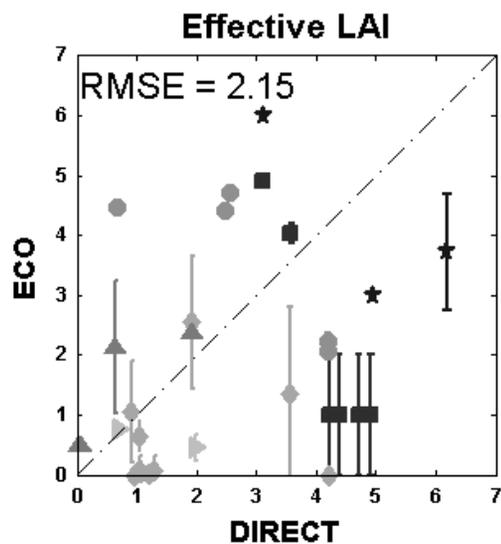
Individual measurements



Sites currently available



Sample results: CYCLOPES/MODIS



Methodological aspects for ground measurements

- Comparison of devices: LAI2000/TRAC DHP: DHP becoming widely used. Careful setting
- Sampling strategy
 - Size of ESUs
 - Number and position for ESUs
- Definition of fAPAR/fIPAR
- Definition of LAI: clumping/woody fraction/understorey
- Design easy to use instruments for continuous monitoring: PAR@METER

Conclusion of the workshop

- **Format of the workshop**
 - Few from across the Atlantic and from east...
 - Lot of discussions: good size!
- **Recommendations**
 - Sharing data
 - Getting more sites for validation
 - Focus on temporal evolution
 - Correcting BELMANIP
 - More investigations on clumping
 - No validation under 3x3km²: consequences on the size of the sites
 - Keeping raw ground data for further processing (LAI2000-fAPAR)
 - Take attention to land cover (for validation of classifications)
 - Characterize (even qualitatively the background)
 - Evaluation of methodology on simulated scenes?
 - Document progresses achieved (accuracy/efficiency) since FIFE, BOREAS, HAPEX, ...
- **Actions**
 - GCOS definitions
 - Paper on fAPAR definitions and measurements
 - Report of this meeting (R. Fernandes, G. Schaepman, B. Pinty, F. Veroustate)
 - Next meeting? In USA?
 - Discussion on resampling/projection required

Future meeting



- Albedo meeting Boston 2008 (IGARSS)
- Soil moisture (SMOS) TBD
- LAI/fAPAR 2009 location?

Pending actions



- Review GEO tasks:
 - Mainly DA_06
- Seed questions for GEO
 - Methodological advances (and results ... and questions) be presented
 - Paper in preparation for intercomparison of products
- Recommendations
 - No new ones (but monitor progress)