

**A high-quality dataset of land-surface and
atmospheric measurements for the
comparison/cross-calibration of data from large
scale optical Earth Observation sensors in Space.
*The Valencia Anchor Station***

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Labajo², N. Pineda⁴, D. Pino^{5,b}, A. Rius⁵, F. Rocadenbosch³, K.
Saleh^{1,c}, M. Sicard³, R. Tarruella⁴, J. Torrobella⁵, and A.
Velazquez¹

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Climatology from Satellites Group
<http://www.uv.es/anchors>

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(b) *Also at Polytechnic University of Catalonia, Barcelona, Spain*

D. Pino^{5,b}

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K. Saleh^{1,c}



Outline

- ▶ Framework and Motivation
- ▶ The Valencia *Anchor Station* (Spain)
- ▶ GERB/CERES Ground Validation Campaigns at the Valencia *Anchor Station*
- ▶ A high-quality dataset of land-surface and atmospheric measurements for the comparison/cross-calibration of data from large scale optical Earth Observation sensors in Space
- ▶ Conclusions. Forthcoming Work



Framework

MSG-RAO

- *GIST Proposal for Calibration/Validation of SEVIRI and GERB*
- *GIST Plan for Scientific Exploitation of SEVIRI / GERB Data*

Regional Government & University of Valencia

VALENCIA ANCHOR STATION A Reference Meteorological Station for Remote Sensing Data and Products

Spanish Programme on Space Research

SCALES (SEVIRI & GERB Cal/Val Area for Large-scale Field ExperimentS)

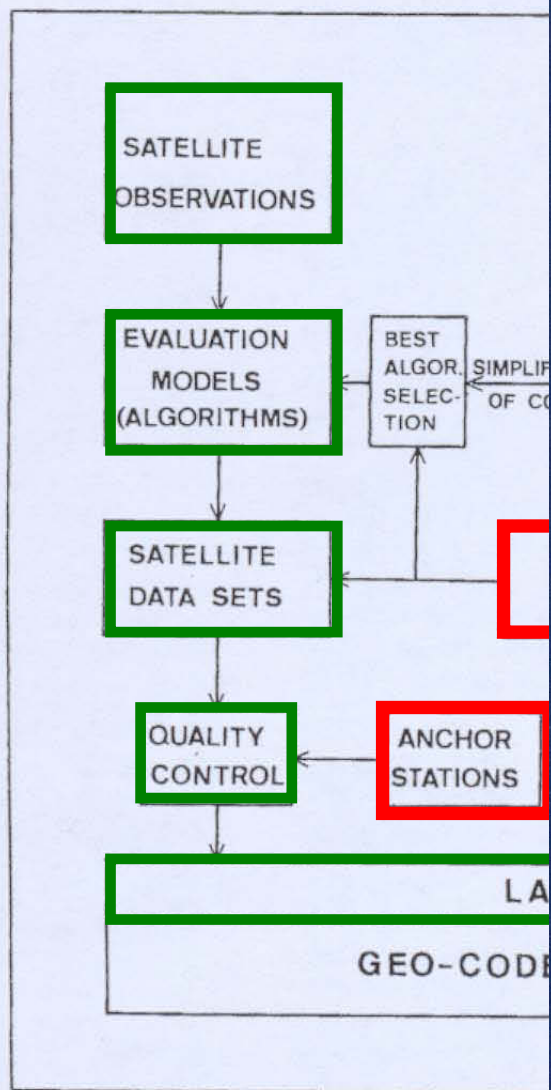


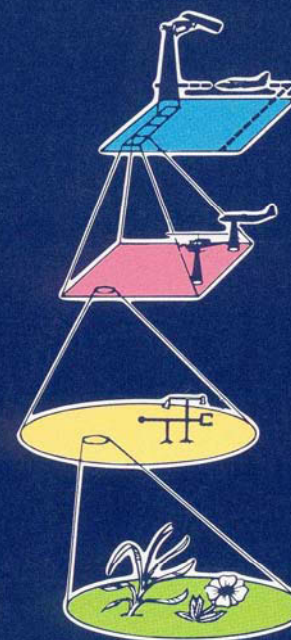
Fig. 1.8 ISLSCP research

UNITED NATIONS ENVIRONMENTAL PROGRAMME



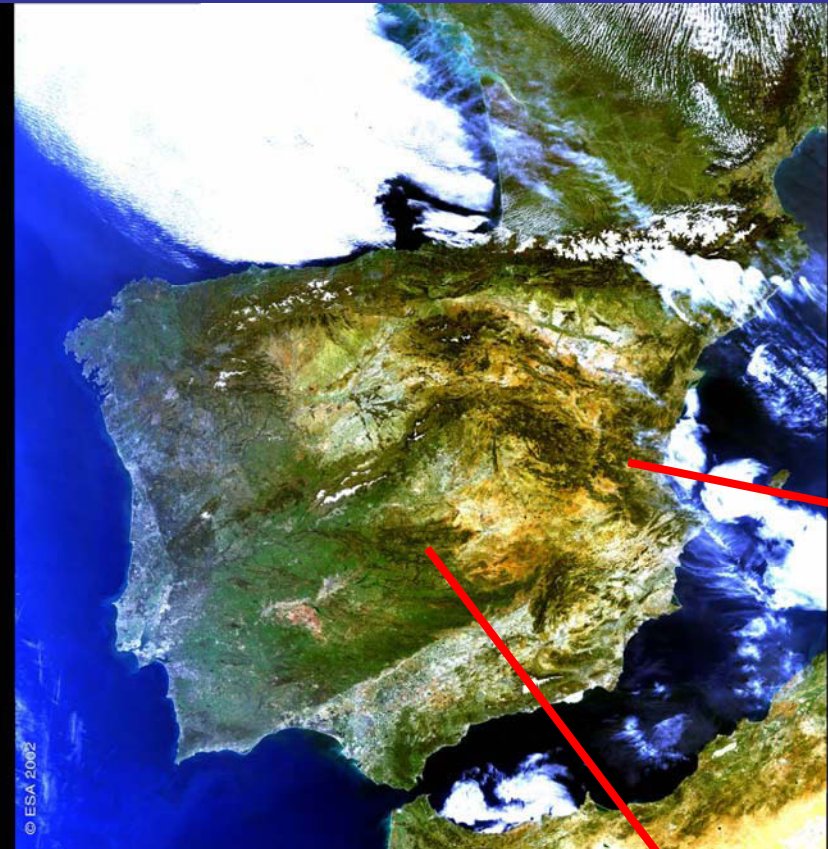
THE INTERNATIONAL SATELLITE LAND-SURFACE CLIMATOLOGY PROJECT

F. BECKER H.-J. BOLLE P. R. ROWNTREE



COMMITTEE ON SPACE RESEARCH (COSPAR)
INTERNATIONAL ASSOCIATION OF METEOROLOGY AND
ATMOSPHERIC PHYSICS (IAMAP)
in co-operation with the
WORLD CLIMATE RESEARCH PROGRAMME
WMO - ICSU

The VALENCIA Anchor Station Site



High Resolution MERIS Image

300 m

*Most suitable area in Europe
for validation of low-resolution
sensors*

23 March 2002



Digital Terrain Model



| | |
|--|-------------|
| | 1 - 223 |
| | 224 - 445 |
| | 446 - 668 |
| | 669 - 890 |
| | 891 - 1113 |
| | 1114 - 1335 |
| | 1336 - 1558 |
| | 1559 - 1780 |
| | 1781 - 2003 |

Remote Sensing Unit
Climatology from Satellites Group

UNIVERSITAT DE VALÈNCIA  Facultat de Física

coSMOS

campaign for validating the operation of SMOS

Hydrological Planning Office



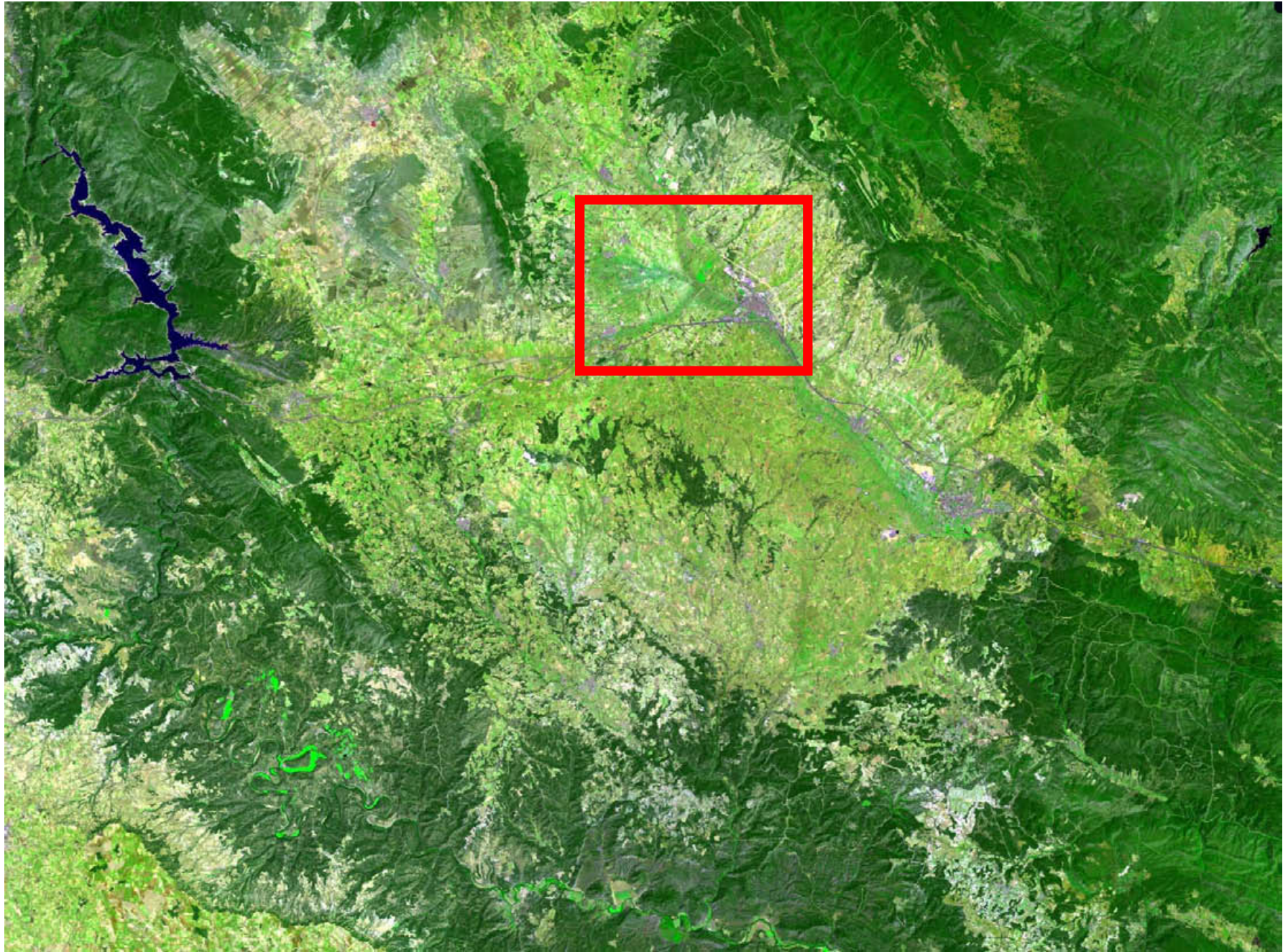
MINISTERIO
DE MEDIO AMBIENTE

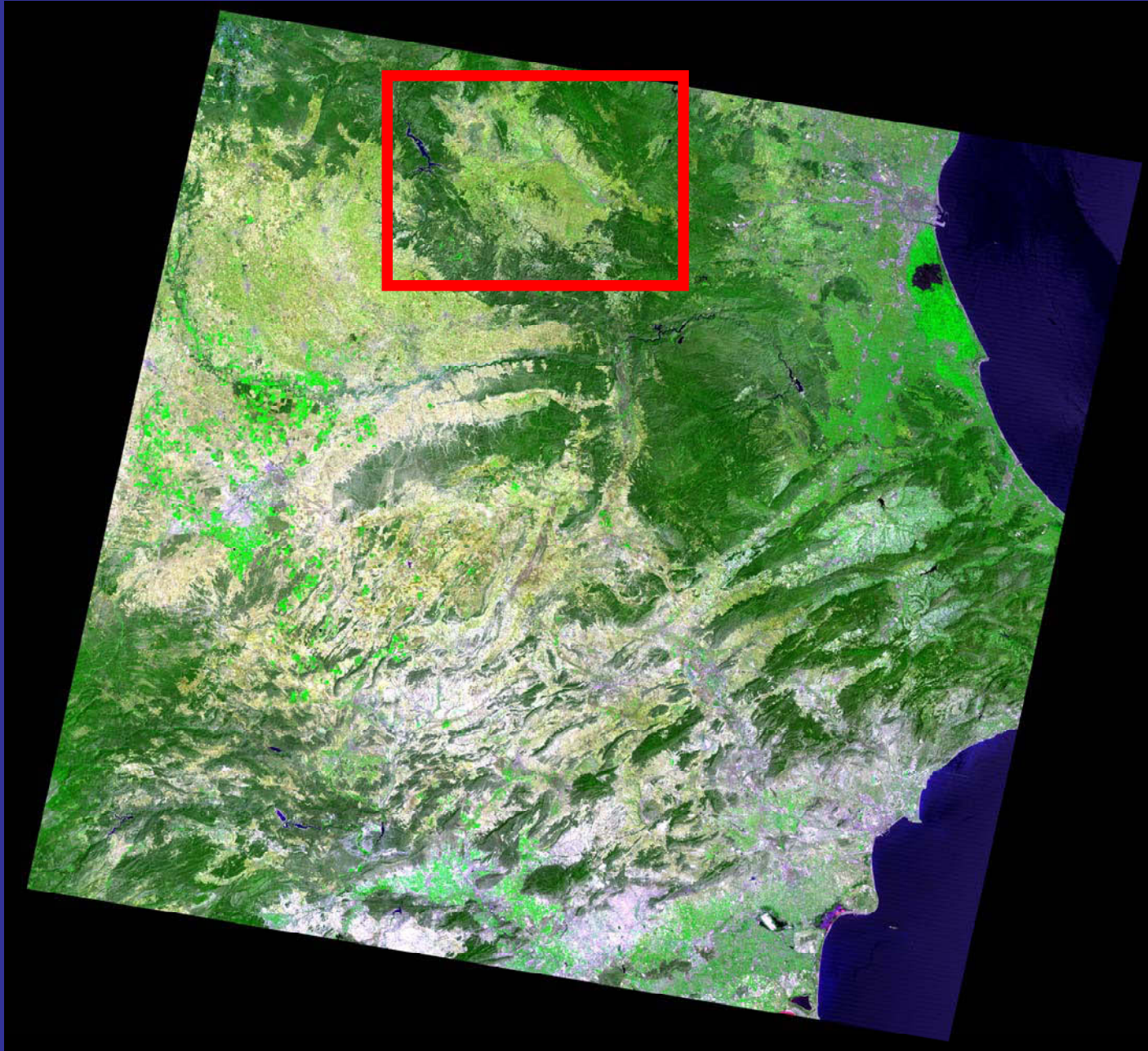
SECRETARÍA DE ESTADO
DE AGUAS Y COSTAS

CONFEDERACIÓN
HIDROGRÁFICA
DEL JÚCAR

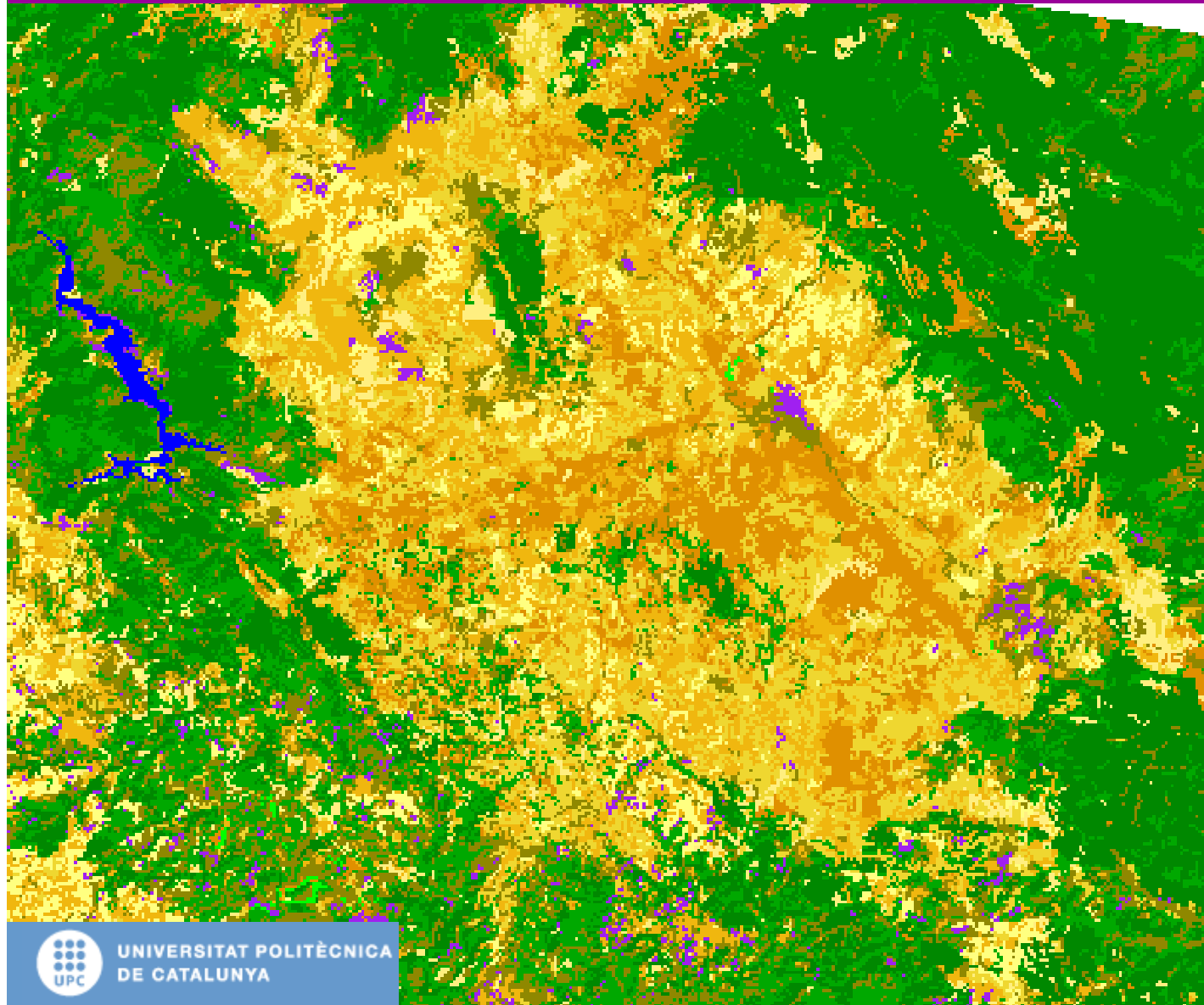


VALENCIA ANCHOR STATION
(39°34'15"N, 1°17'18"W, 813 m)





