CENTRE NATIONAL D'ÉTUDES SPATIALES

CNES Activity Report for CEOS WGCV

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Activity for CNES project in orbit

- **JASON 2**
  - **Completion of in flight commissionning phase**
  - **Very good performances**
- **Missions in operation**
  - **Monitoring of IASI calibration : excellent performances**
  - **PARASOL, IIR (Calipso), SPOT HR, VGT : routine calibration operation**
  - **Reprocessing of VGT1 calibration to insure 10 years of consistent data (VGT1 + VGT2)**

Activity for CNES project in development phase

- **Pleiades**
  - **Final instrument characterization ⇒ all performances above specification**
  - **Calibration & performance assessment Centre development in progress**
  - **Definition of calibration methods (geometric and radiometric) to be applied during in flight commissioning**
- **Venμs**
  - **Definition of processing algorithms**
  - **Stray light characterization and correction**

2008 CNES study over desert sites

- **Establishing a method for directional ground reflectance characterization**
  - **Improvement of atmospheric correction**
  - **Study of several BRDF models**
  - **Definition of an iterative filtering method (to get rid of data affected by atmospheric problem)**
- **Focusing on the 5 CEOS selected sites**
  - **Computation of directional characterization for 5 spectral bands : $\rho(\theta_s,\theta_v,\Delta\phi)$**
- **Main conclusions**
  - **Very good results except in the 'blue' range**
  - **Proof of existing models limitation**
  - **Definition of a range of geometrical condition acceptable for accurate cross calibration process**

Final results (1)

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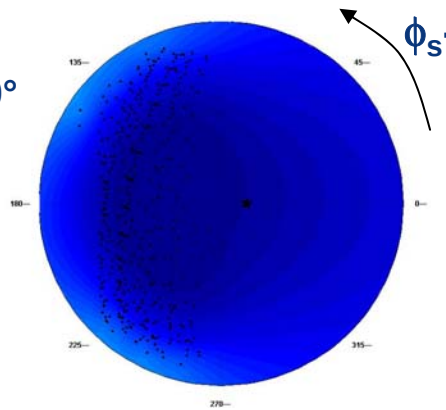

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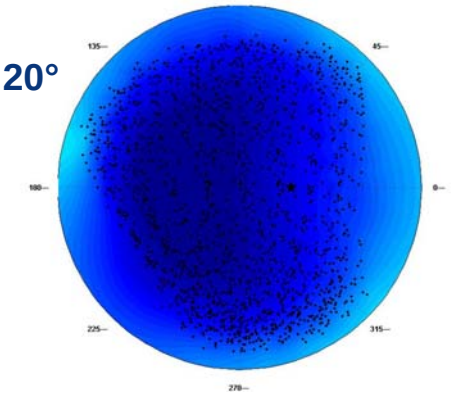

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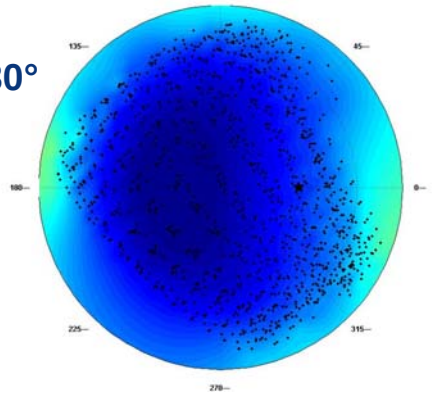

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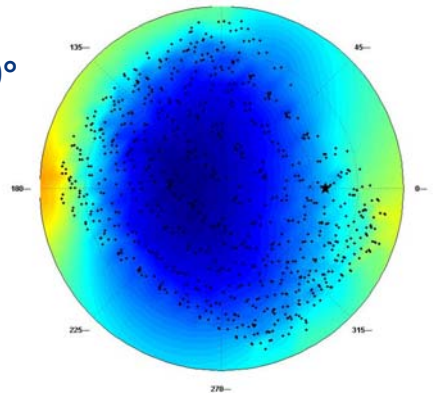

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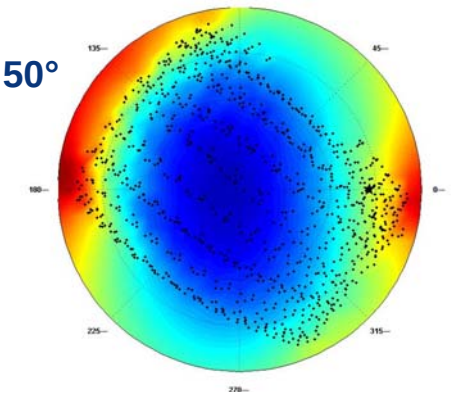
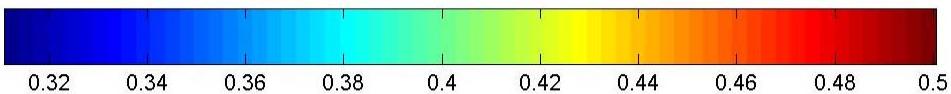


Libya 1 site – 565 nm band
(Snyder model)



Final results (2)

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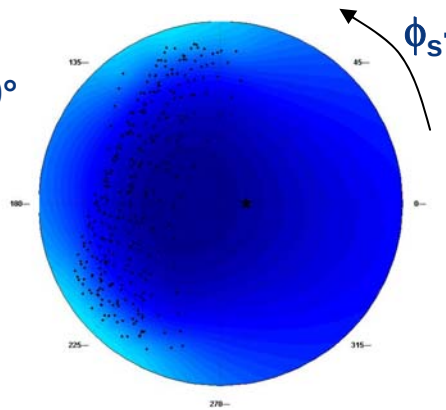

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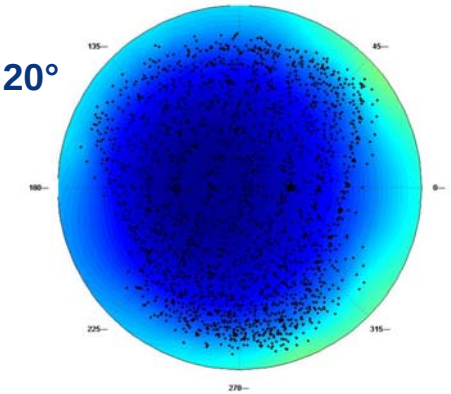

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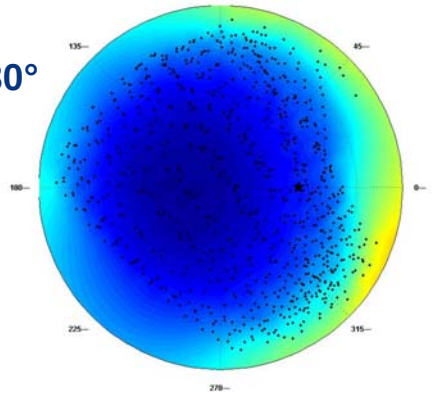

