A DATABASE OF DIRECTIONAL REFLECTANCE SIGNATURES WITH AN ANALYSIS TOOL

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The POLDER-3 instrument onboard the CNES/Parasol satellite was launched in December 2004. Although Parasol main scientific objectives concern the monitoring of atmospheric parameters, it is a great tool to observe the directional signatures of land surfaces. Thanks to the multi-directional capabilities of POLDER instrument, Parasol acquires up to 16 reflectance measurements from different directions as the satellite passes over a target. The monthly time composite of measurements provides a near complete description of the bidirectional reflectance distribution (BRDF) for the view zenith angles up to 60°. From the full Parasol archive, a database of high-quality BRDF measurements has been derived and is made available to the scientific community.

This database has many potential applications, including the evaluation of BRDF models, the definition of typical BRDF shapes for the correction of directional effects on reflectance measurements, or the correction of surface reflectance and atmospheric scattering coupling. An interactive tool is available for the data analysis.

DESCRIPTION OF THE DATABASE

The database is implemented on the basis of the :

- **16 biomes of the "International Geosphere-Biosphere Program" (IGBP) classification**
- **4 broad latitude bands (0-20°, 20-40°, 40-60°, 60-90°)**
- **12 months from November 2005 to October 2006.**

The IGBP surface types

1	Evergreen NeedleLeaf Forest
2	Evergreen BroadLeaf Forest
3	Deciduous NeedleLeaf Forest
4	Deciduous BroadLeaf Forest
5	Mixed Forests
6	Closed Shrublands
7	Open Shrublands
8	Woody Savannas
9	Savannas
10	Grasslands
11	Permanent Wetlands
12	Croplands
13	Urban and Build-up
14	Cropland/Natural Vegetation Mosaic
15	Snow and Ice
16	Barren and Sparsely Vegetated

For each surface type and latitude band, we extracted the **best signatures**, i.e. those **with a large number of clear sky observations** (no aerosol or cloud contamination). The database provides the sun and view geometry together with the surface reflectances at **490, 565, 670, 765, 865 and 1020 nm**. The measurements have been corrected for molecular and aerosols scattering, as well as atmospheric absorption.

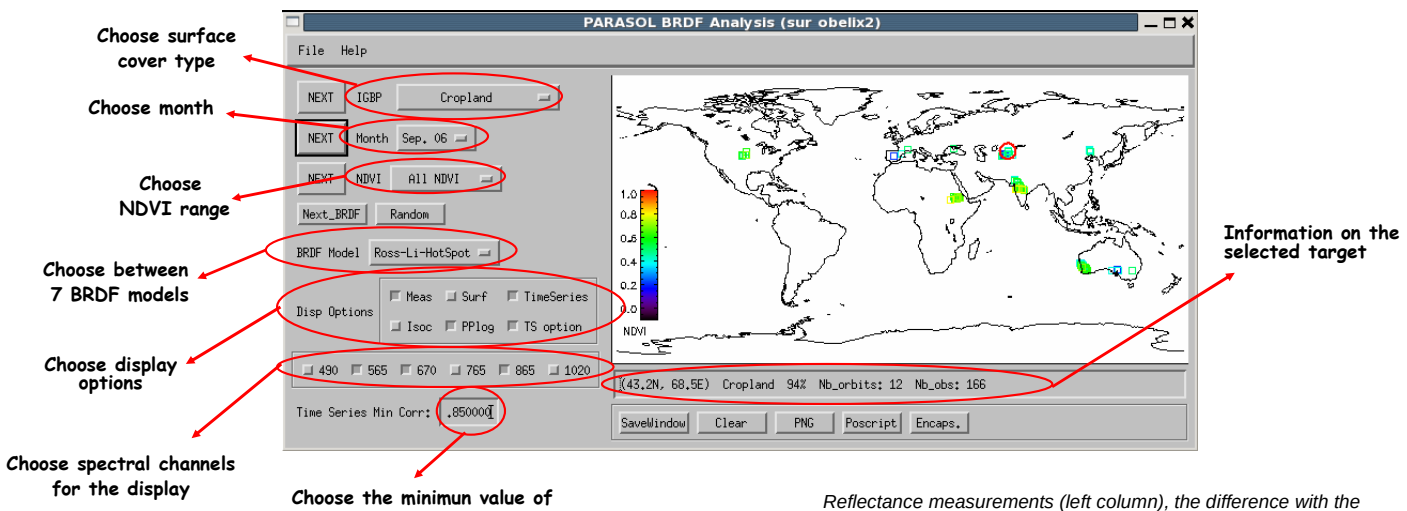
In practice, two databases have been build :

- a **monthly base** "BASE_MONTH" : all months were processed independently and the highest quality pixels were kept for each biome and latitude band.
- a **annual base** "BASE_YEAR" : the pixel selection was based on the quality of the measurements over the full year for each biome and latitude band with the aim to follow the annual cycle of vegetation.

The BRDF data files contain the Parasol measurements (viewing geometry and the spectral reflectances) for each pixel acquired during a month.

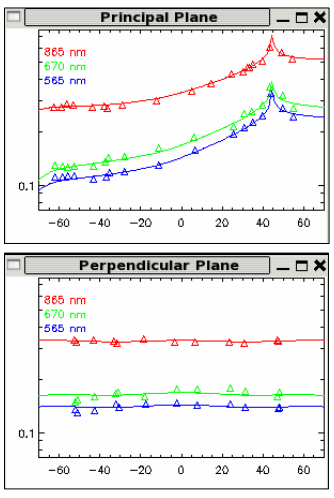
The databases are available on the website : ***http://postel.mediasfrance.org***. The databases also exist with "Global Land Cover for the year 2000" (GLC2000) classification.