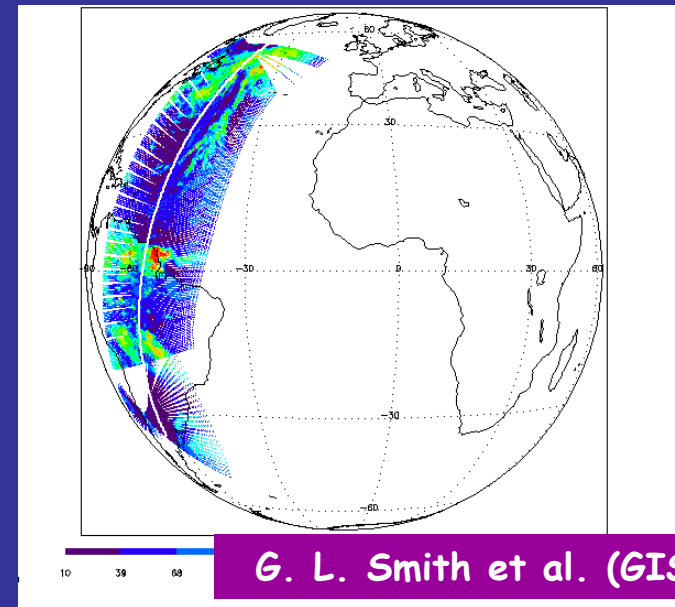
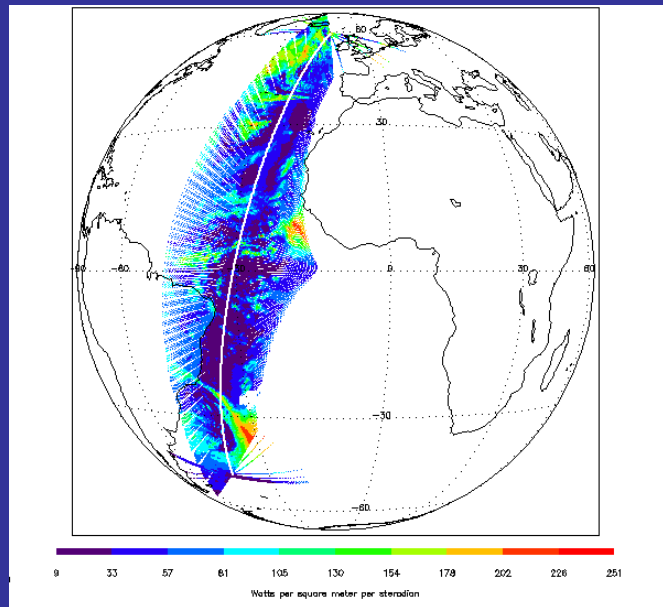
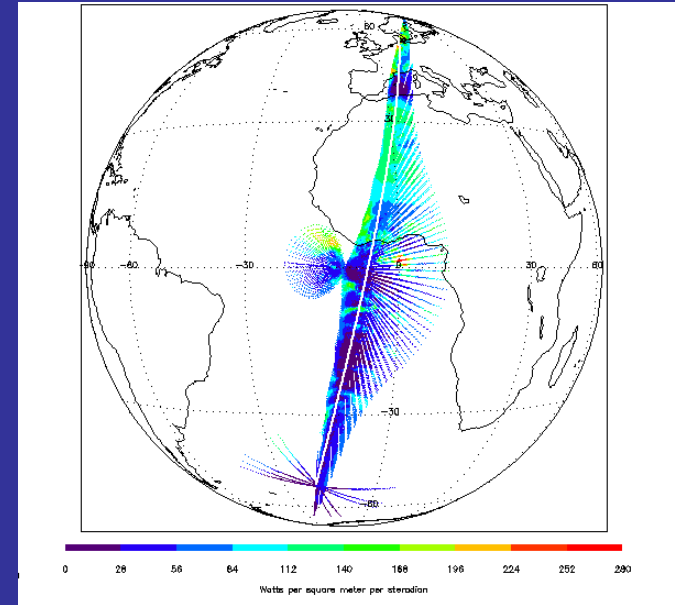
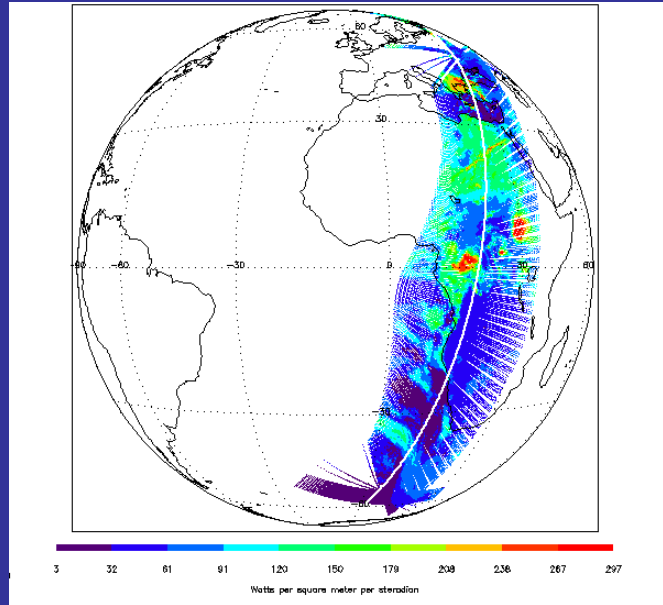
Classified LANDSAT image (5th July 2003): 11 categories for the Valencia Anchor Station area (50 x 50 km²)



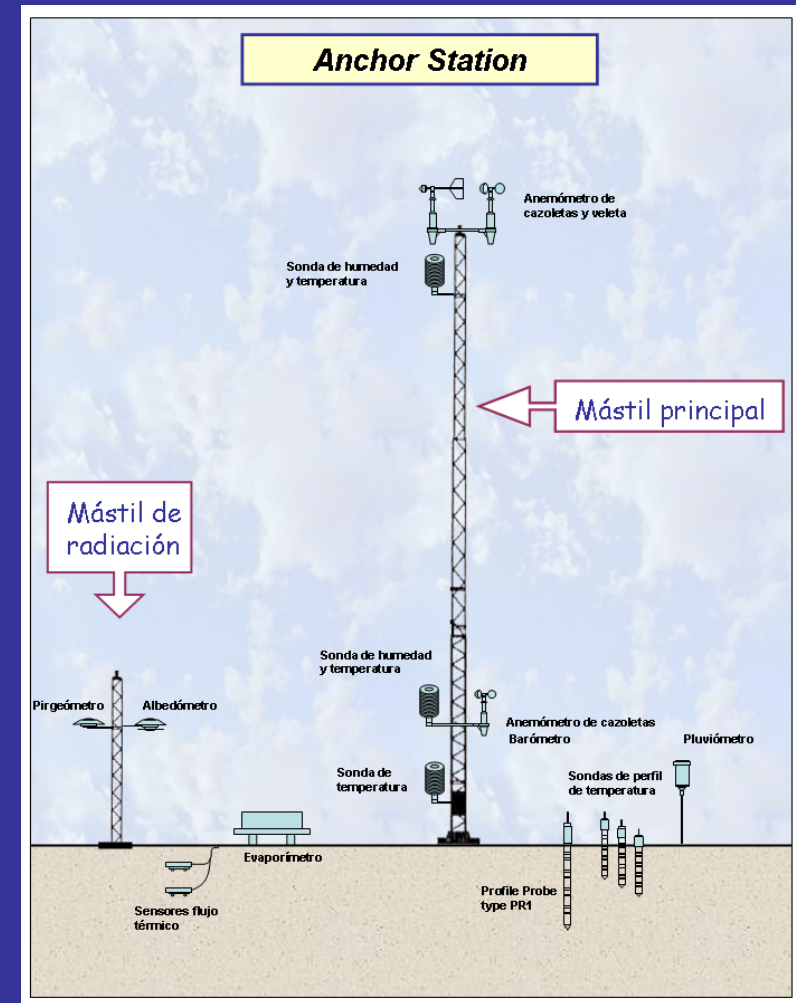
| | |
|----|------------------------|
| 1 | Water |
| 2 | Pine trees |
| 3 | Low-density Pine trees |
| 4 | Shrubs |
| 5 | Irrigated |
| 6 | Vineyard |
| 7 | Low-density vineyard |
| 8 | Very low density |
| 9 | Dry crops |
| 10 | Bare soil |
| 11 | Degraded |



UNIVERSITAT POLITÈCNICA
DE CATALUNYA



G. L. Smith et al. (GIST 20)









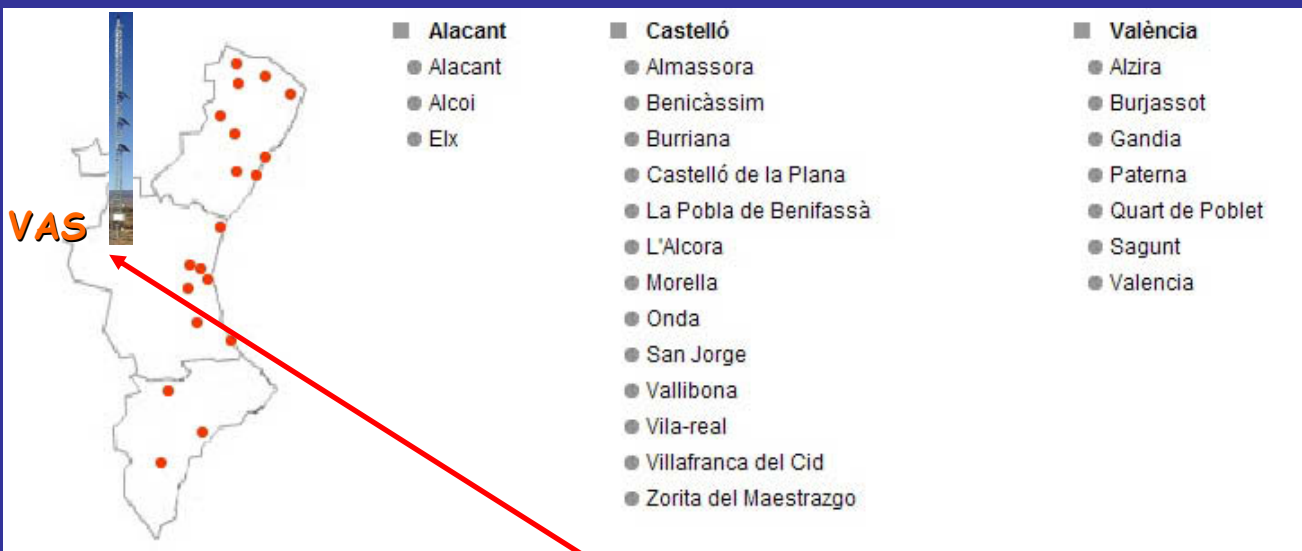
Mobile stations



June 2003



February 2004

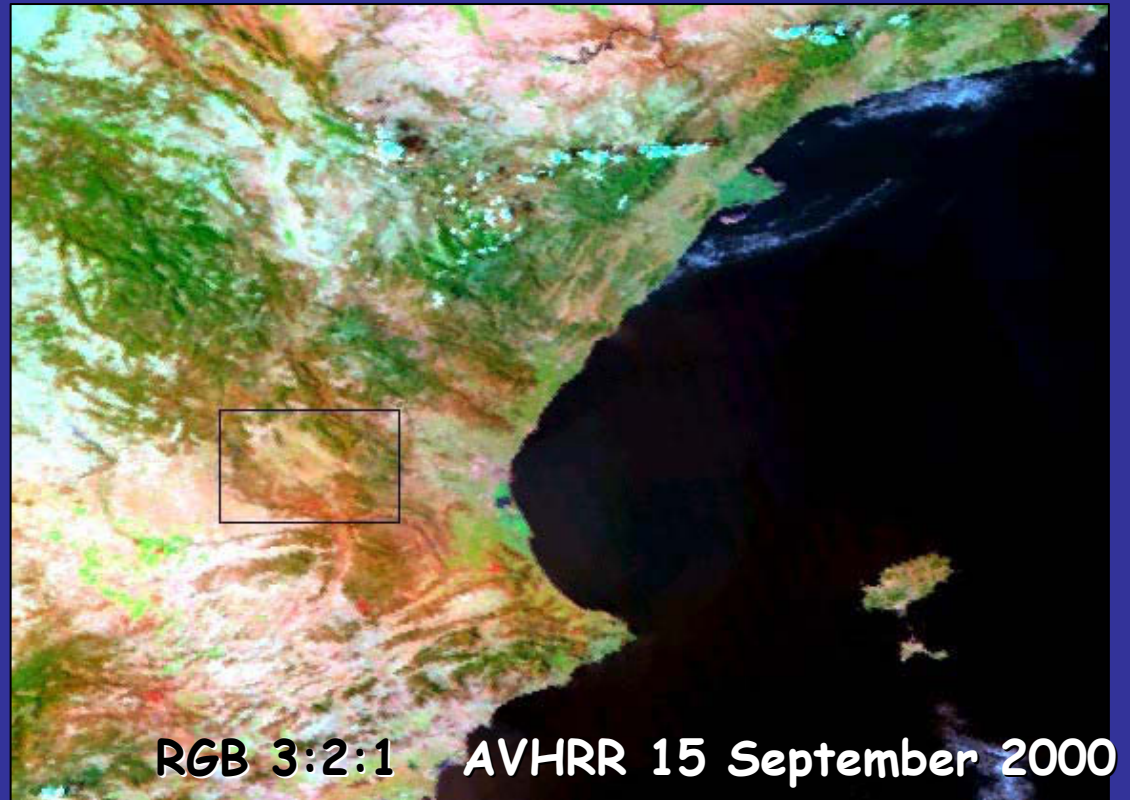


Regional Government Air Quality Network



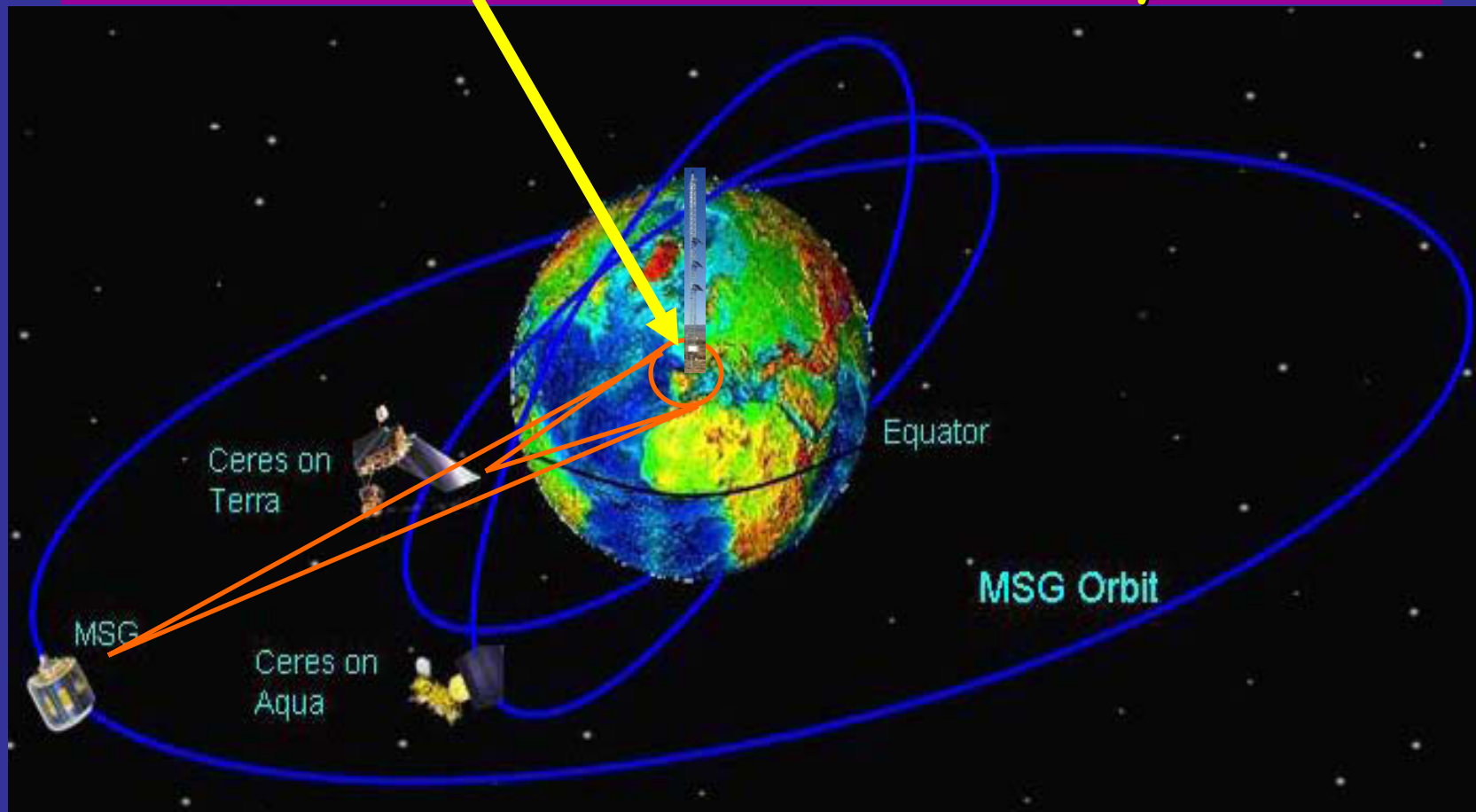
Retrospective Study of Surface Parameters