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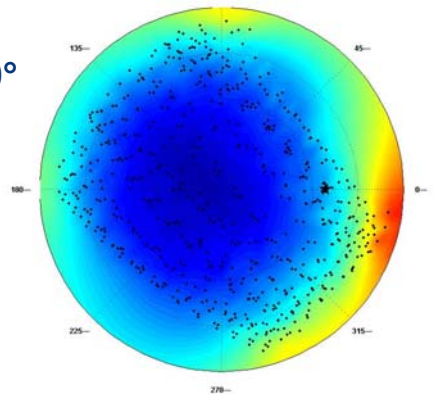

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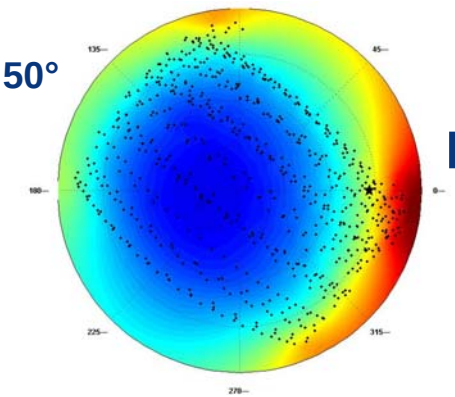
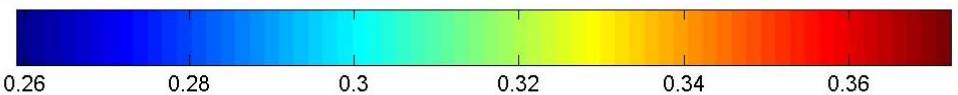
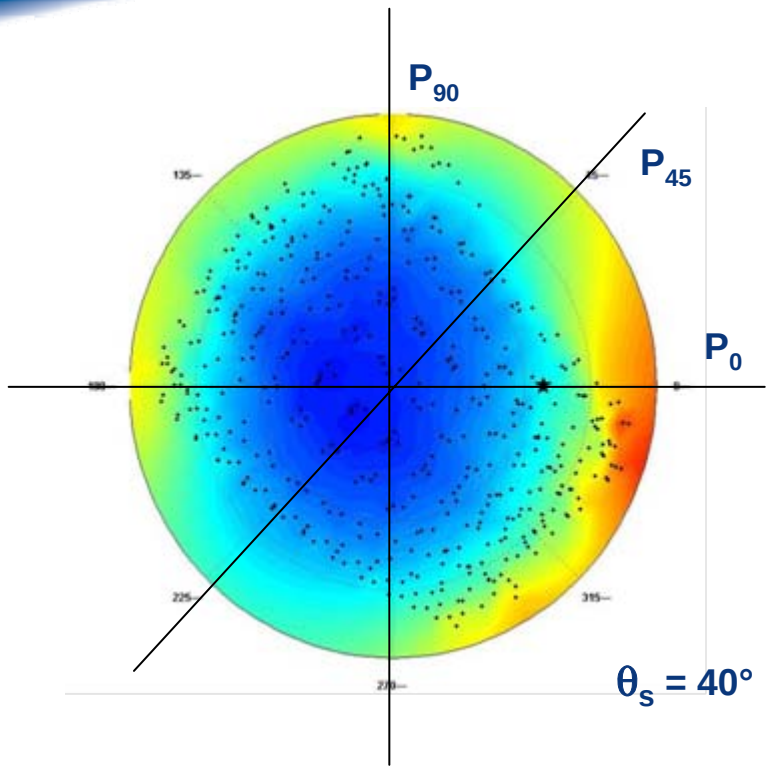


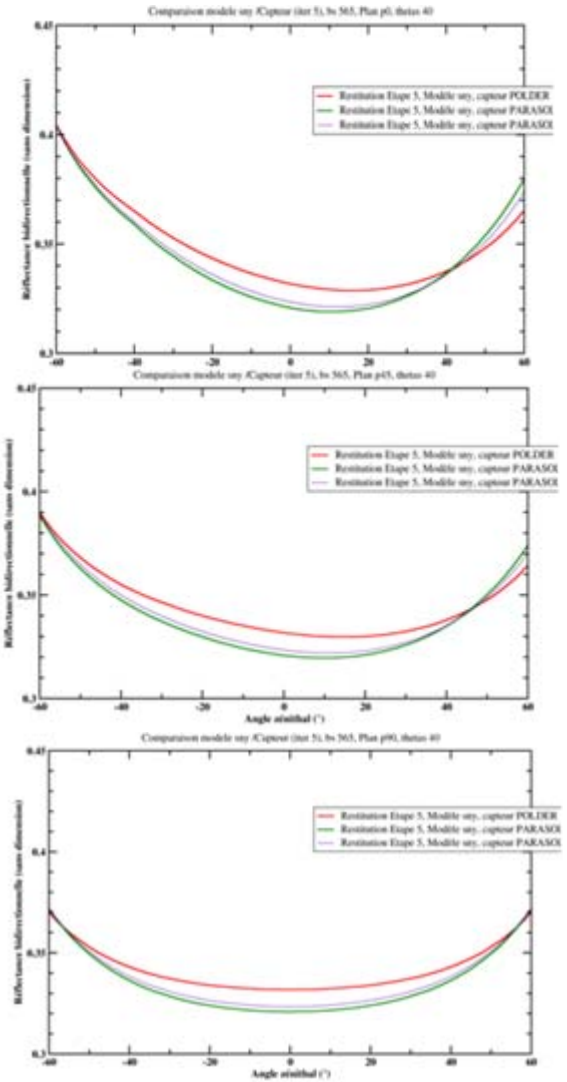
Mauritania 2 site – 565 nm band
(Snyder model)



Final results (3)



Libya 1 site – 565 nm band
(Snyder model)



Filtering effect (1)

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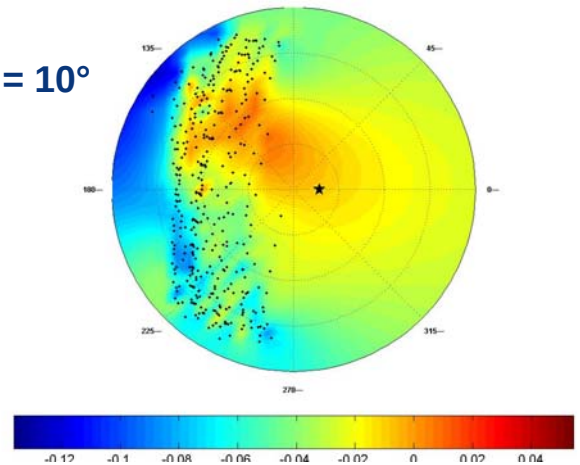

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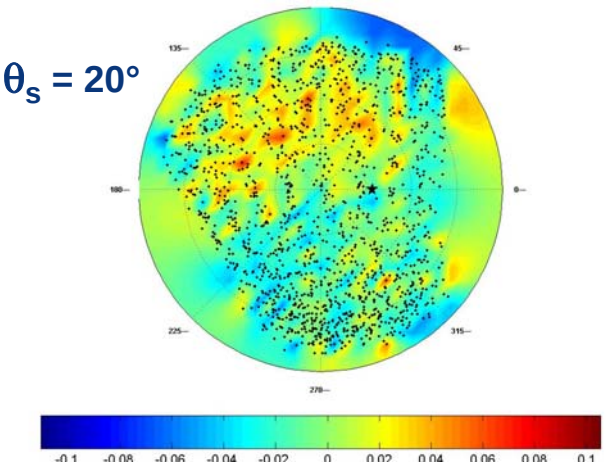