BRDF ANALYSIS TOOL

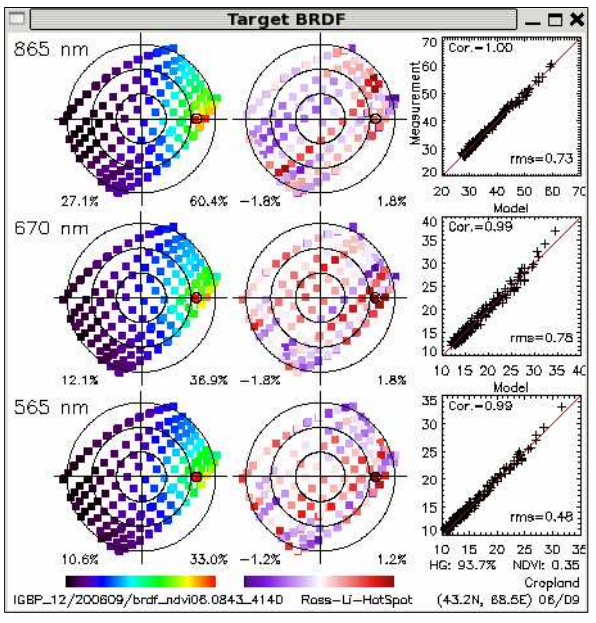


A graphical interface tool has been developed to analyze the BRDFs data. The map of the main window of the BRDF analysis tool, above, shows the available targets for a given surface type, a month and a NDVI range. A target can be selected and its measurements are displayed with various options choices (different windows).

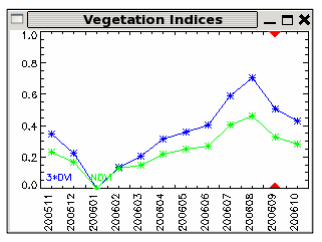
Measured (symbols) and modeled (lines) reflectances in the principal and perpendicular planes for the selected wavelengths. The Y axis can be either on a linear or a log scale.



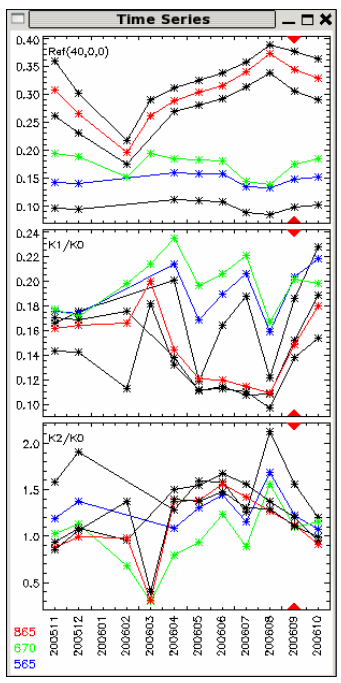
Reflectance measurements (left column), the difference with the modeling (center column) and the measurement-model scatter plot (right column). It is possible to display other representations of measurements through the main command window (display options).



*Time series of NDVI and 3*DVI .*

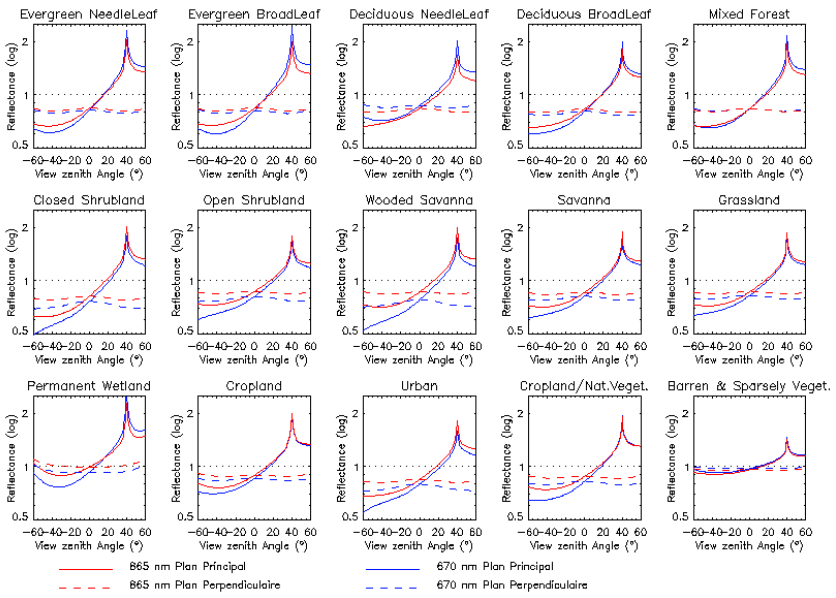


Time series of the BRDF model parameters, derived from the measurements. The parameters are displayed only when the measurement-model correlations are larger than the threshold set in the command window.



APPLICATIONS

We derived typical BRDF shapes for each of the main IGBP surface types. The shapes are shown here for 15 surface types, in the principal (solid lines) and perpendicular (dashed lines) planes, for a solar zenith angle of 40°, at 670 (blue) and 865 (red) nm.



Cumulative histograms of the RMSEs at 670 AND 865 nm, derived from the full dataset, using various BRDF models. The quality of the model is quantified by its ability to fit measurements (i.e. low RMSE). The noise in the measurements has a similar effect to each RMSE histogram. Based on these curve, we conclude that the Ross-Li model, with an added Hot-Spot component, is the best to accurately reproduce the observed signatures.