- Albedo
- Emissivity
- NDVI
- Surface Temperature
(day, night)
- Thermal Inertia
- Monthly values
 - AVHRR
 - SPOT-VEGETATION

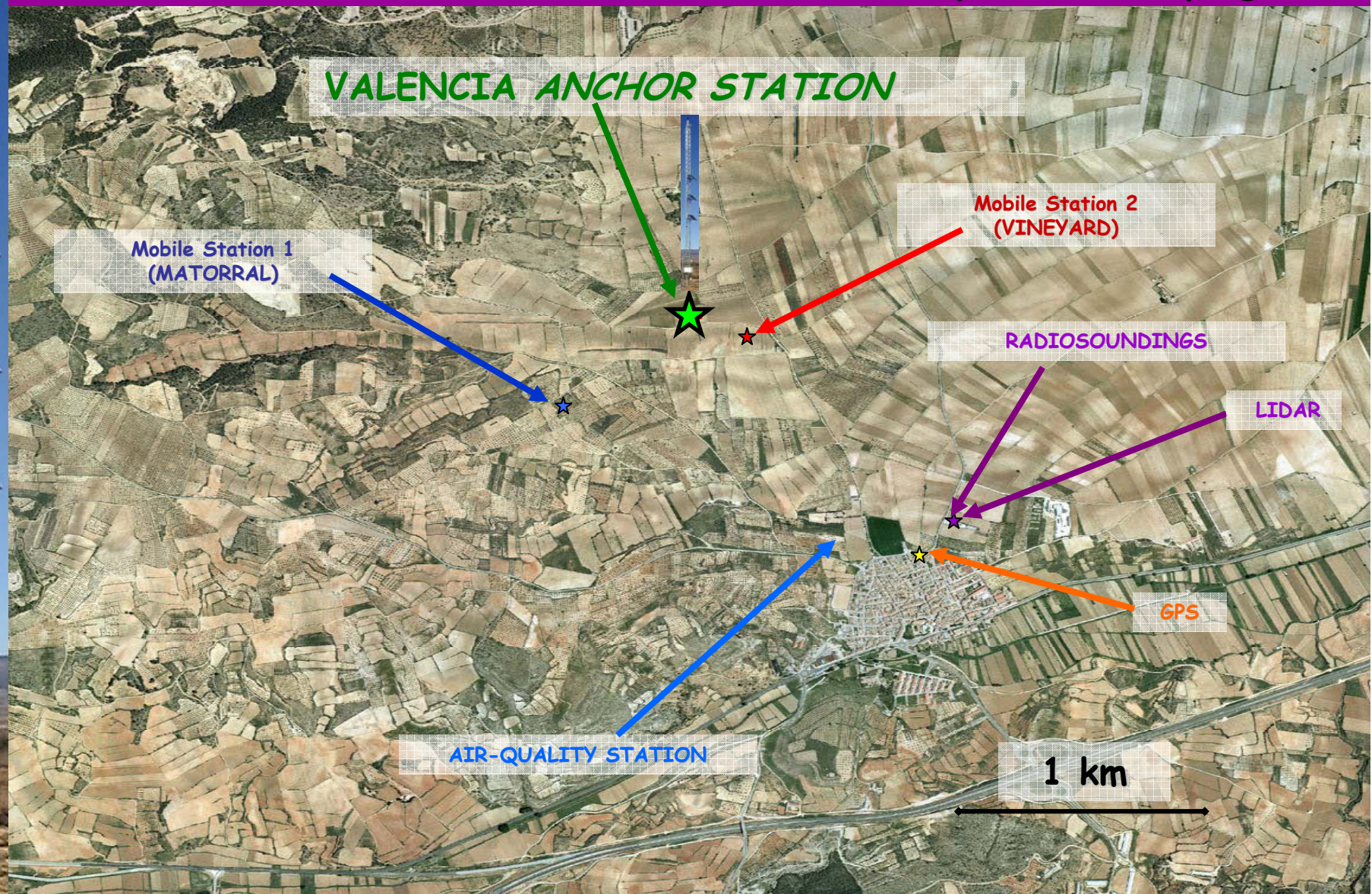


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DE CATALUNYA

***GERB Ground Validation Campaigns at
VALENCIA ANCHOR STATION
14-30 June 2003 & 9-12 February 2004***

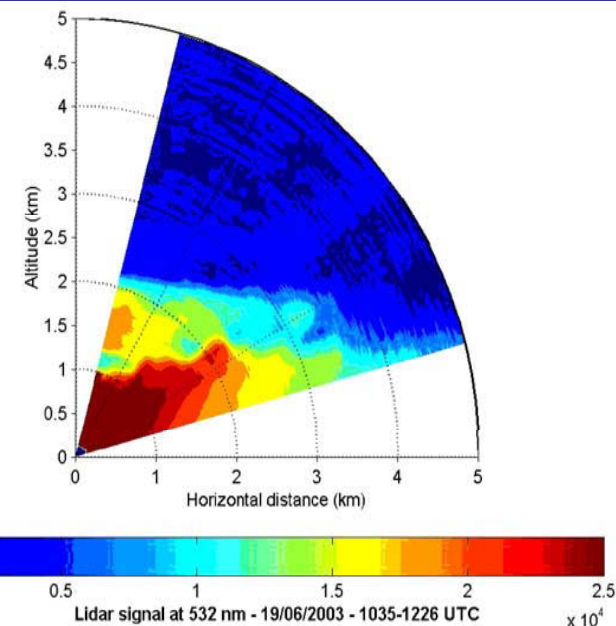


Localization of the measurements (February 2004 campaign)

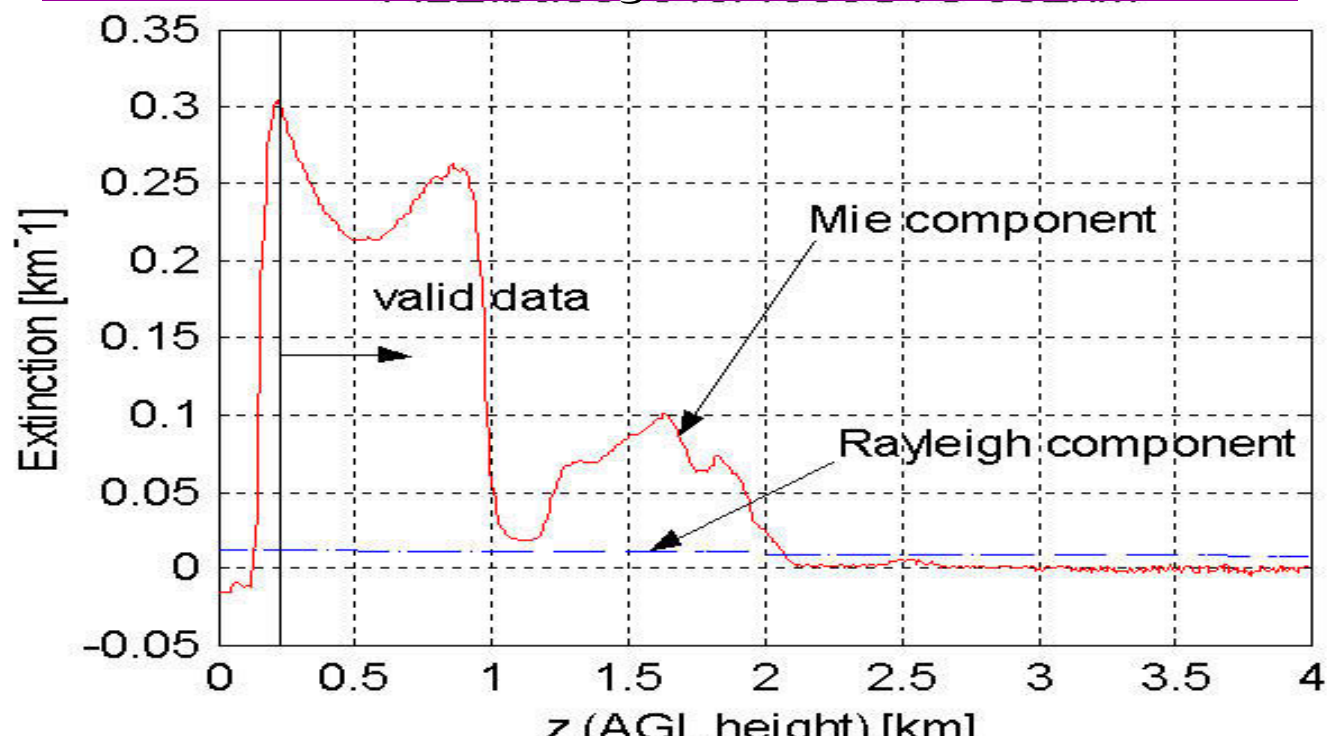


LIDAR from Polytechnic Univ of Catalonia, Spain

Jun-19th Elevation Scan 1

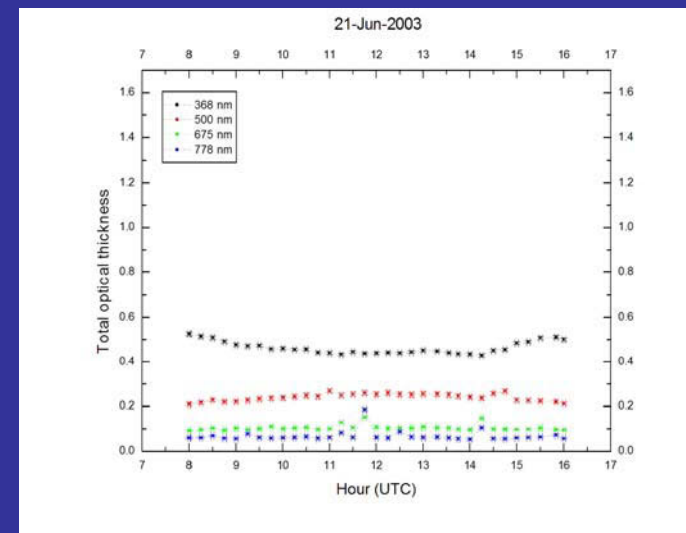
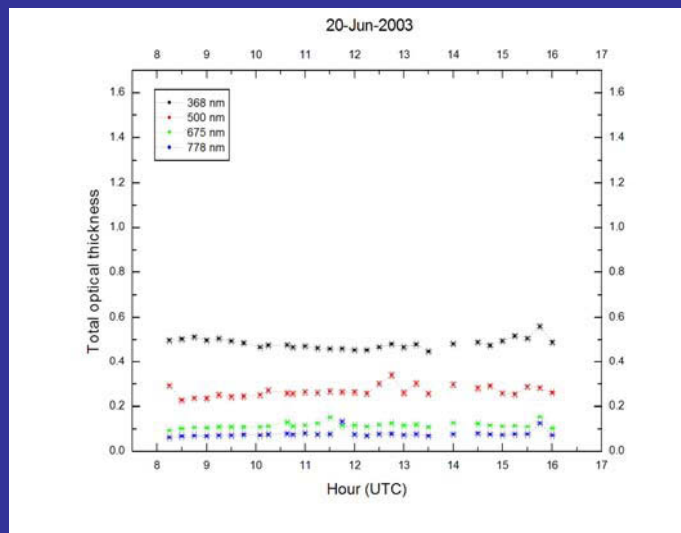
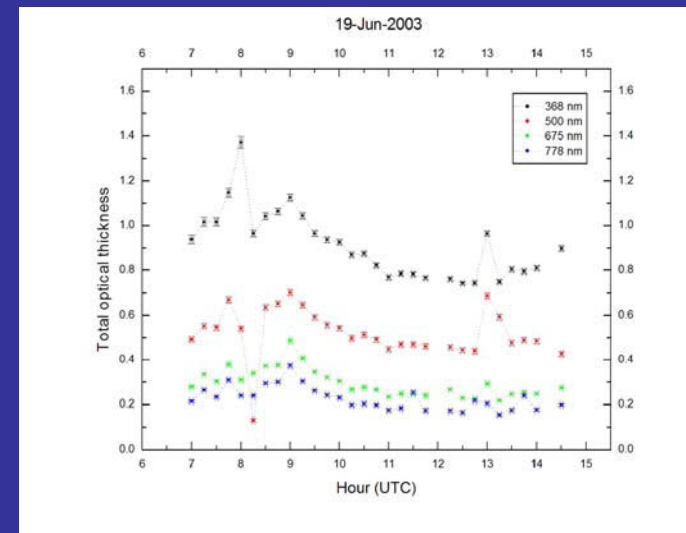
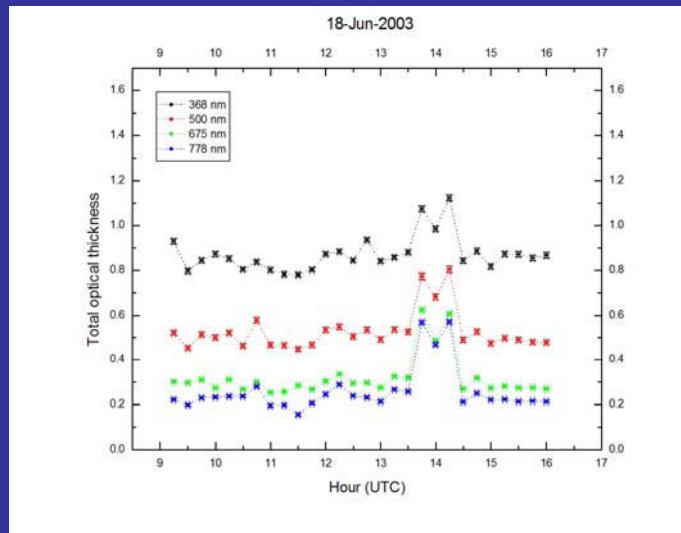


Jun-19th 15-deg Zenith Inversion 1

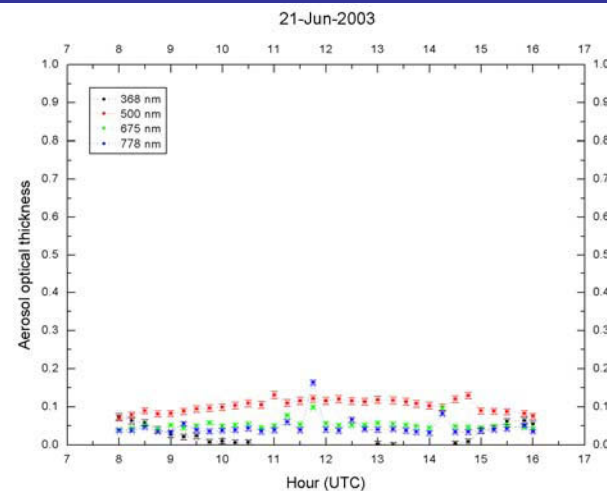
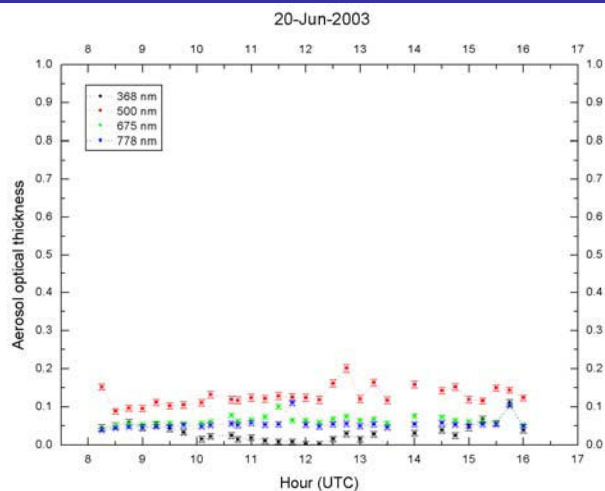
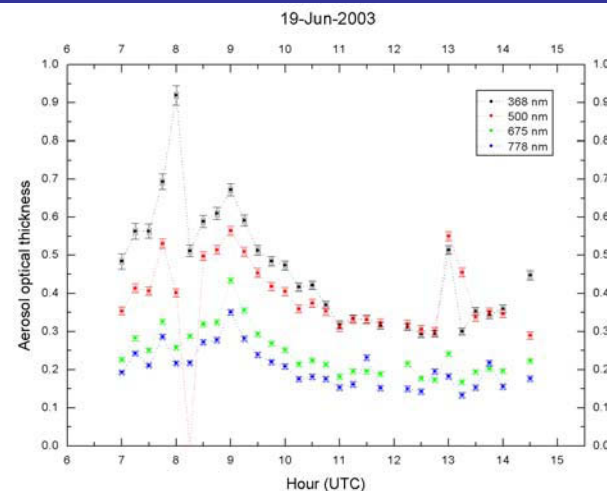
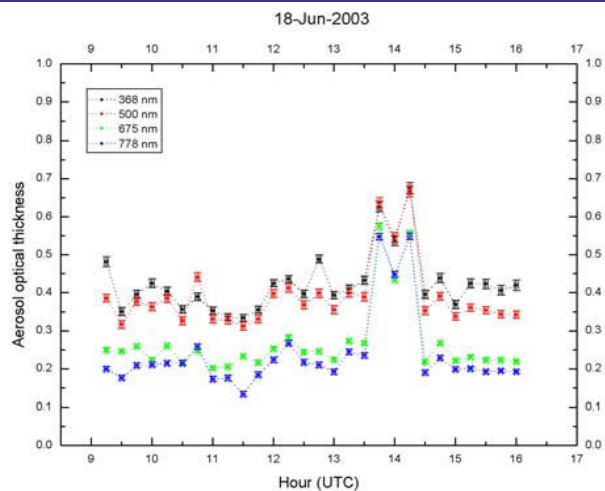