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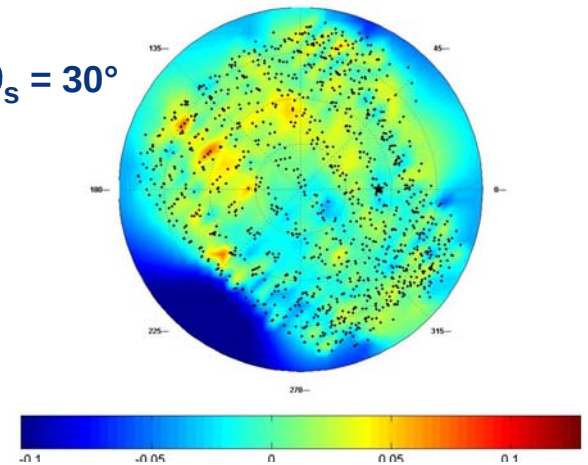

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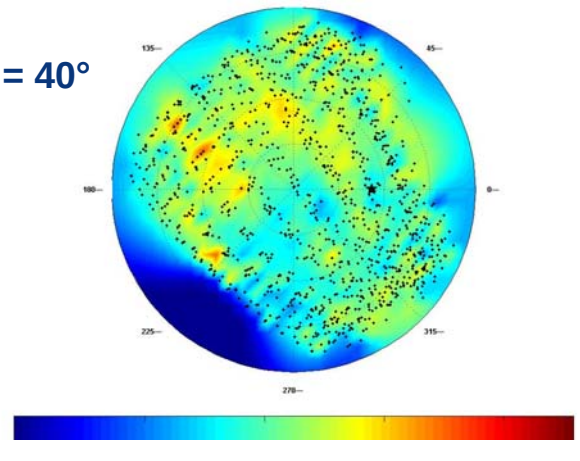
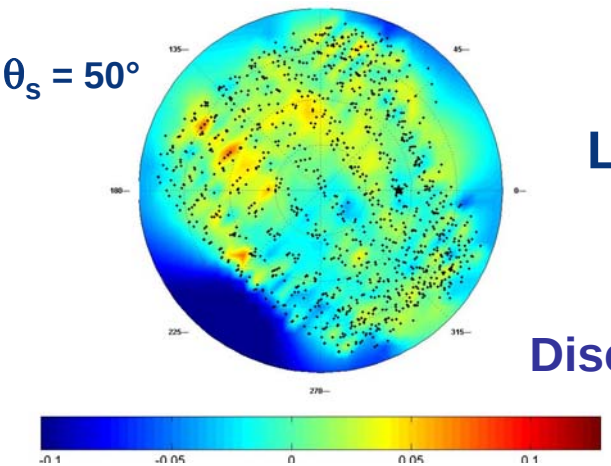


θ_s = 50°

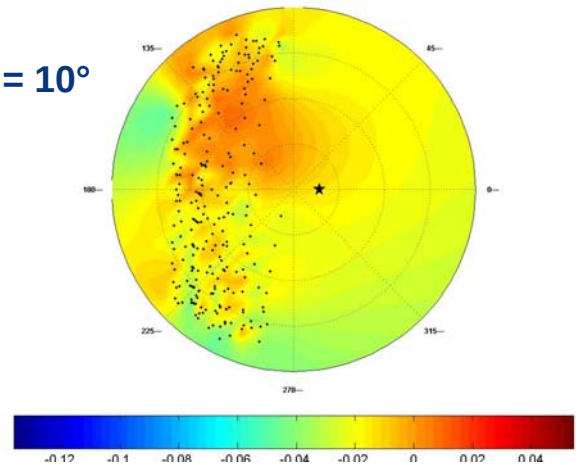


Libya 1 site – 565 nm band

Discrepancies model - measure before filtering

Filtering effect (2)

θ_s = 10°



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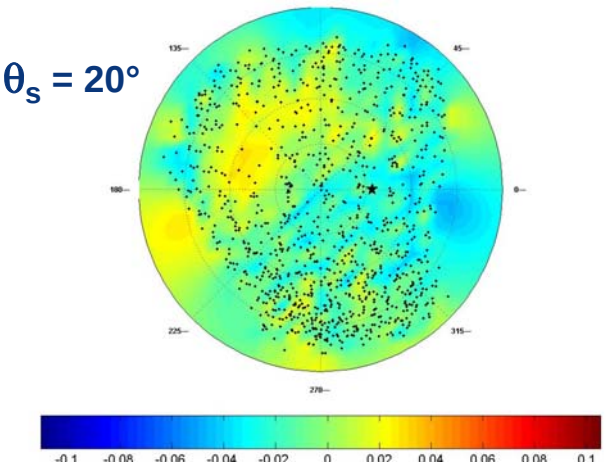

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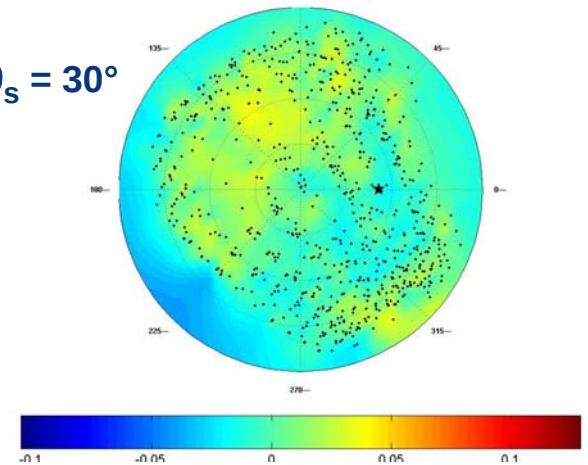

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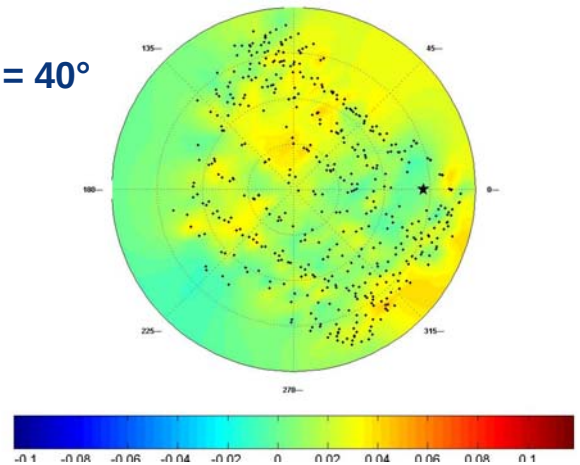
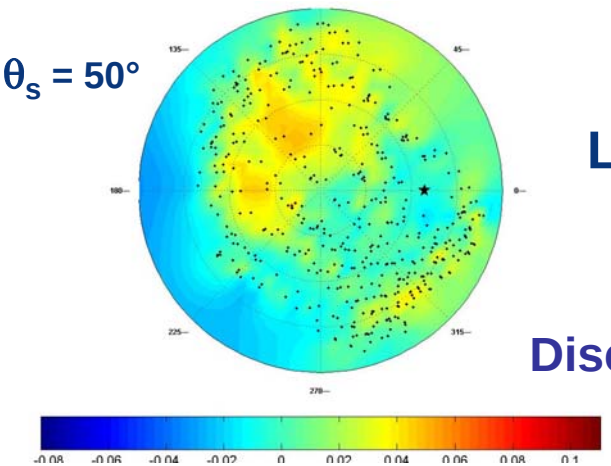