Sun-photometer Data Analysis: Total Optical Thickness

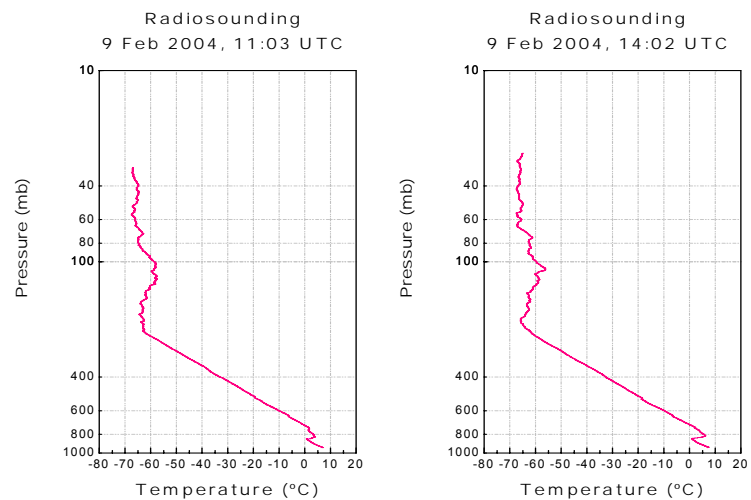
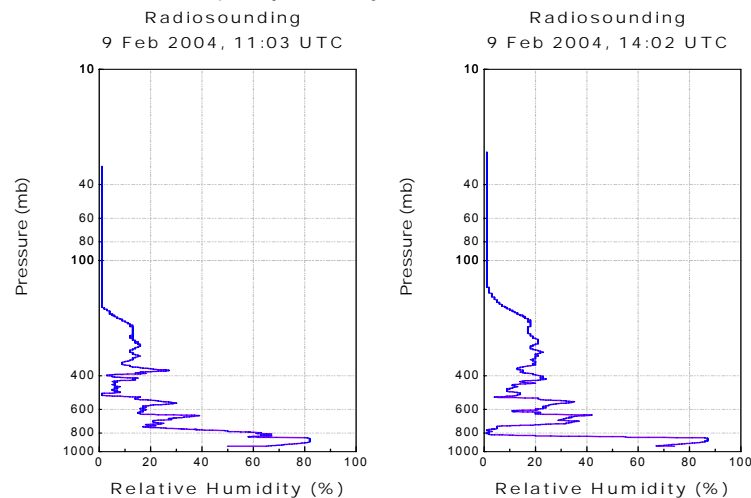


Data Analysis: Aerosol Optical Thickness

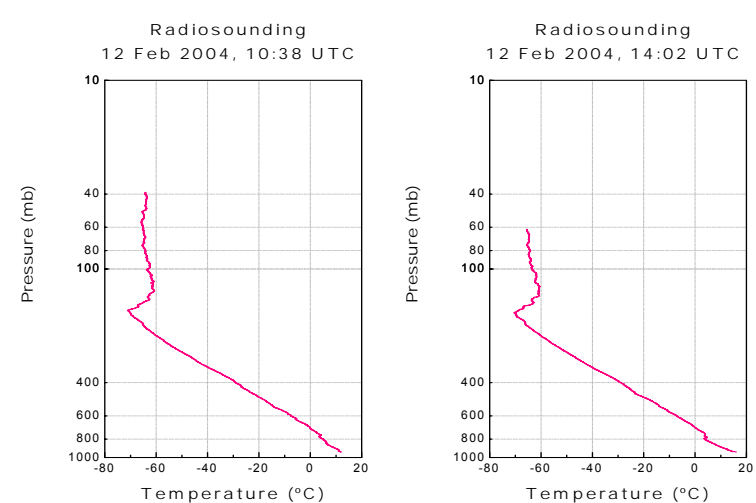
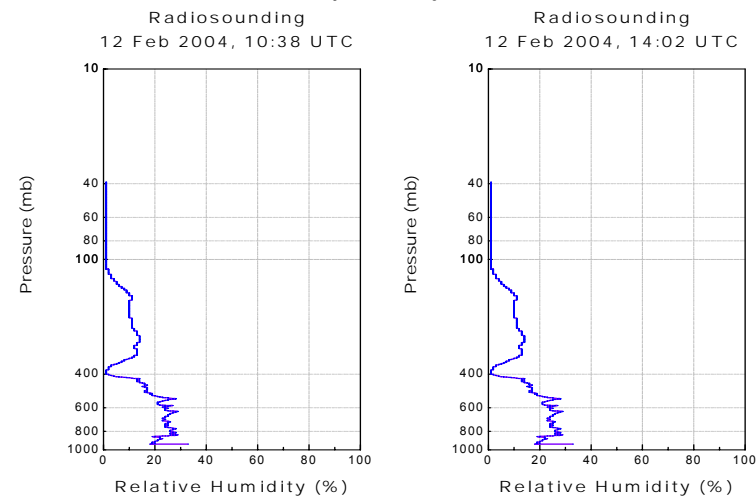


Radiosounding ascents from Spanish Met Institute, exactly on spot at CERES overpassing times

9 Feb. 2004



12 Feb. 2004



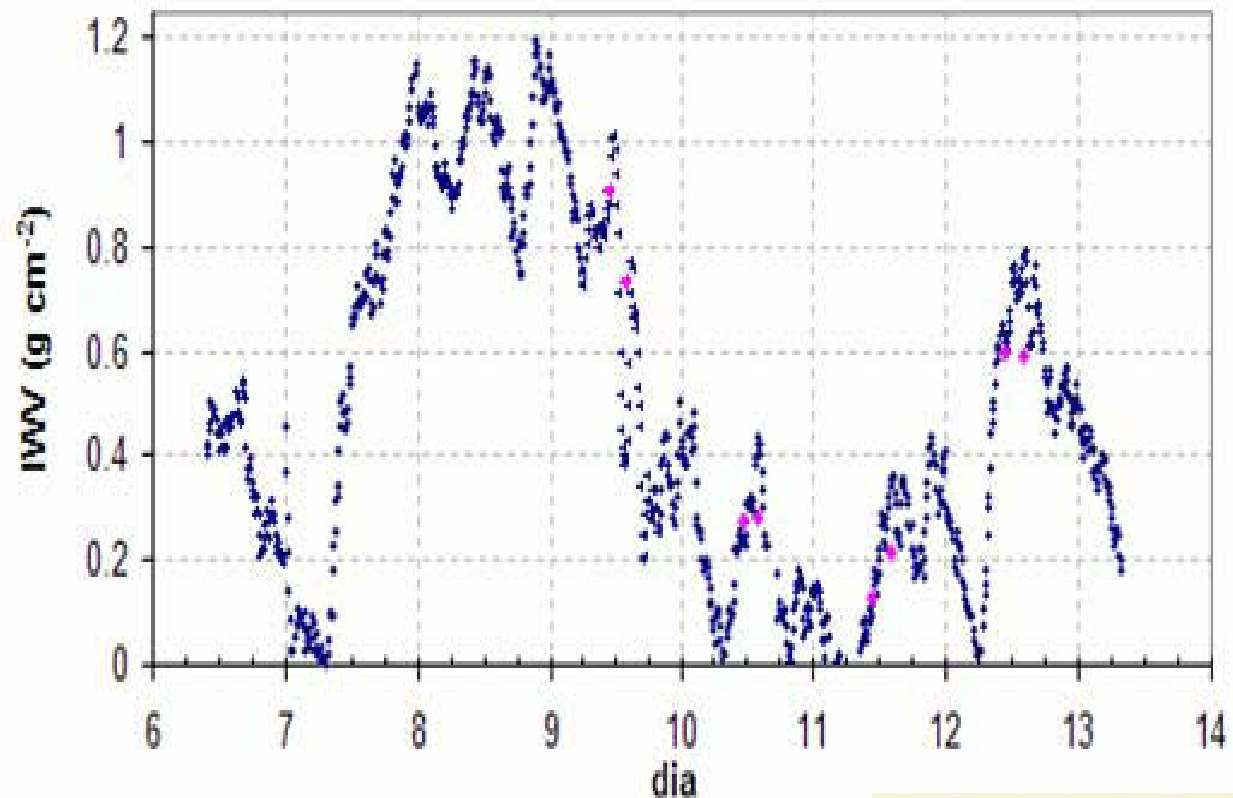
Continuous Precipitable Water Content Measurements (IEEC)

- Choke Ring antenna at the top of the roof
- Antenna, tripod and low-losses cable.



Comparison between PWC and radiosondings

6-13 febrero 2004



• GPS • Radiosondeo

IEEC



GERB

BANDA TOTAL

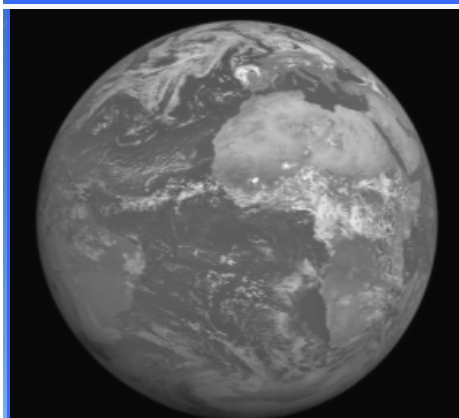


Imagen GERB 24. 06. 2003 (11:35h UTC)

BANDA SOLAR

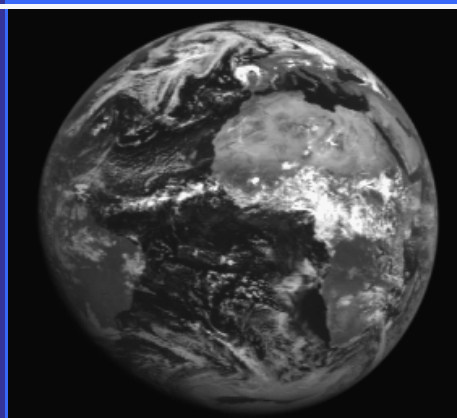


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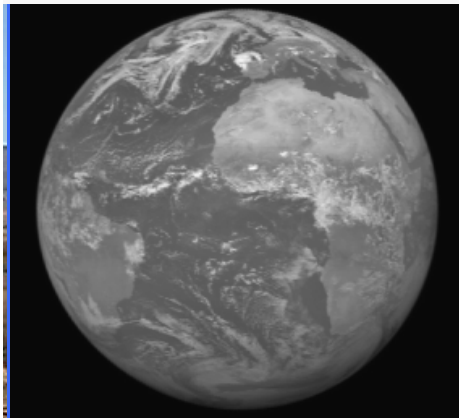


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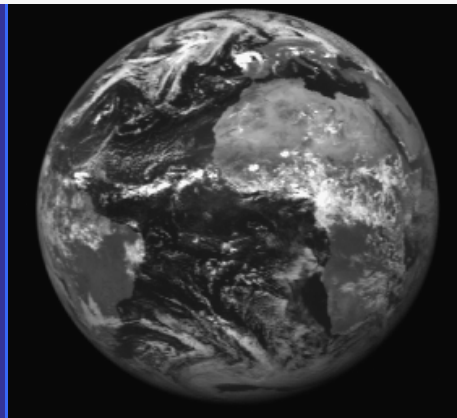


Imagen GERB 24. 06. 2003 (13:14h UTC)

BANDA TOTAL

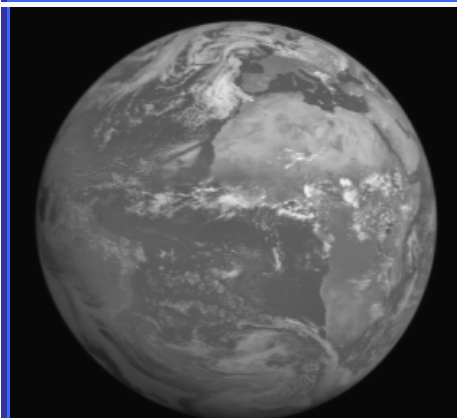


Imagen GERB 21. 06. 2003 (11:04h UTC)

BANDA SOLAR

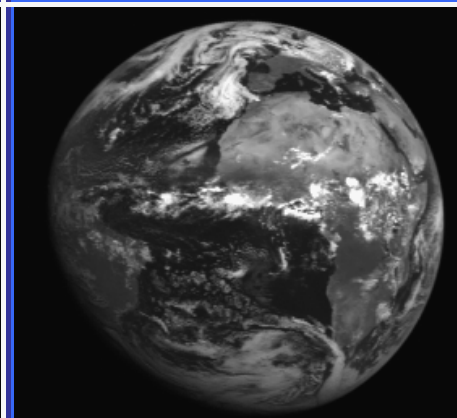


Imagen GERB 21. 06. 2003 (11:07h UTC)

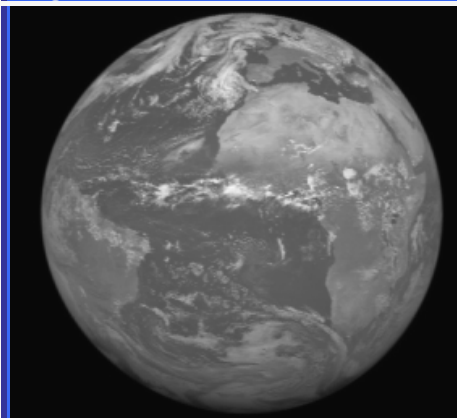


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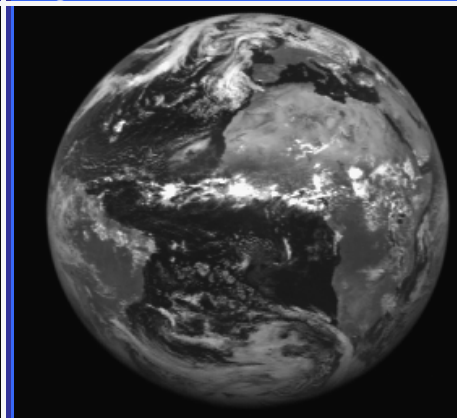
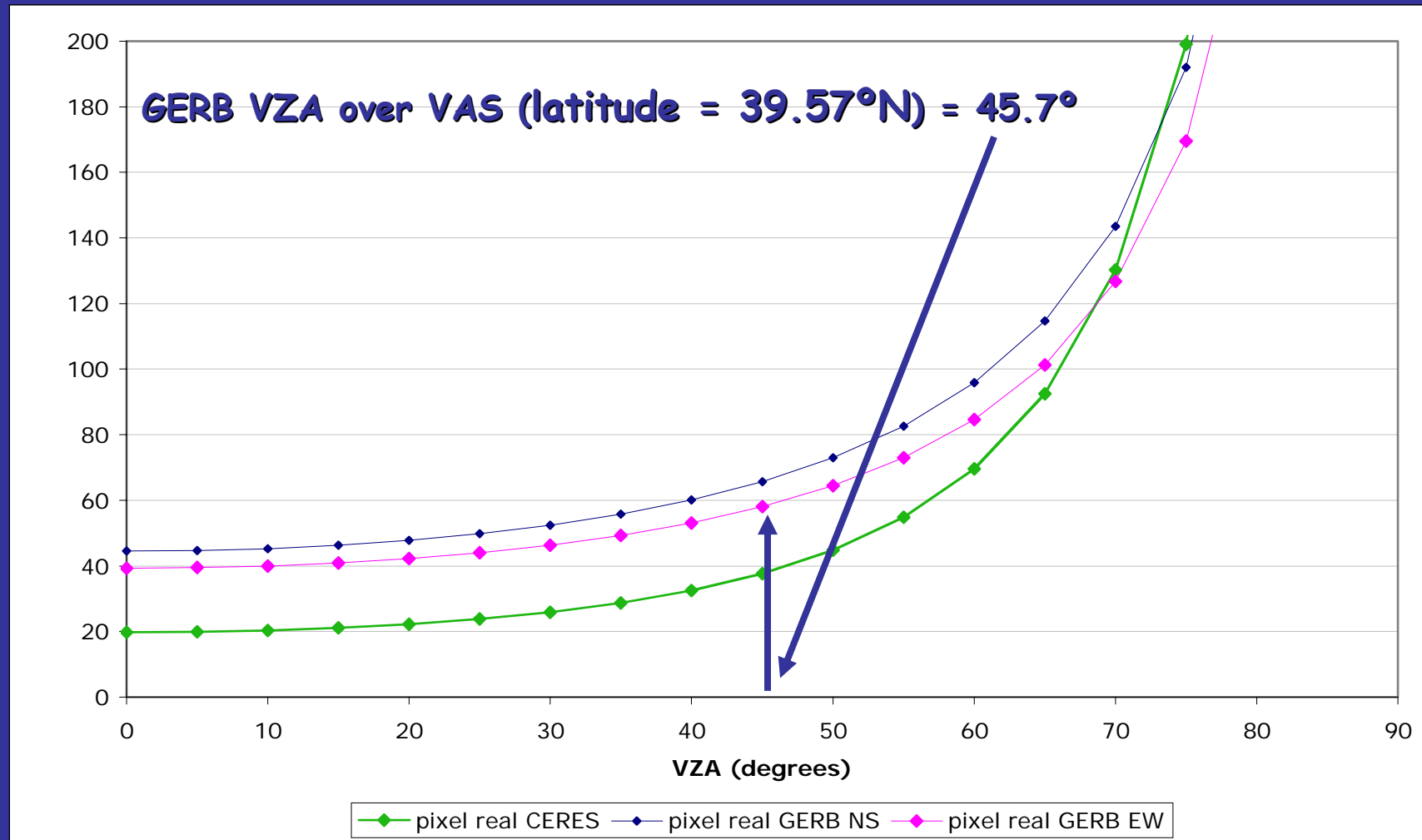
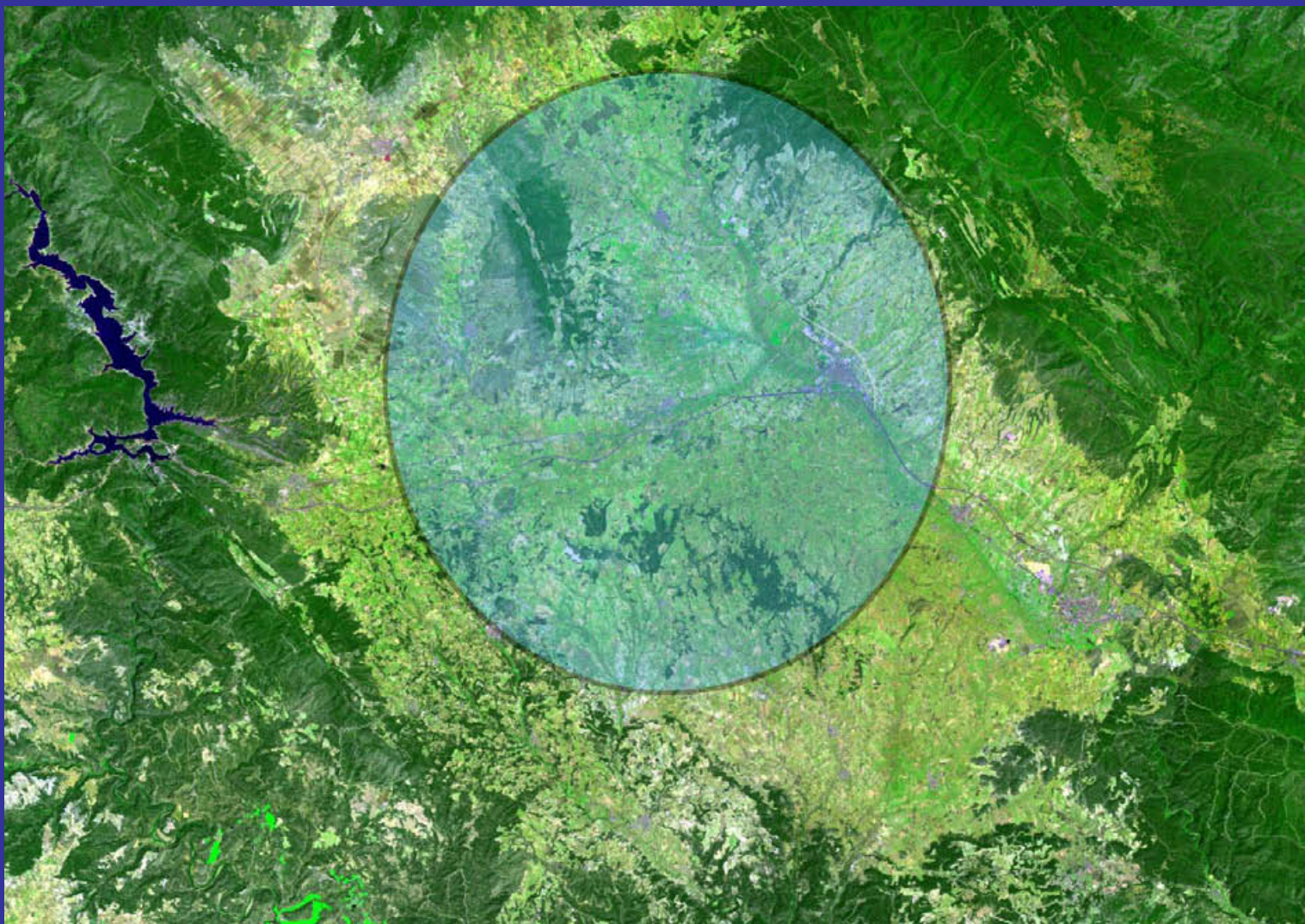


Imagen GERB 21. 06. 2003 (12:43h UTC)

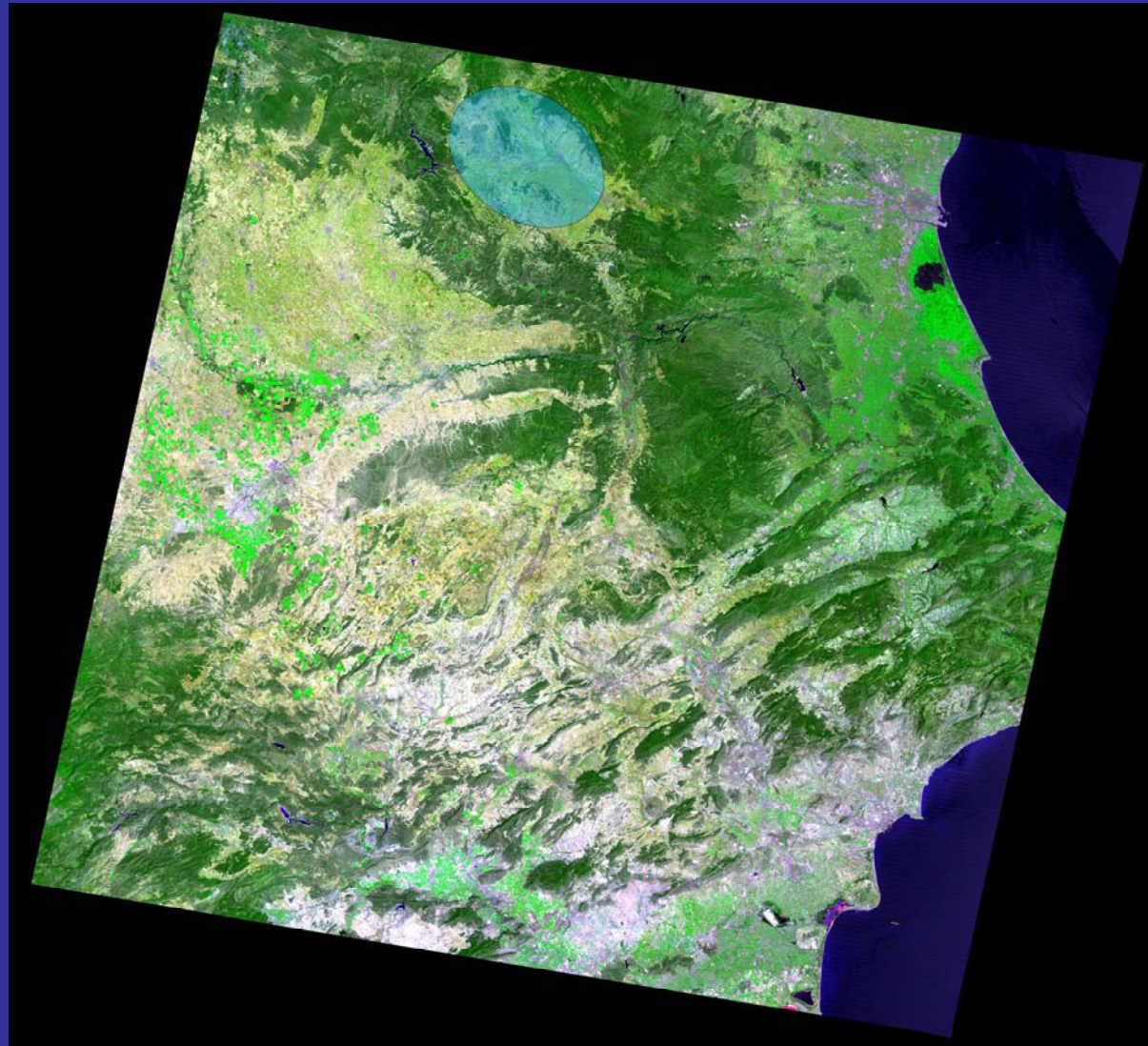
Change of Pixel Size as a Function of VZA (GERB and CERES)



LANDSAT image with CERES Footprint (15° VZA)



LANDSAT image with CERES Footprint (40° VZA)



CERES on Aqua (FM3) 10 Feb. 2004. SW Radiance

Shortwave Unfiltered Radiance from CERES ERBE-like Processing

Aqua-FM3 February 10, 2004 ES-8

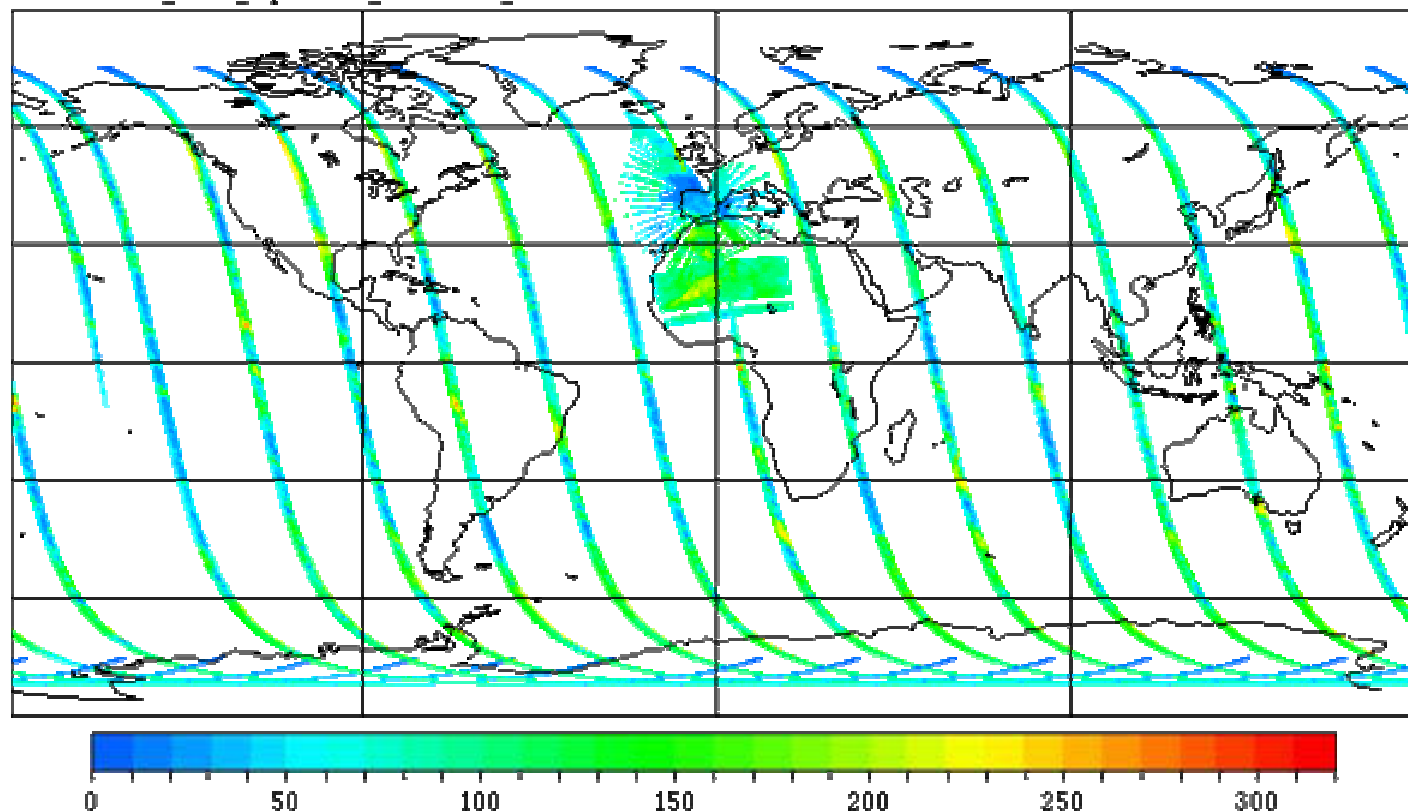
Processed : 2004/06/21

Measurement Level

Instantaneous

File : CER_ES8B_Aqua-FM3_Edition2_026025.20040210

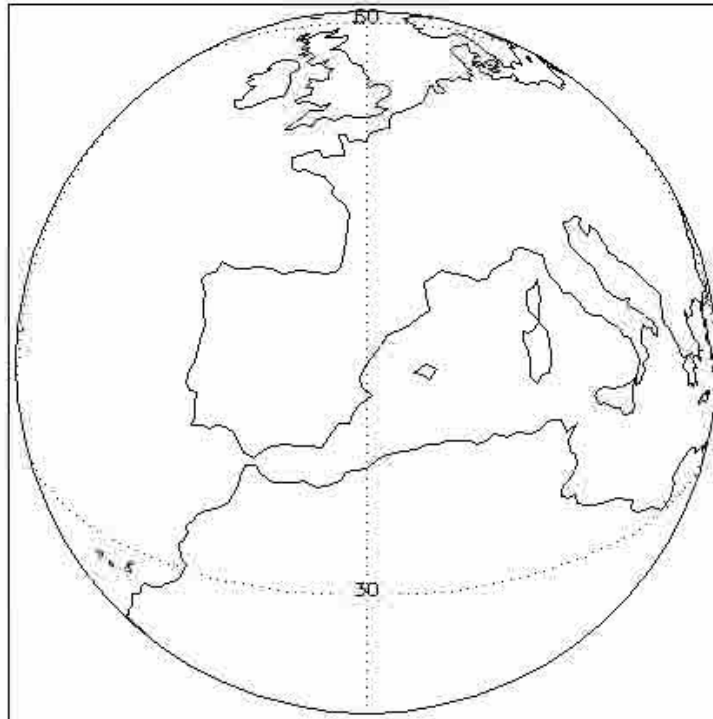
00:00 - 23:27



Watts/Meter²/Steradian

CERES on Aqua (FM3) 9 Feb. 2004. SW Radiance

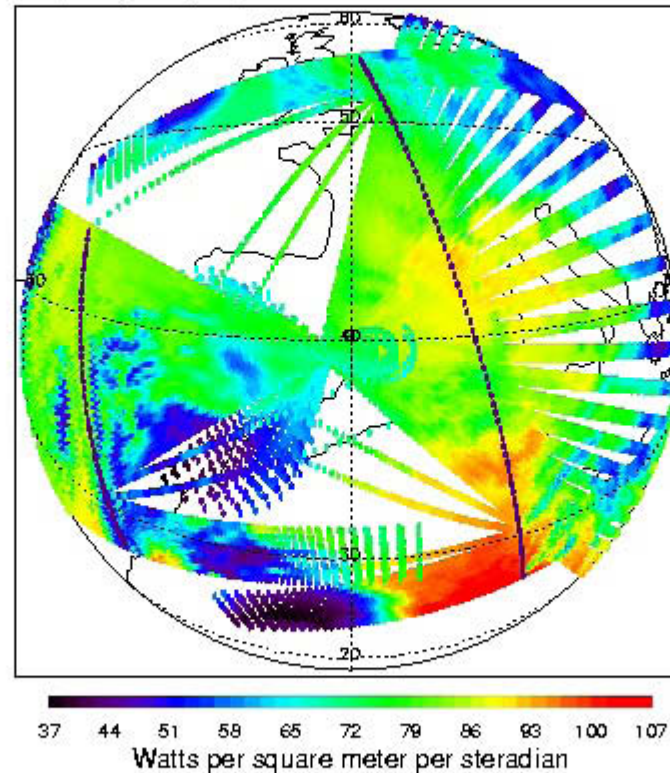
D:\Peter\FM3_vas_040.hdf Thu Mar 25 12:46:46 2004



Z. Peter Szewczyk & Kory J. Priestley

CERES on Aqua (FM3) 9 Feb. 2004. LW Radiance

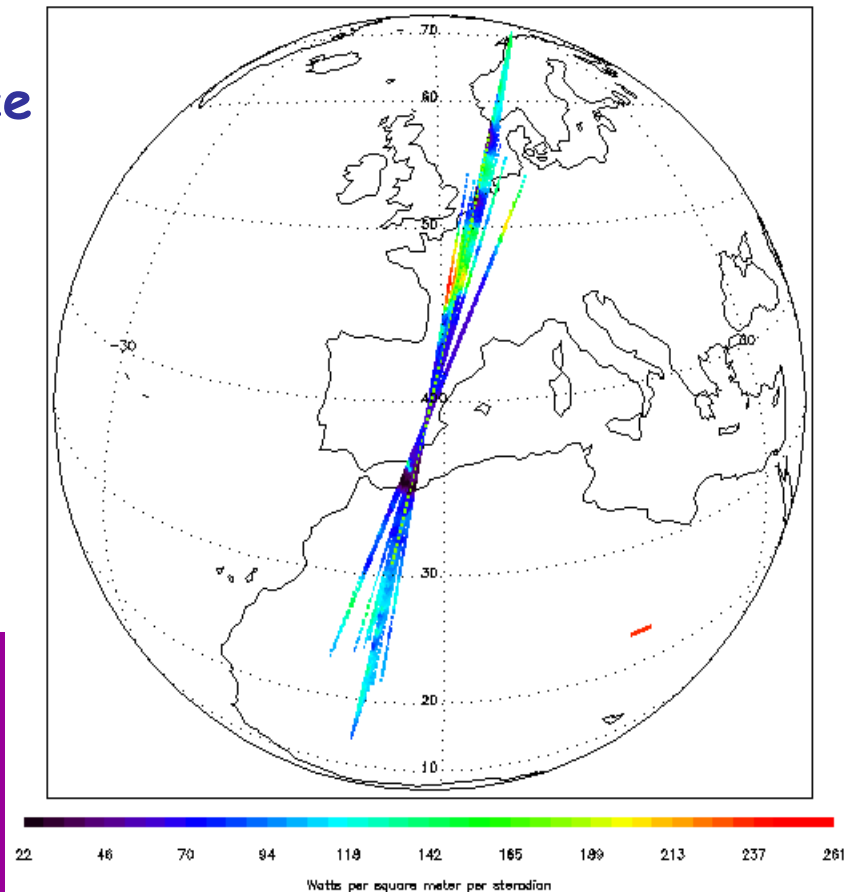
CERES LW unfiltered radiance Data Range: 1: 116: 1; 1: 660: 1
/home/szew/Plots/Feb/FM3_vas_040.hdf Fri Mar 26 09:18:52 2004