θ_s = 50°



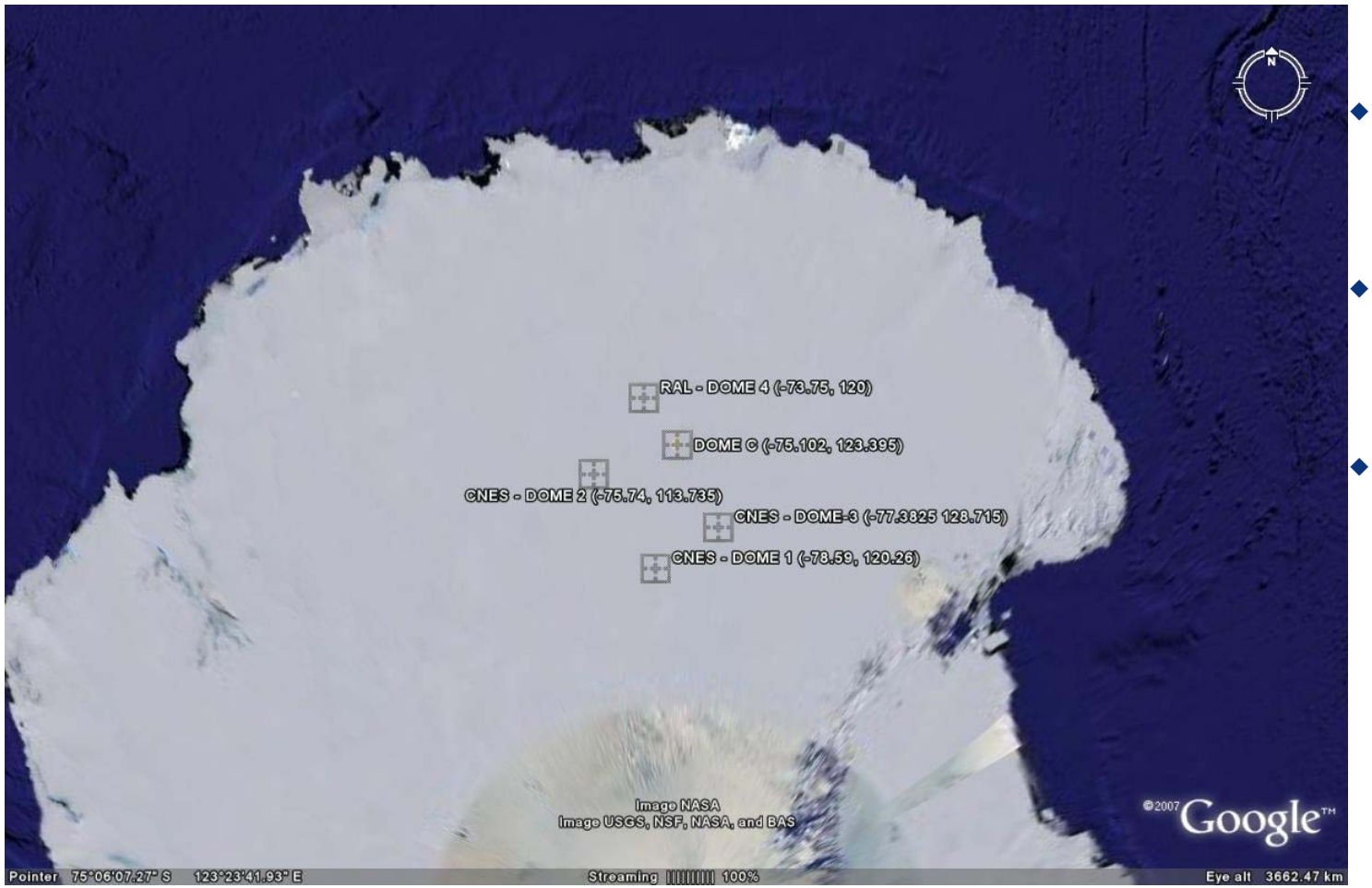
Libya 1 site – 565 nm band

Discrepancies model - measure
after filtering

2008 CNES study over Dôme C sites

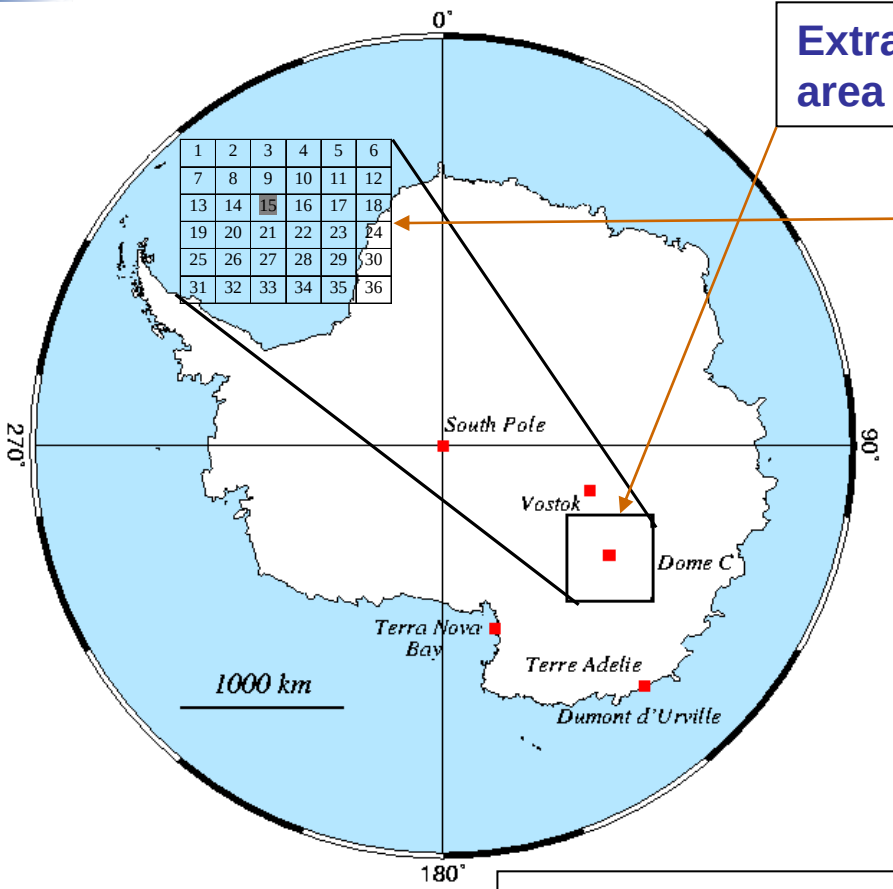
- **Dôme C sites characterization using :**
  - **6 years of VGT1 images (Nov. 1998 to Feb. 2004)**
  - **5 years of VGT2 images (Nov. 2002 to Feb. 2007)**
- **Main objectives :**
  - **Effect of atmospheric correction**
  - **BRDF modelling of data**
  - **Sites behaviour and (if possible) selection of a 'top' site**
  - **Accuracy assessment**
- **Final goal :**
  - **Use of Antarctica sites for multitemporal calibration**
  - **Use of Antarctica sites for sensors cross calibration**

Dôme C area : selected sites comparison



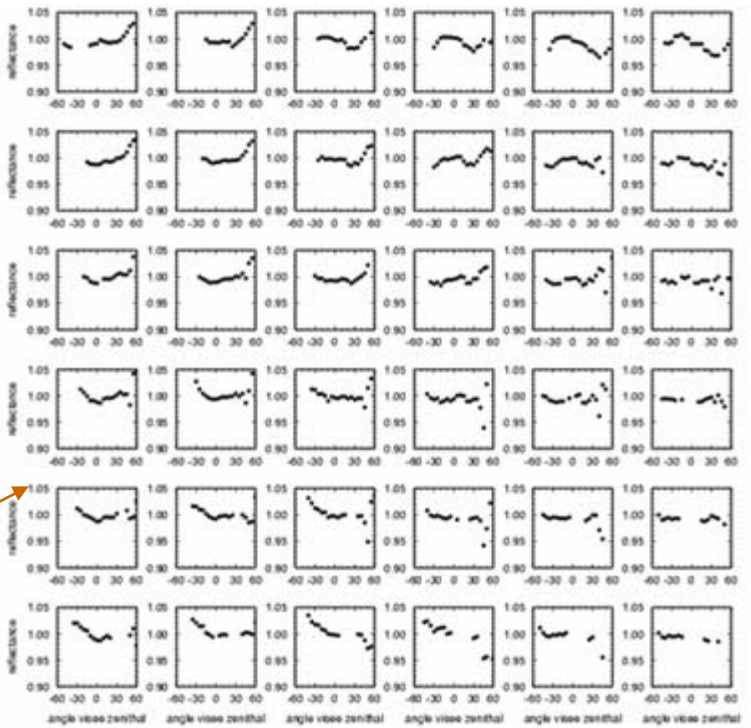
- **RAL (ESA) :**
  - **ATSR, MERIS**
  - **Dôme 4 (100x100 km^2)**
- **NASA :**
  - **(MODIS, SeaWiFS)**
  - **Dôme C (20x20 km^2)**
- **CNES :**
  - **VGT, PARASOL, SPOT**
  - **Dôme 1, 2, 3 & C (100x100 km^2)**

Dôme C characterization using VGT images



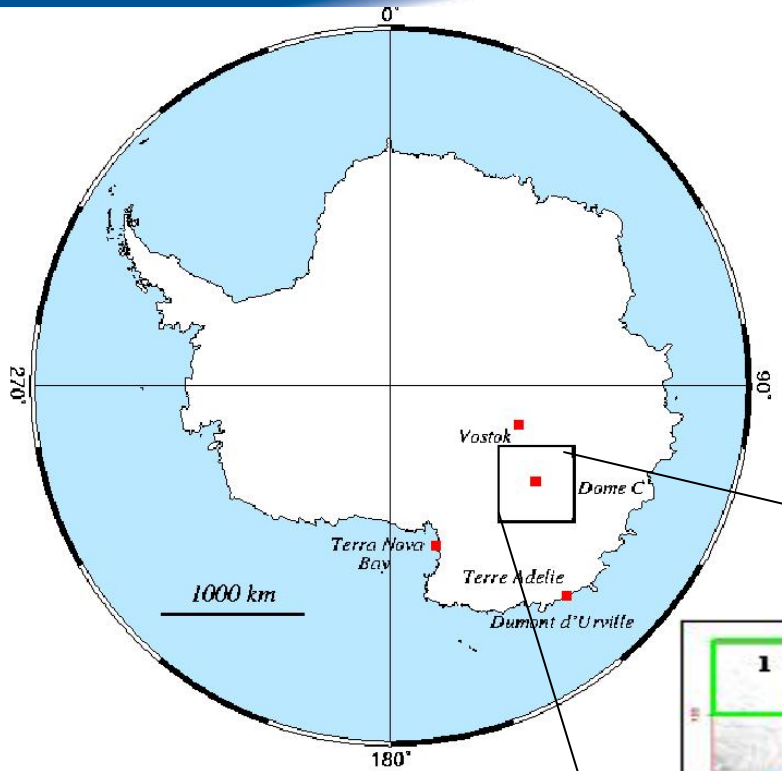
Extraction of a 720*720 km² area centred on Dome C base

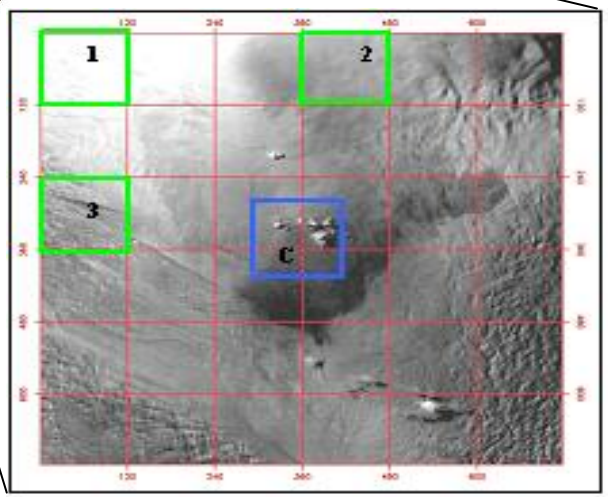
divided in 36 smaller areas (120*120 km²)