Z. Peter Szewczyk & Kory J. Priestley

Terra pass at 10:56–11:03 on 06/14/2003; view from 2000 km

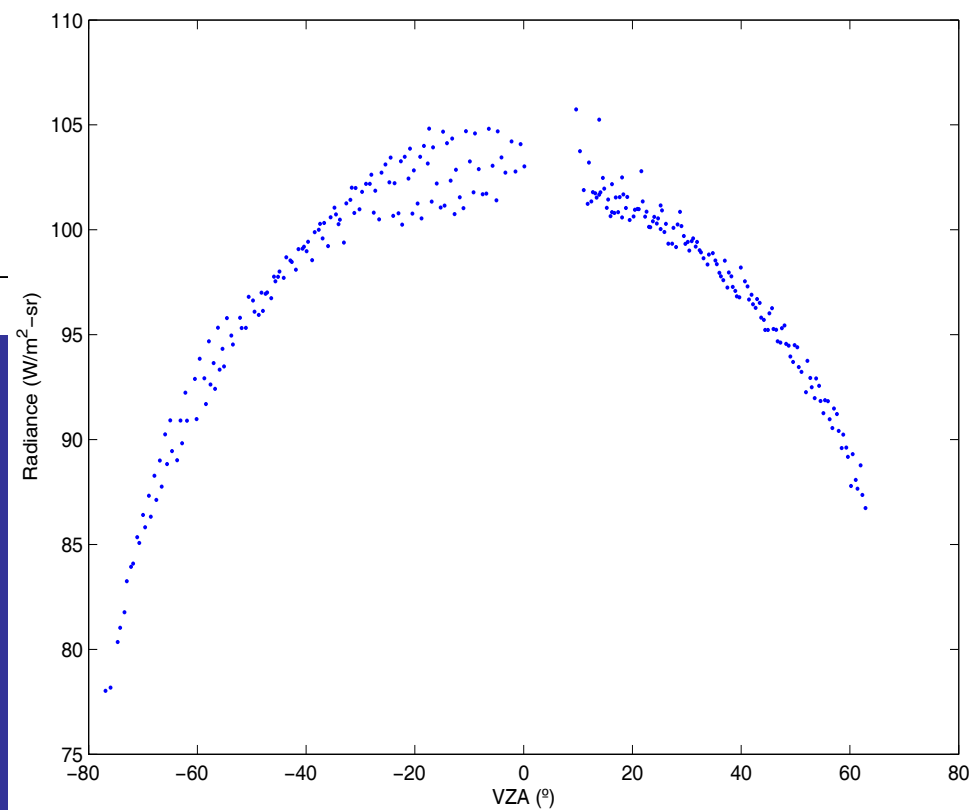
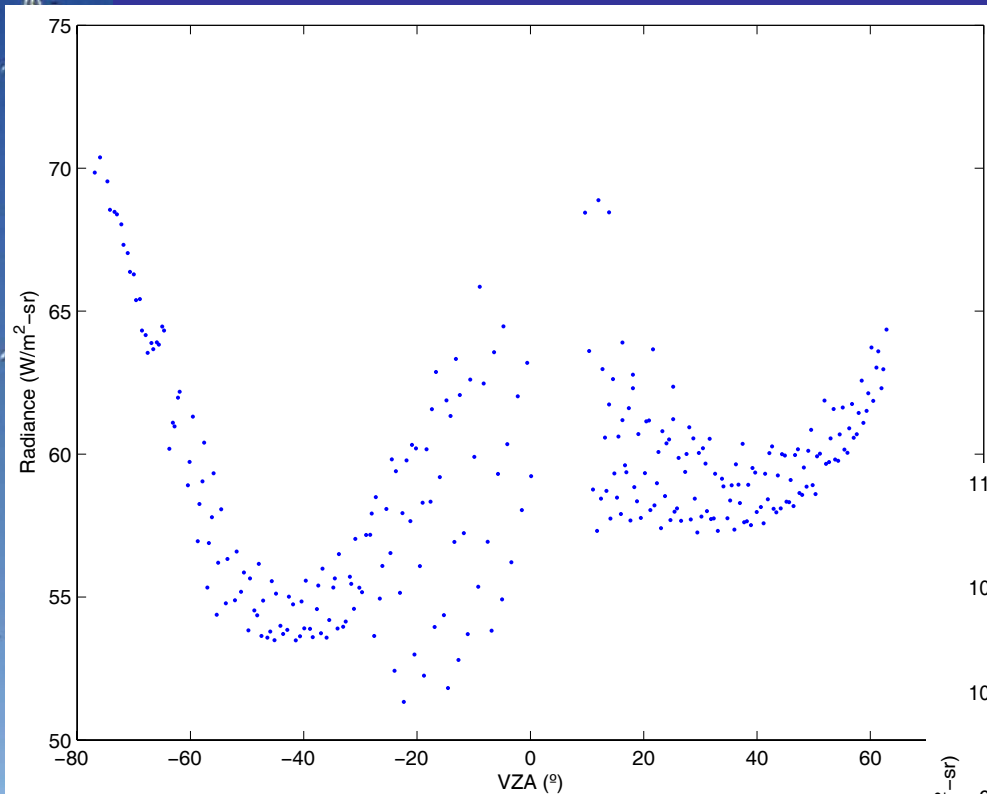
Shortwave radiance



*GERB/CERES
SCALES Campaign
June, 2003 (13–30
June 2003). 1st
GERB Ground
Validation Campaign*

Z. Peter Szewczyk & G. L. Smith (GIST 19)

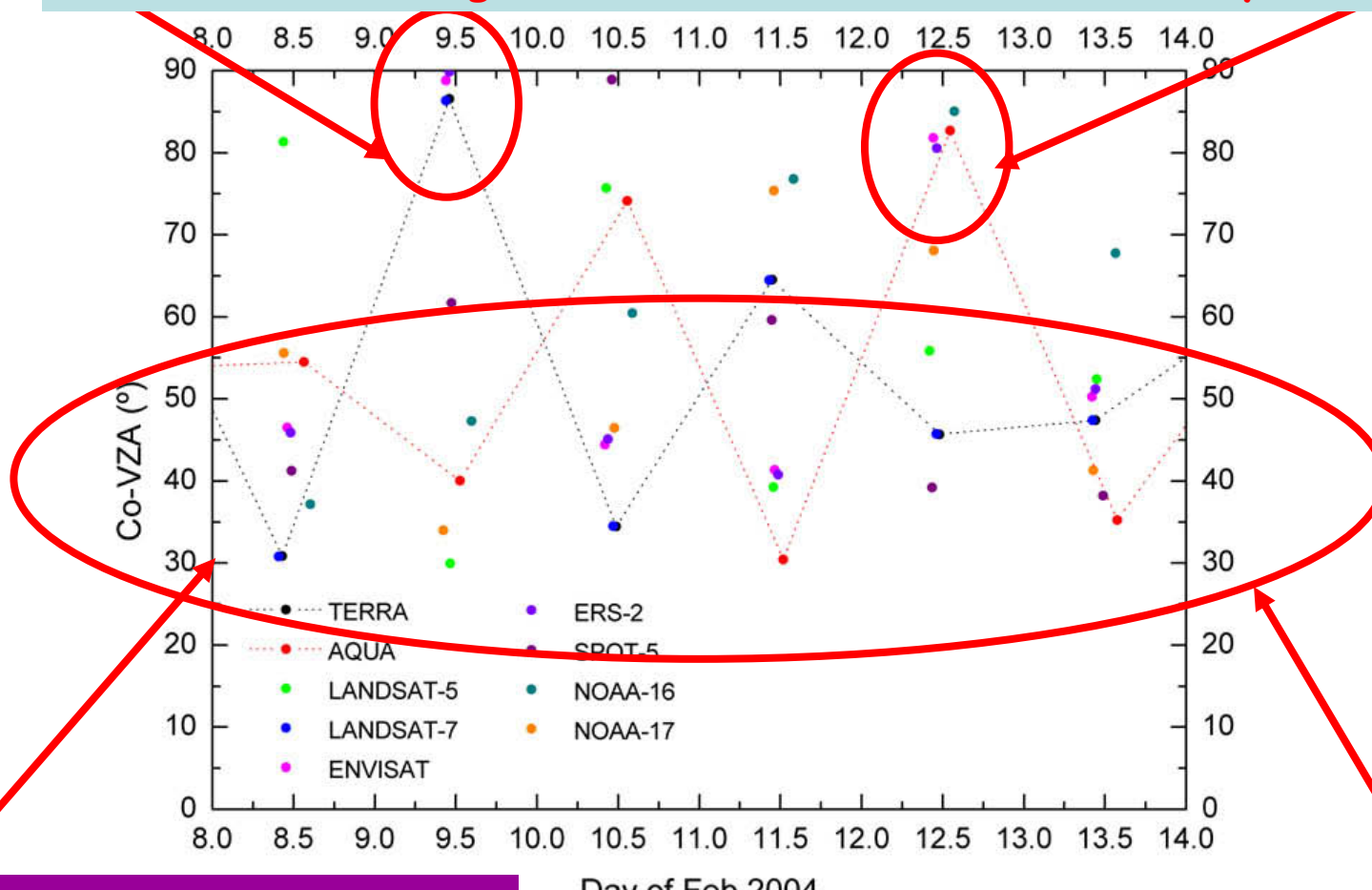
**Data from Terra
pass at 10:56–11:03
on 06/14/2003**



Z. Peter Szewczyk & G. L. Smith (GIST 19)

Hundreds of along-track observations from the very same spot!!!

TE



SENSORS IMPLIED

MSG

GERB

SEVIRI

TERRA & AQUA

CERES (FM2)

ASTER

MISR

MODIS

MOPITT

ENVISAT

MERIS

AATSR

MIPAS

SCIAMACHY

NOAA-16 & -17

AVHRR

-5

VEGETATION

SAT

LANDSAT-7 ETM

LANDSAT-5 TM

ERS-2

ATSR-2

Hundreds of BRDF measurements from the very same spot!!!

At different spatial scales!!!

(February 2004)

2nd GERB Ground Validation Campaign

RADIO SOUNDING ASCENTS

GPS

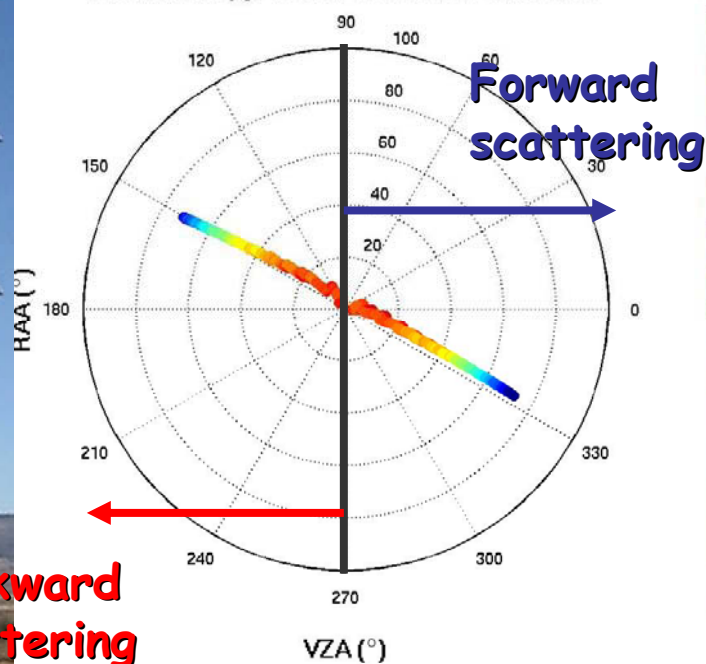
SUN-PHOTOMETER

DELTA-T THETA PROBES AND SOIL PROFILE PROBE

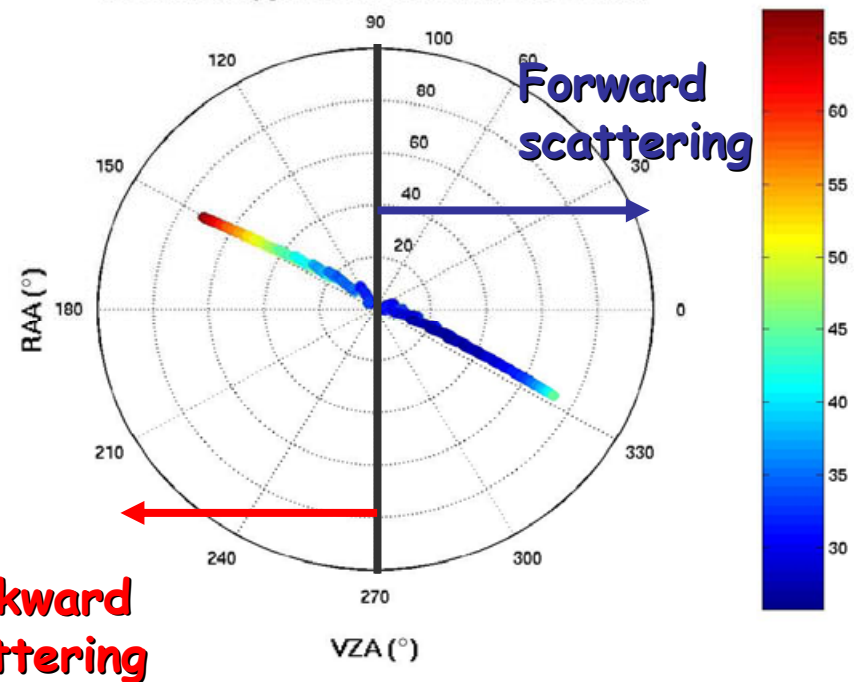
Anisotropic radiances from CERES PAPS over the Valencia Anchor Station



LW anisotropy, 12-Feb-2004 13:05-13:12 UTC



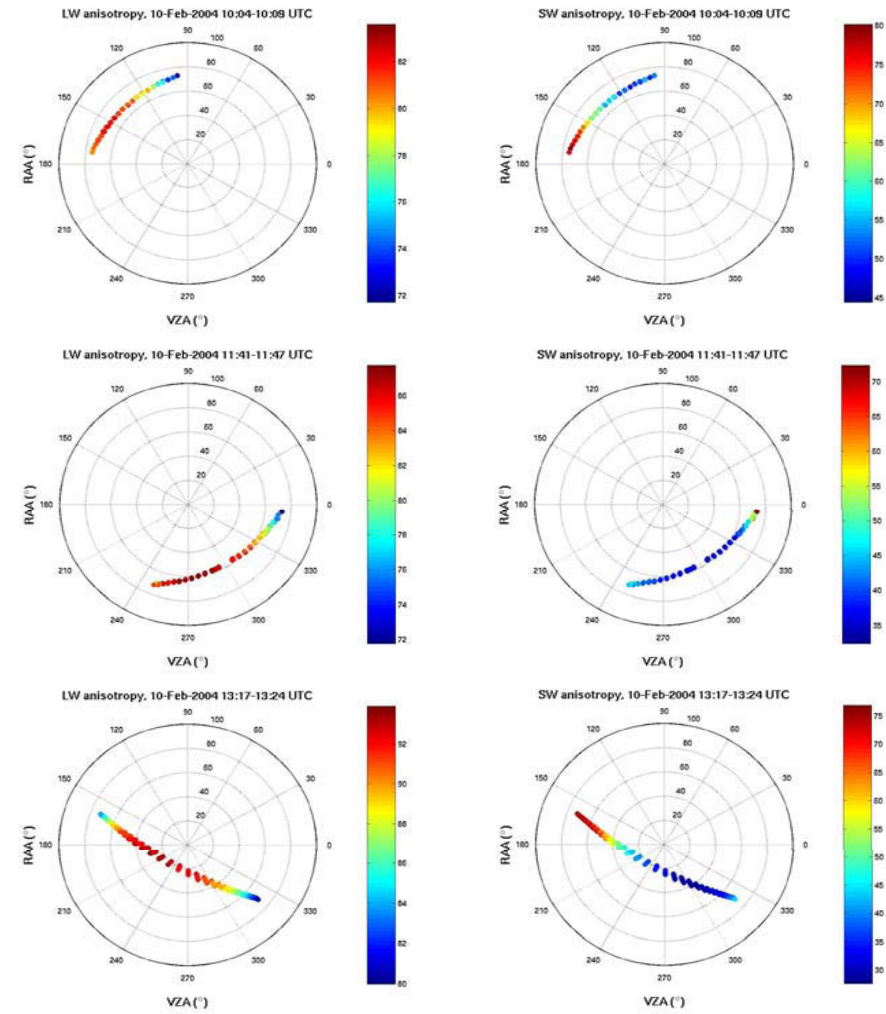
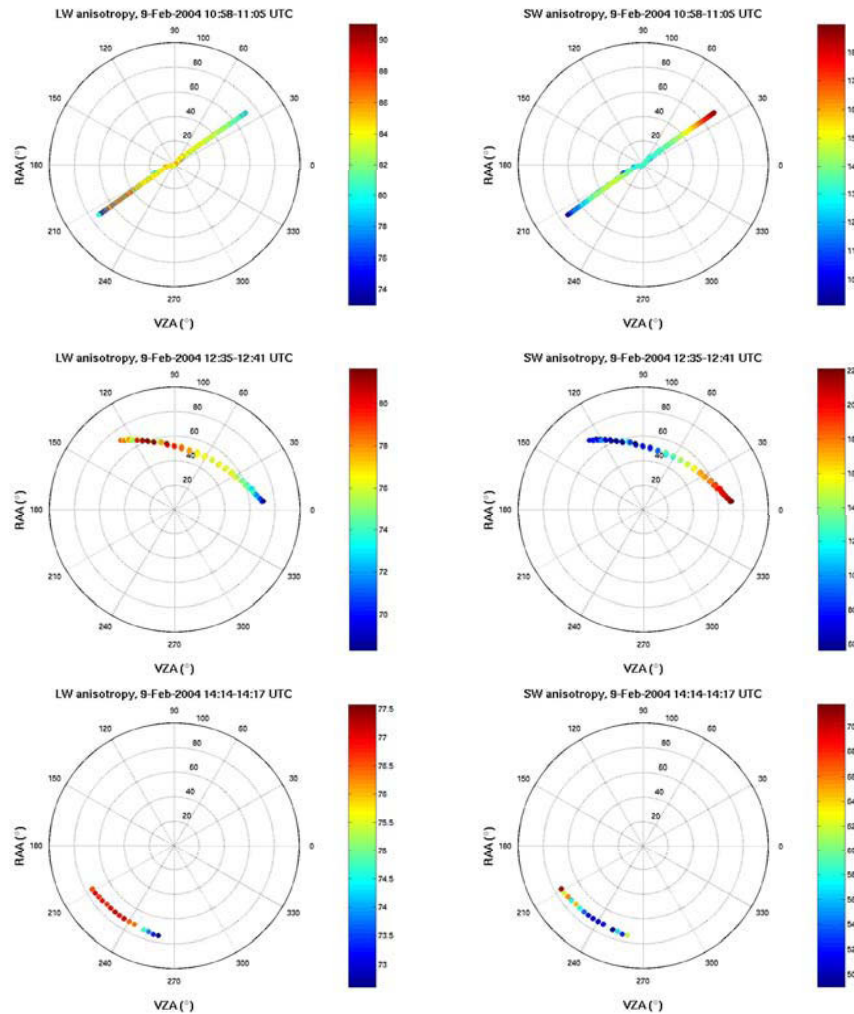
SW anisotropy, 12-Feb-2004 13:05-13:12 UTC