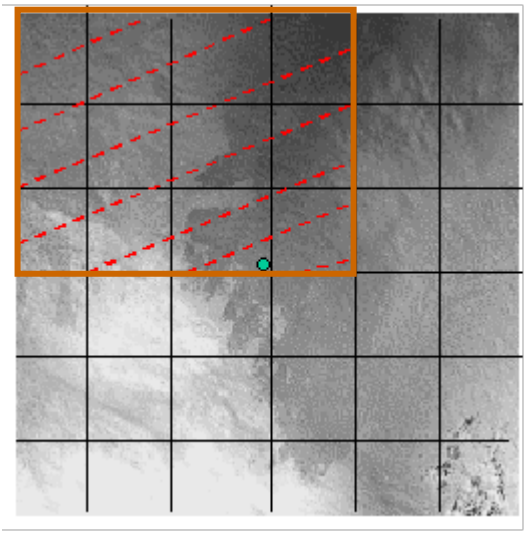


each zone carefully studied against different parameters

Choice of 4 calibration sites







large zone (480*360 km²) more suitable for calibration

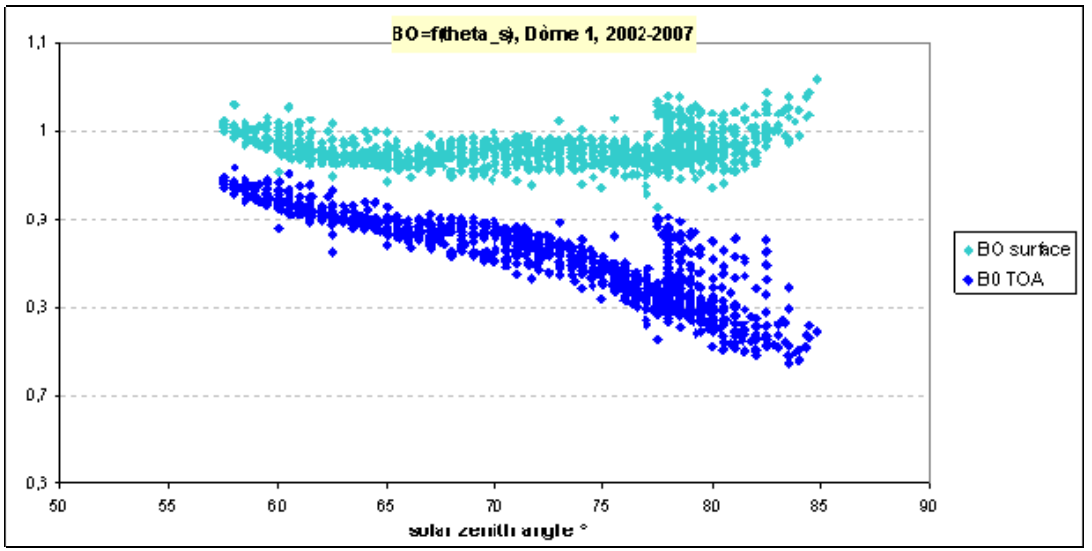
4 zones (120*120 km²) finally selected : Dome 1,2,3 & C

✞ Calibration over different zones allows to distinguish sensor behaviour from site behaviour

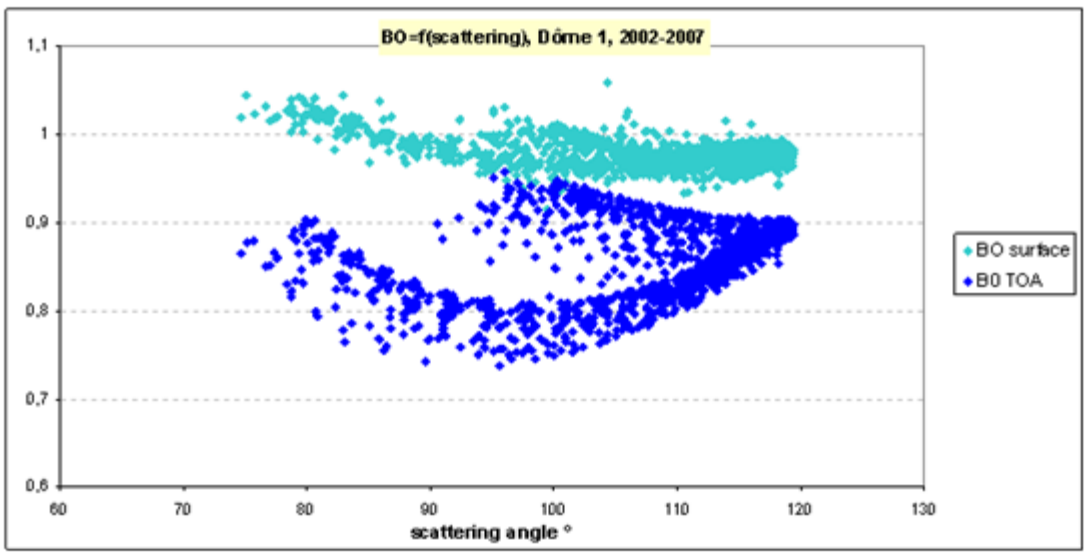
Need for atmospheric correction (1)

VGT2 data over Dôme 1 (blue band)

- Plotted against sun zenith angle



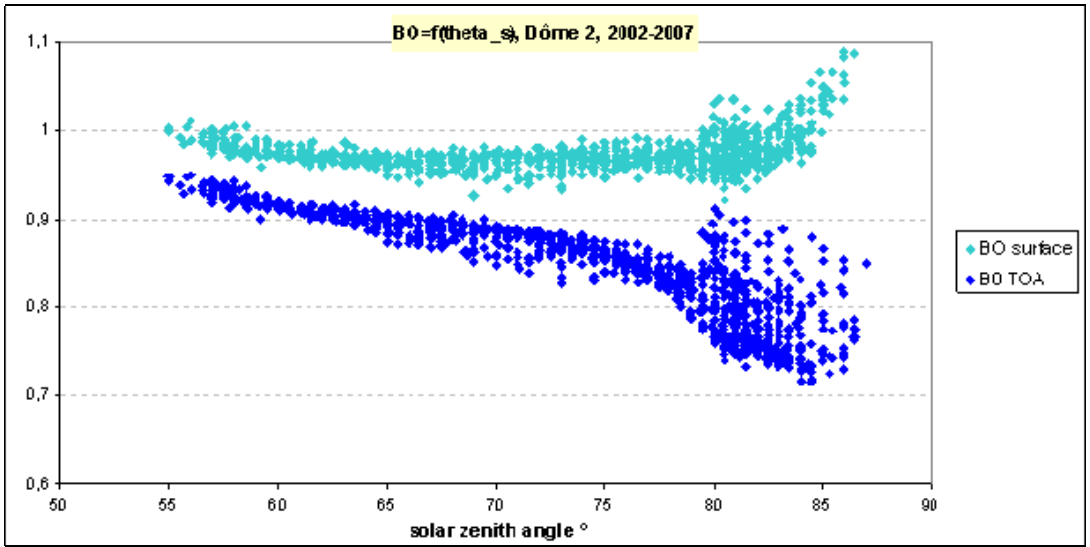
- Plotted against scattering angle



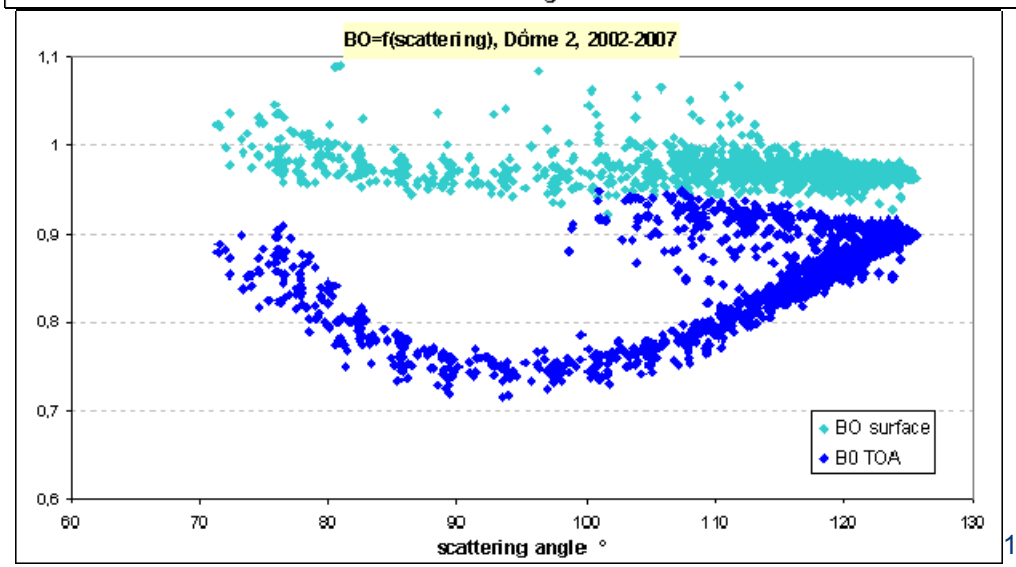
Need for atmospheric correction (2)

VGT2 data over Dôme 2 (blue band)