Anisotropy from CERES PAPS over the Valencia Anchor Station

9 Feb. 2004

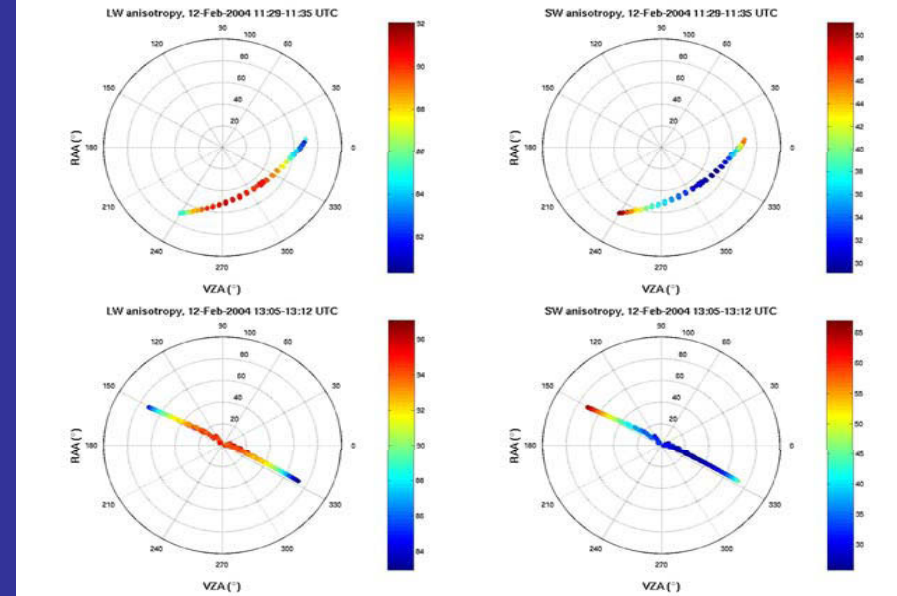
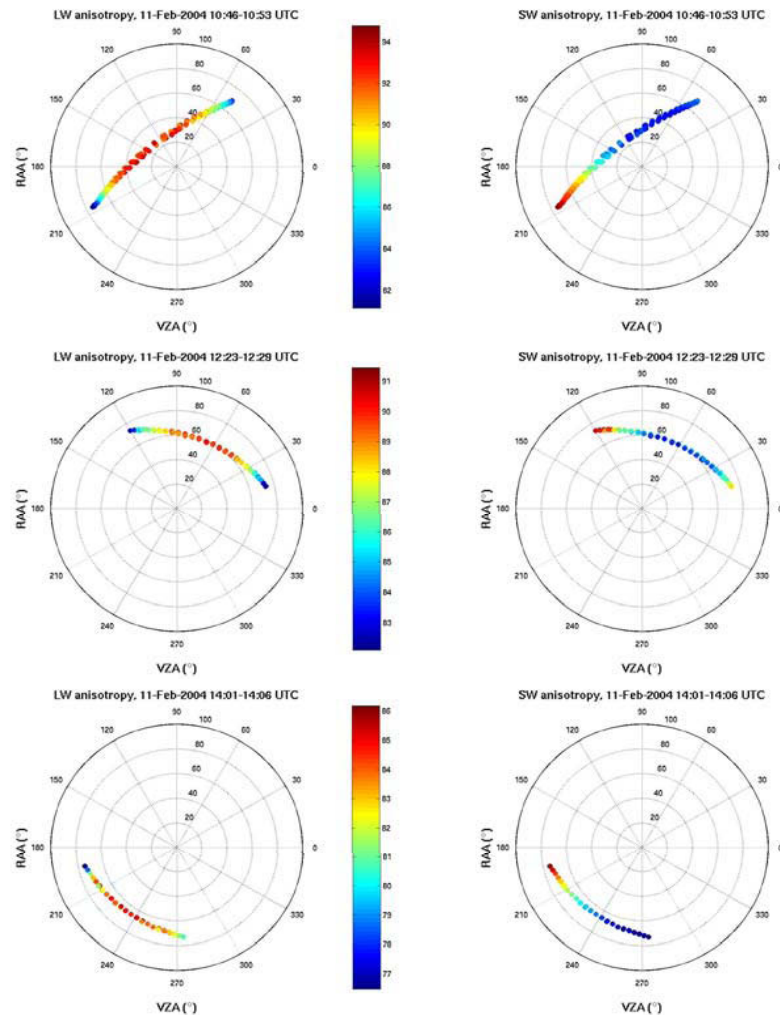
10 Feb. 2004



Anisotropy from CERES PAPS over the Valencia Anchor Station

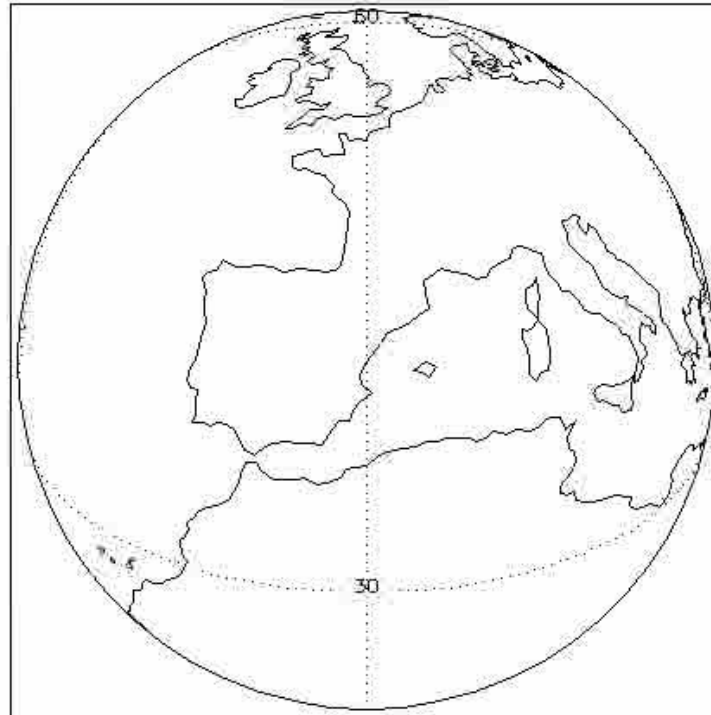
11 Feb. 2004

12 Feb. 2004



CERES on Terra (FM2) 9 Feb. 2004. SW Radiance

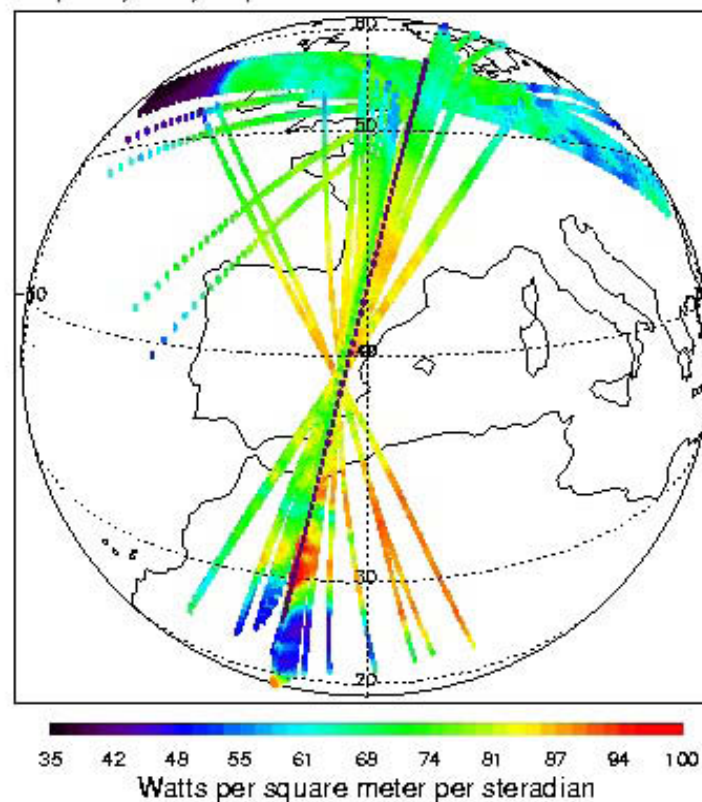
D:\Peter\FM2_vas_040.hdf Wed Mar 24 08:43:23 2004



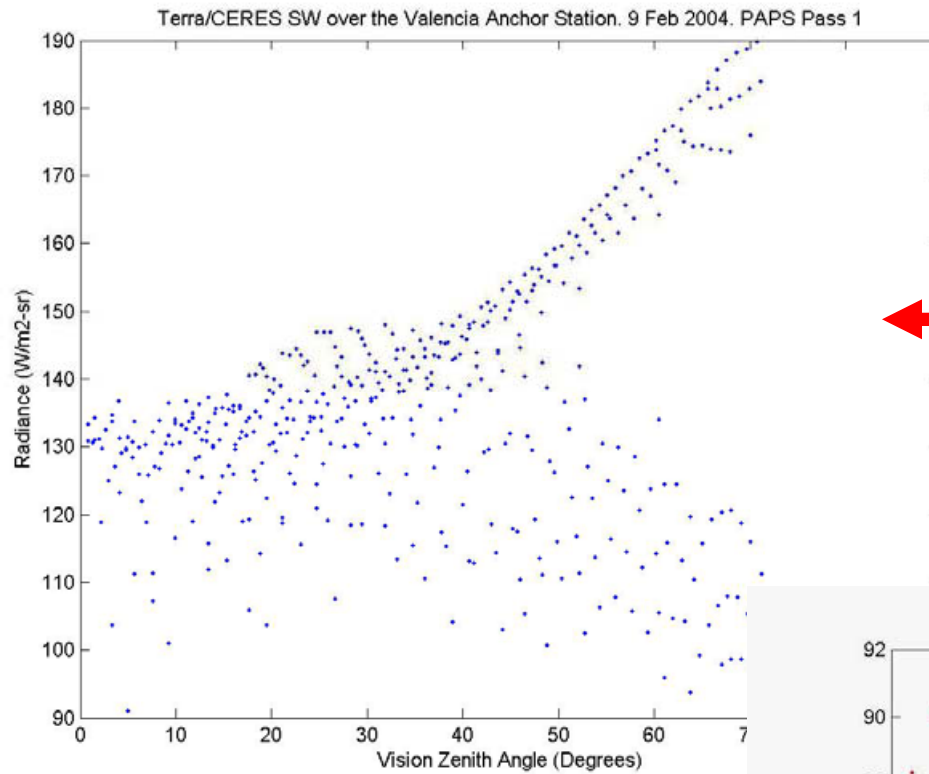
Z. Peter Szewczyk & Kory J. Priestley

CERES on Terra (FM2) 9 Feb. 2004. LW Radiance

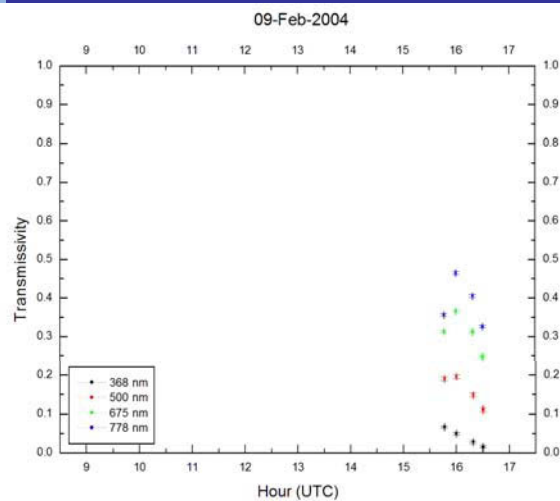
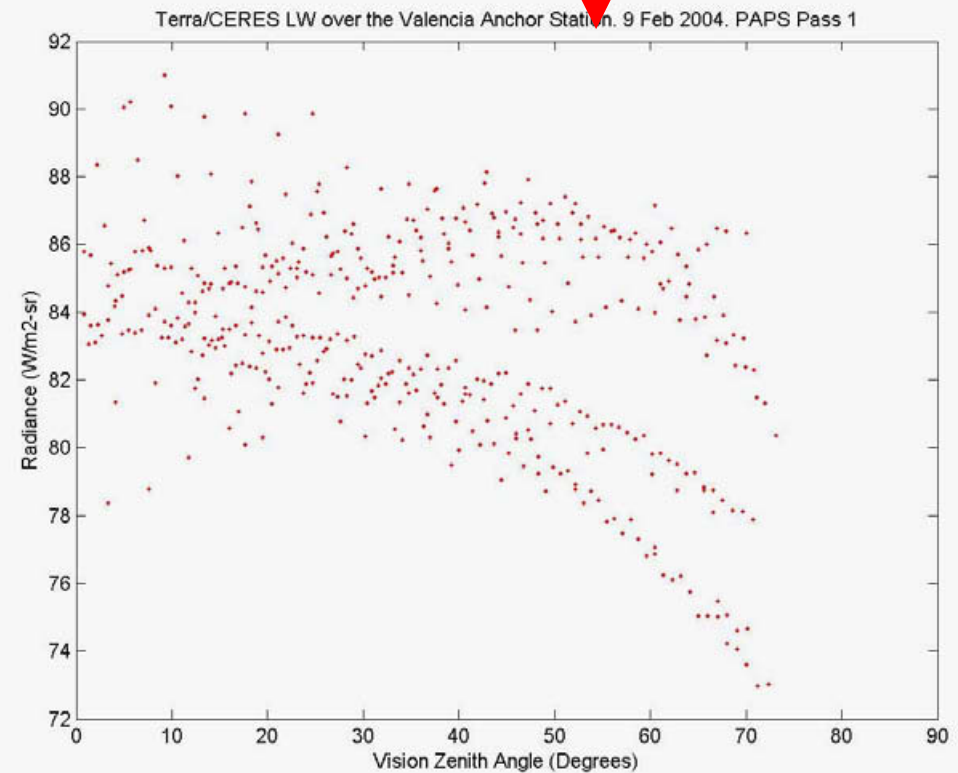
CERES LW unfiltered radiance Data Range: 1: 73: 1: 1: 660: 1
/home/szew/Plots/Feb/FM2_vas_040.hdf Fri Mar 26 09:14:21 2004

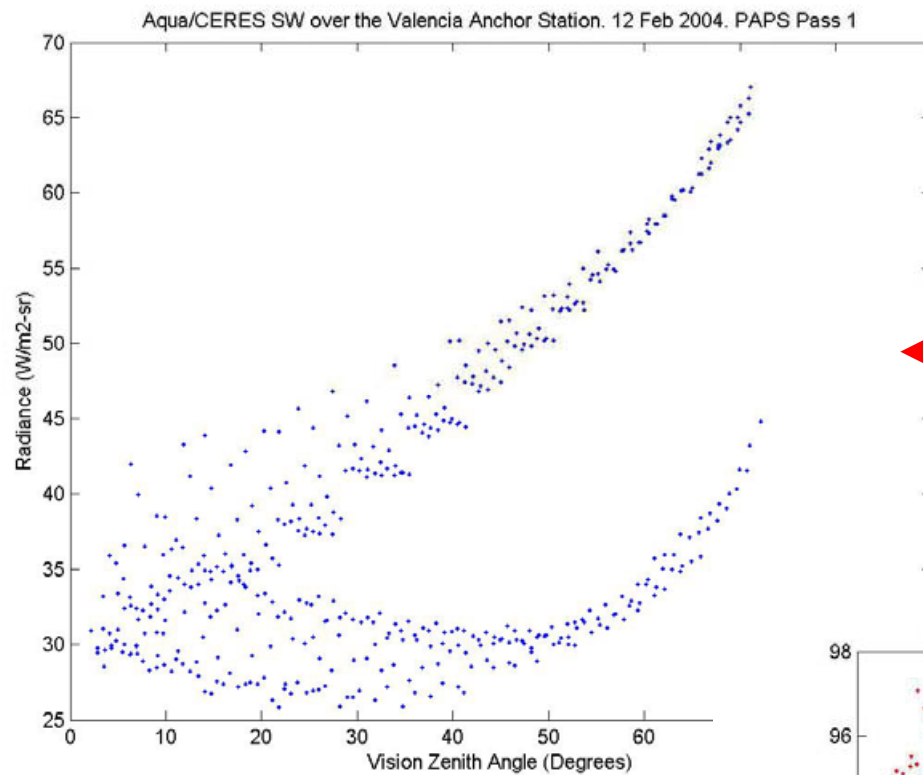


Z. Peter Szewczyk & Kory J. Priestley



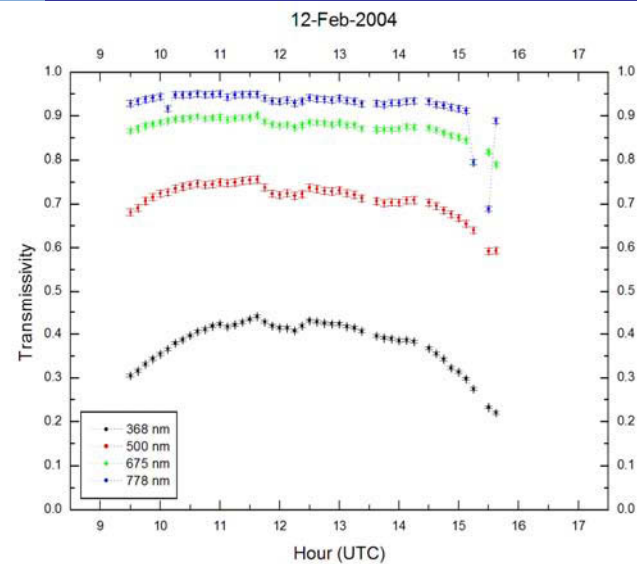
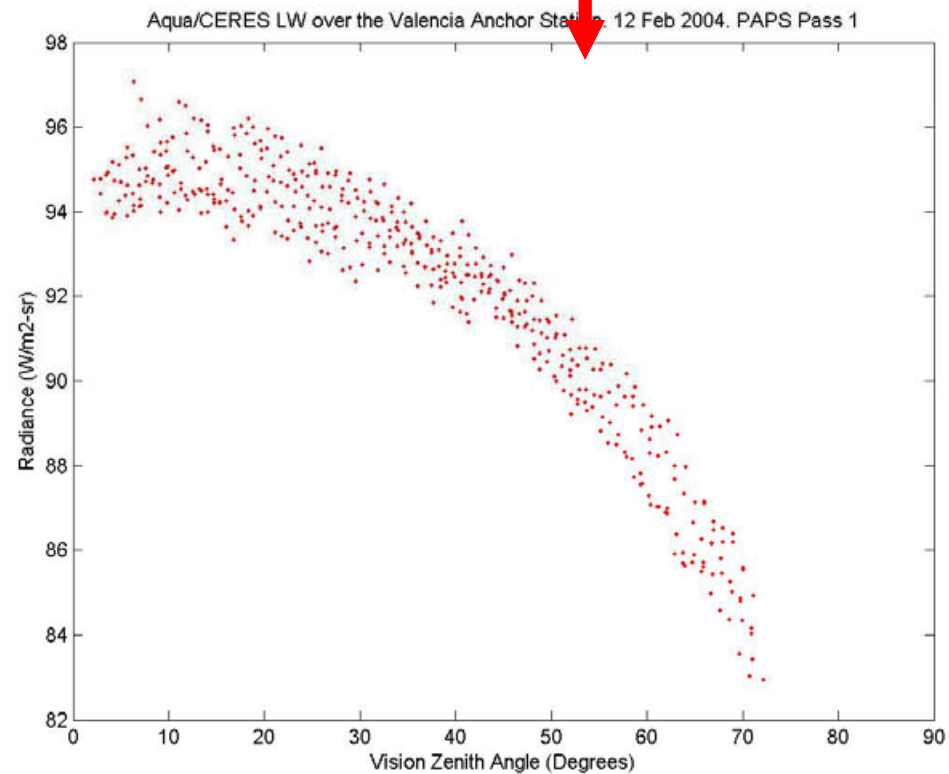
**CERES on Terra
(FM2) 9 Feb. 2004.
SW & LW Radiances**