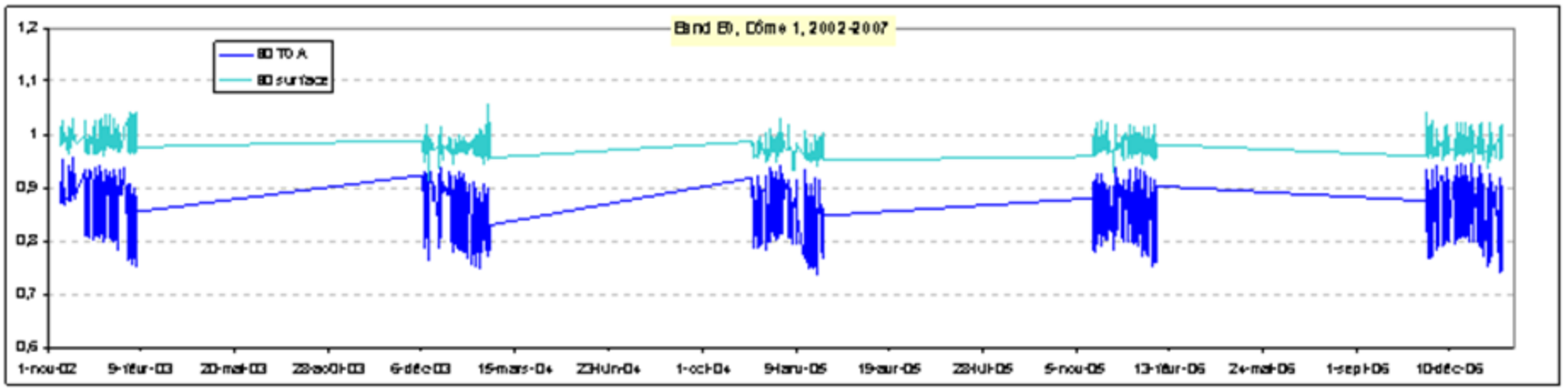
- Plotted against sun zenith angle

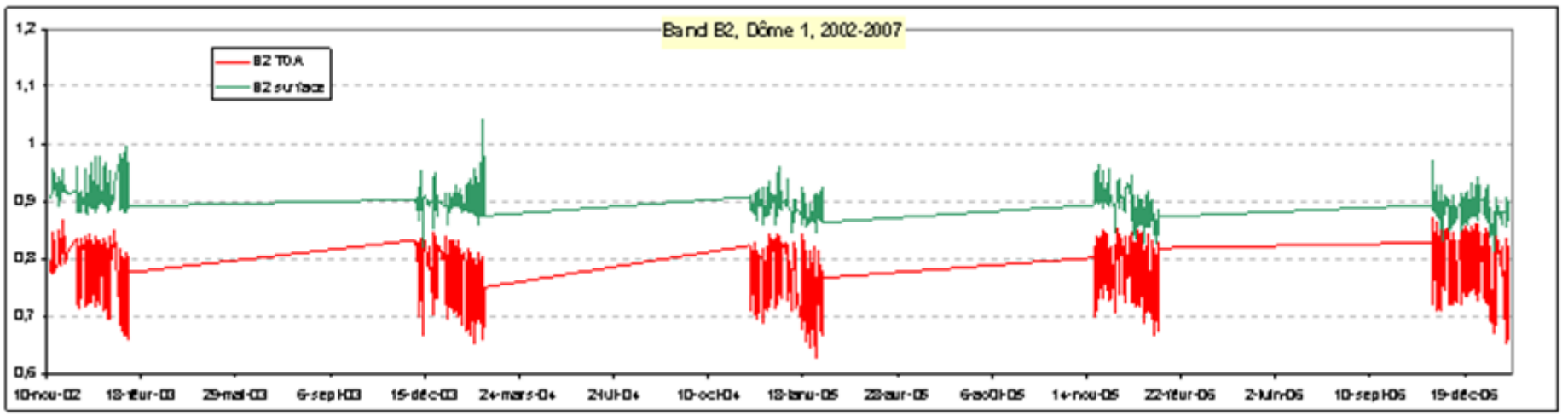


- Plotted against scattering angle

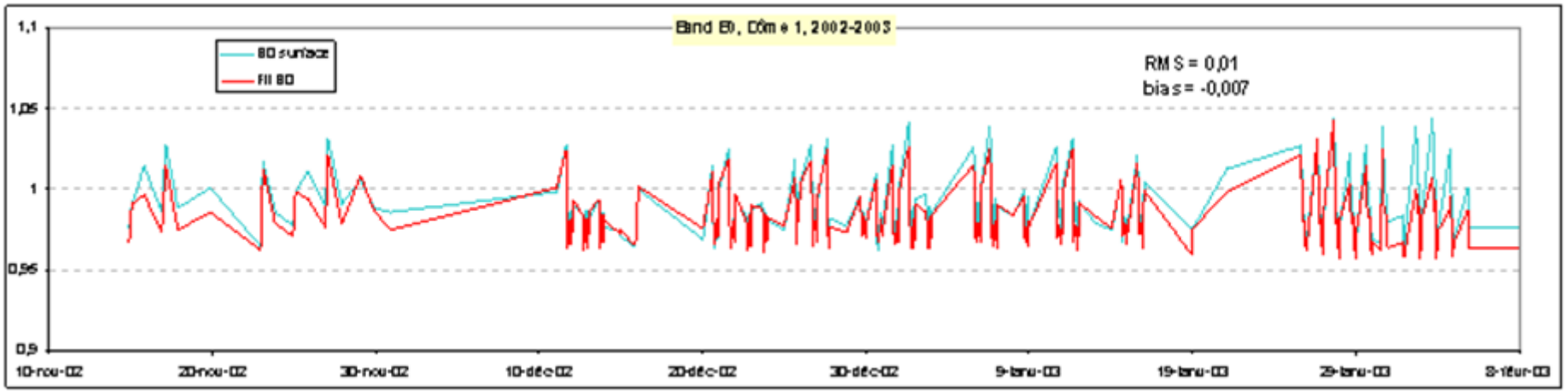


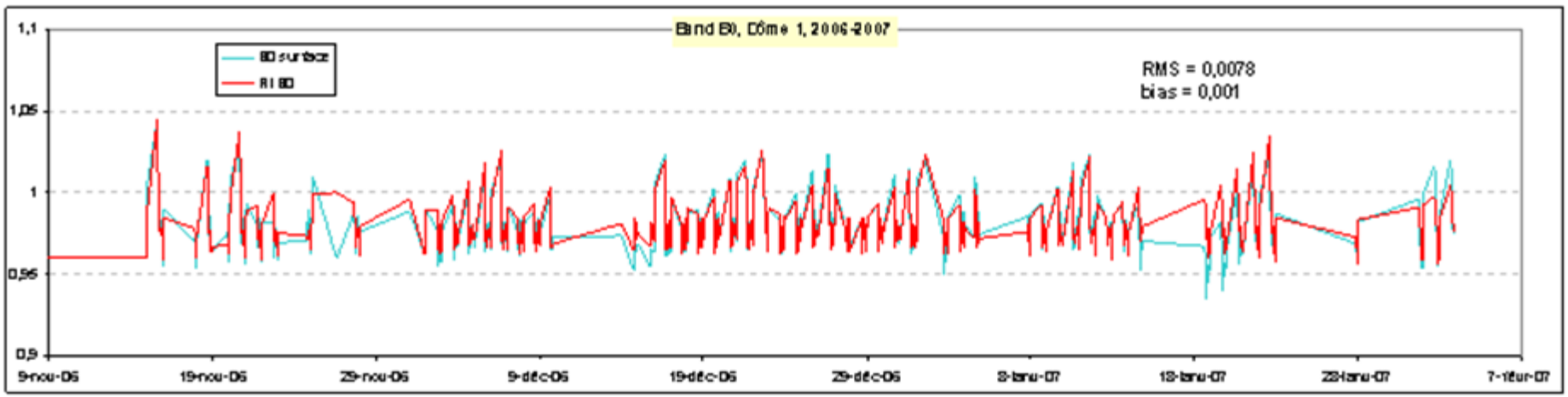
Need for atmospheric correction (3)





Data fit with a BRDF model



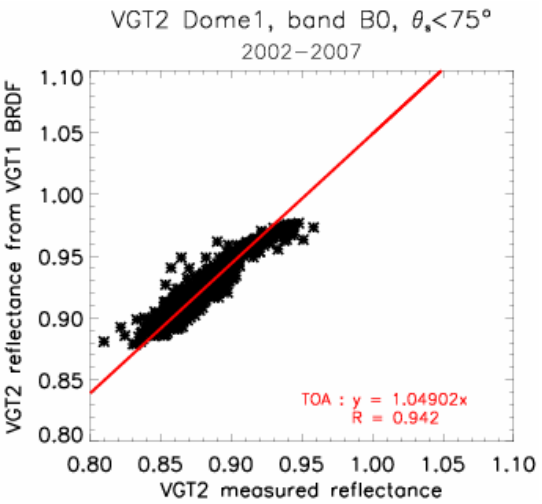


Warren BRDF model

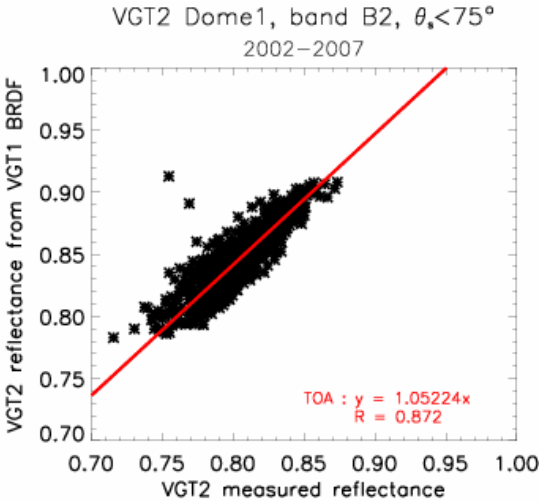
Cross calibration of sensors over Dôme C

VGT1 / VGT2 cross calibration over Dôme 1

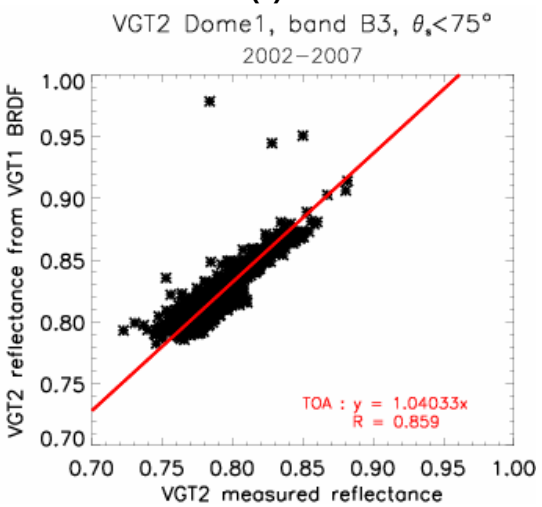
- 4 spectral bands (blue, red, NIR, SWIR)
- BRDF modelling
- 6 years of VGT1 vs 5 years of VGT2



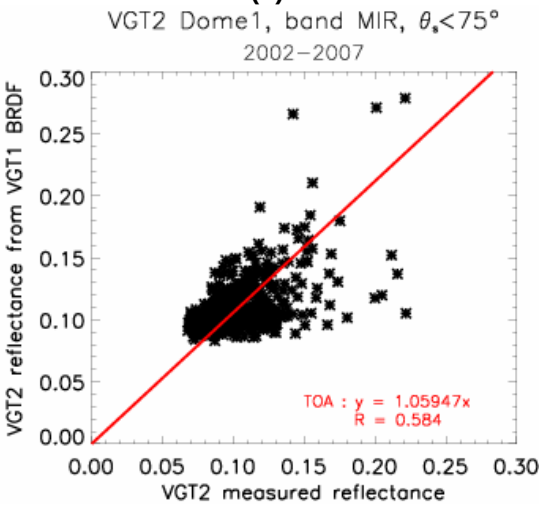
(a)



(b)



(c)



(d)

Recommendations for calibration over Dôme C

- Atmospheric correction is to be applied
  - First level correction with standard parameters
  - Ozone measurements mandatory
- Sun zenith angle lower than 75°
- Use of several sites to get rid of site behaviour
- As many as possible acquisitions every day during austral summer
- For sensors cross calibration : use of a BRDF model (Warren model recommended)

- Dome-C can also be used for low temperature TIR channels calibration

THANK YOU