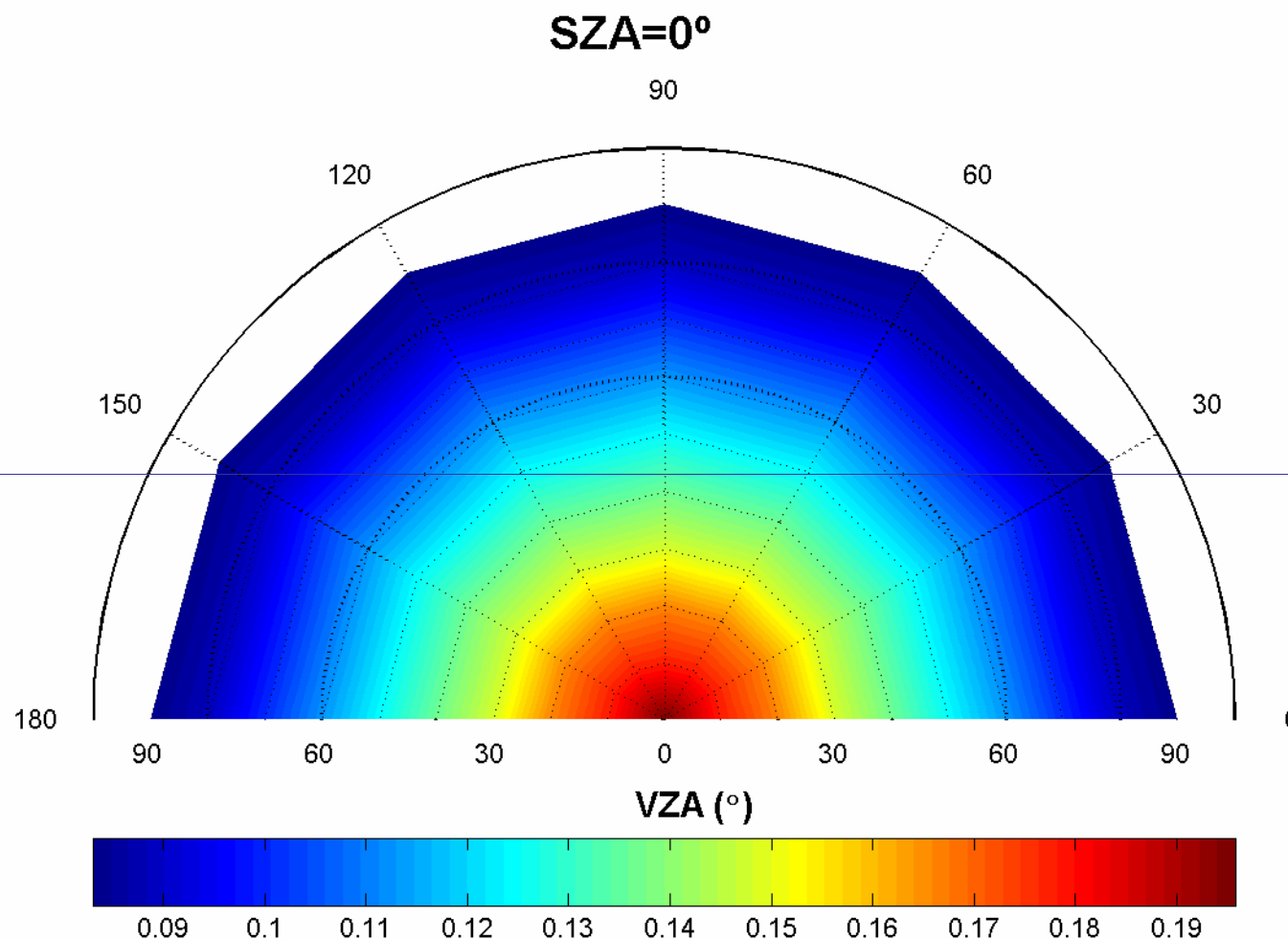


**CERES on Aqua (FM3)
12 Feb. 2004.**

SW & LW Radiances

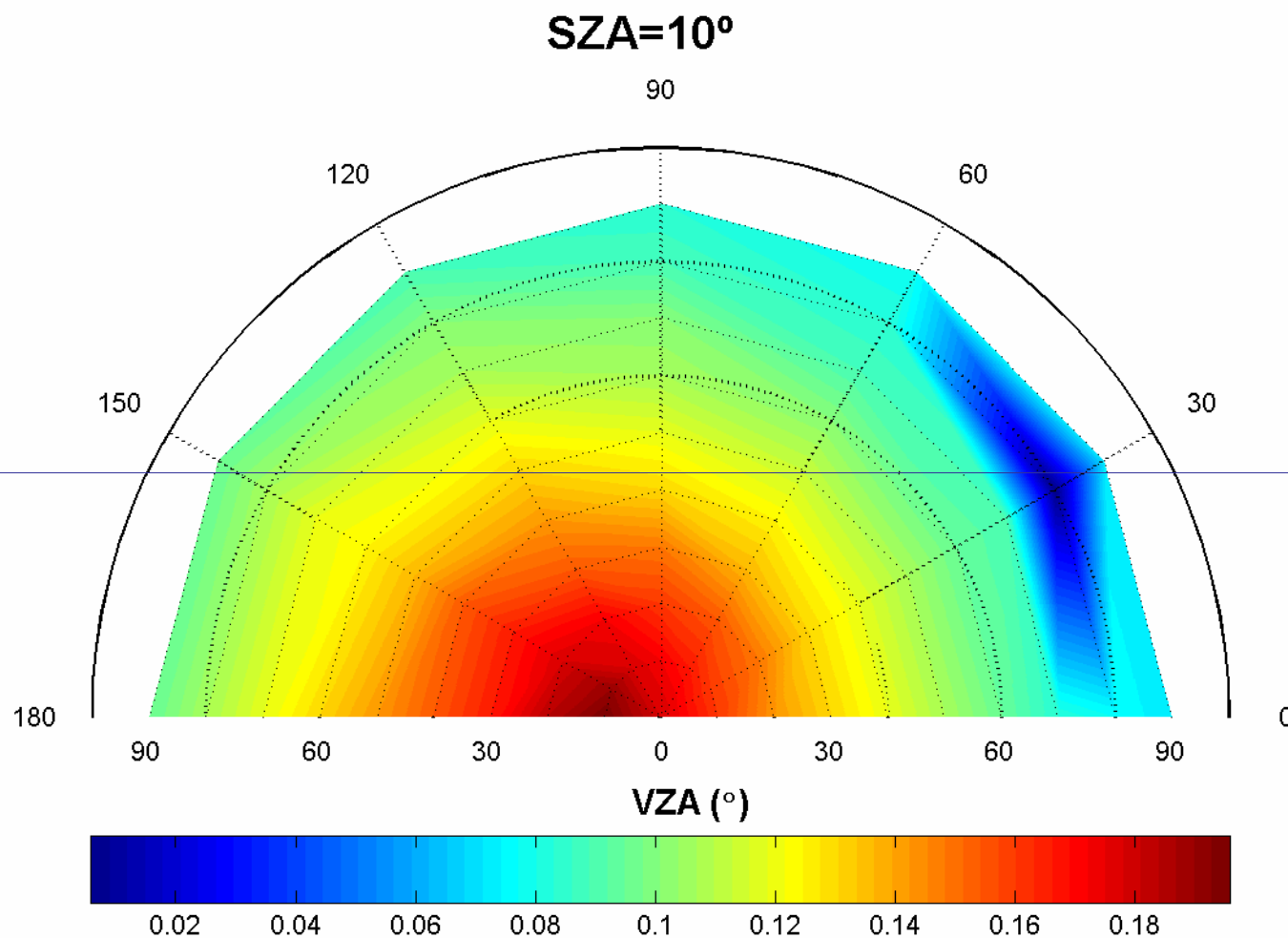


Bidirectional Reflectances at $0.662 \mu\text{m}$



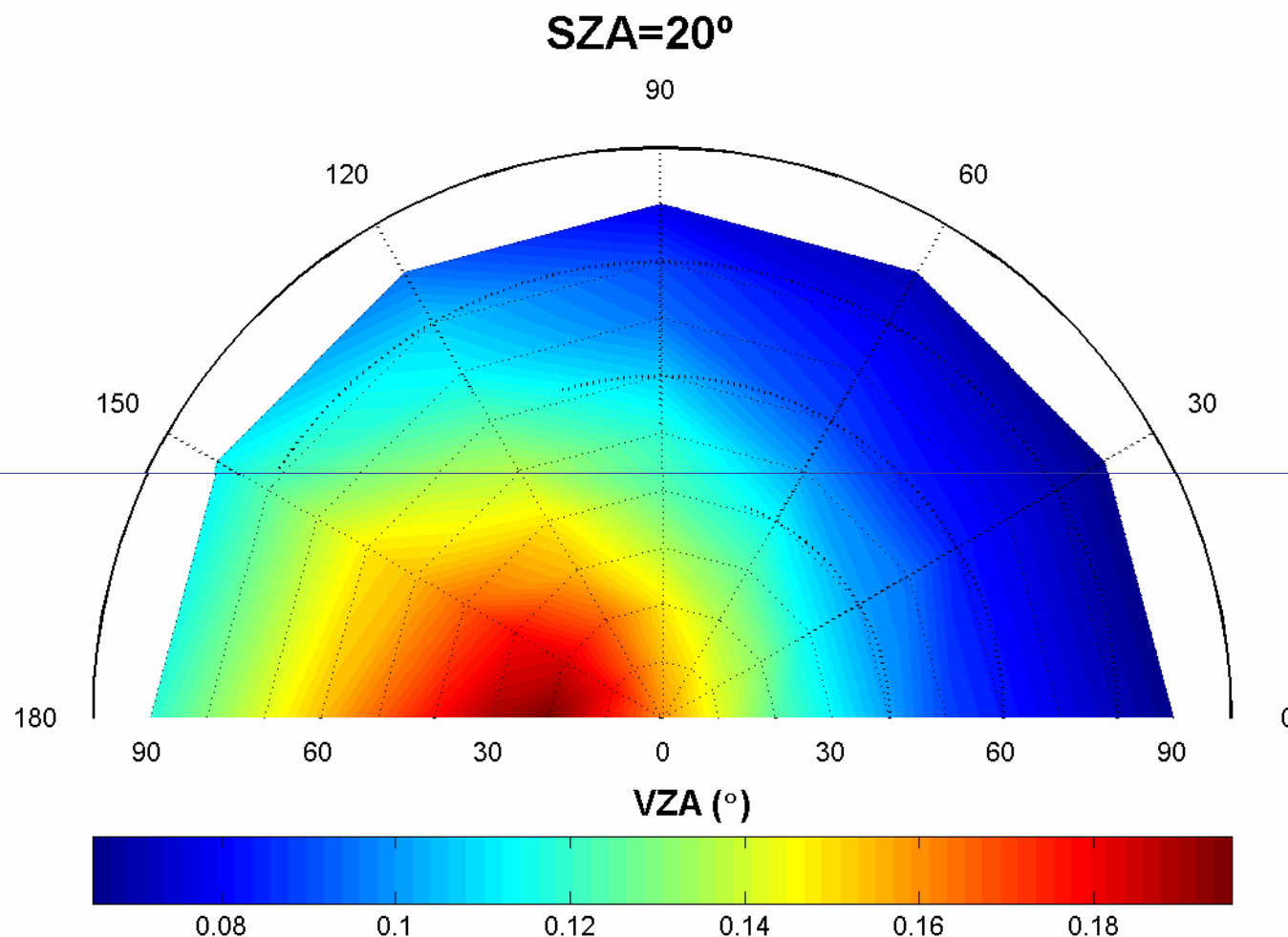
S. P. Ahmad, D. W. Deering (1992): *A simple Analytical Function for Bidirectional Reflectance*. J. Geophys. Res., 97, D17, pages 18867-18886

Bidirectional Reflectances at $0.662 \mu\text{m}$



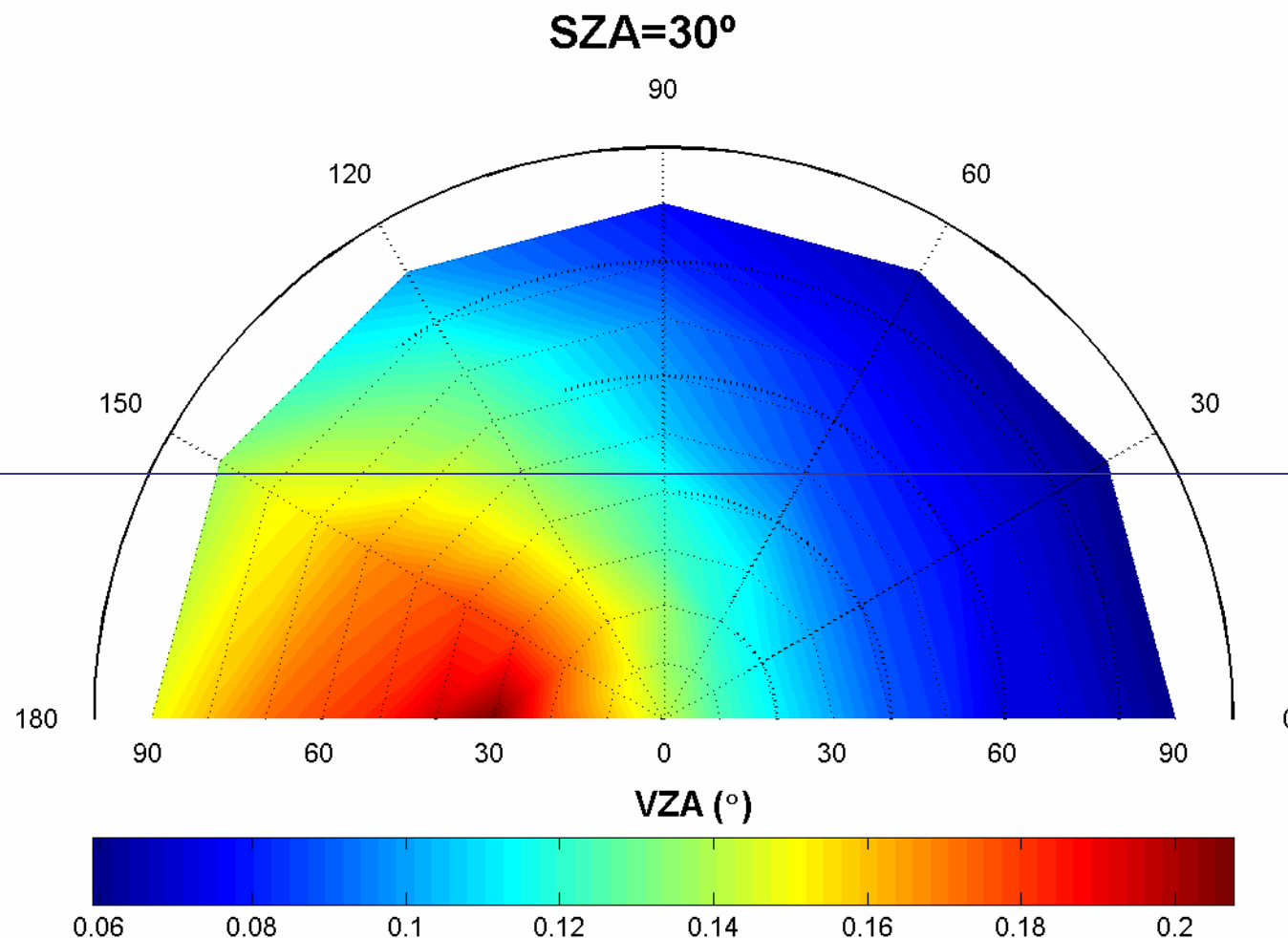
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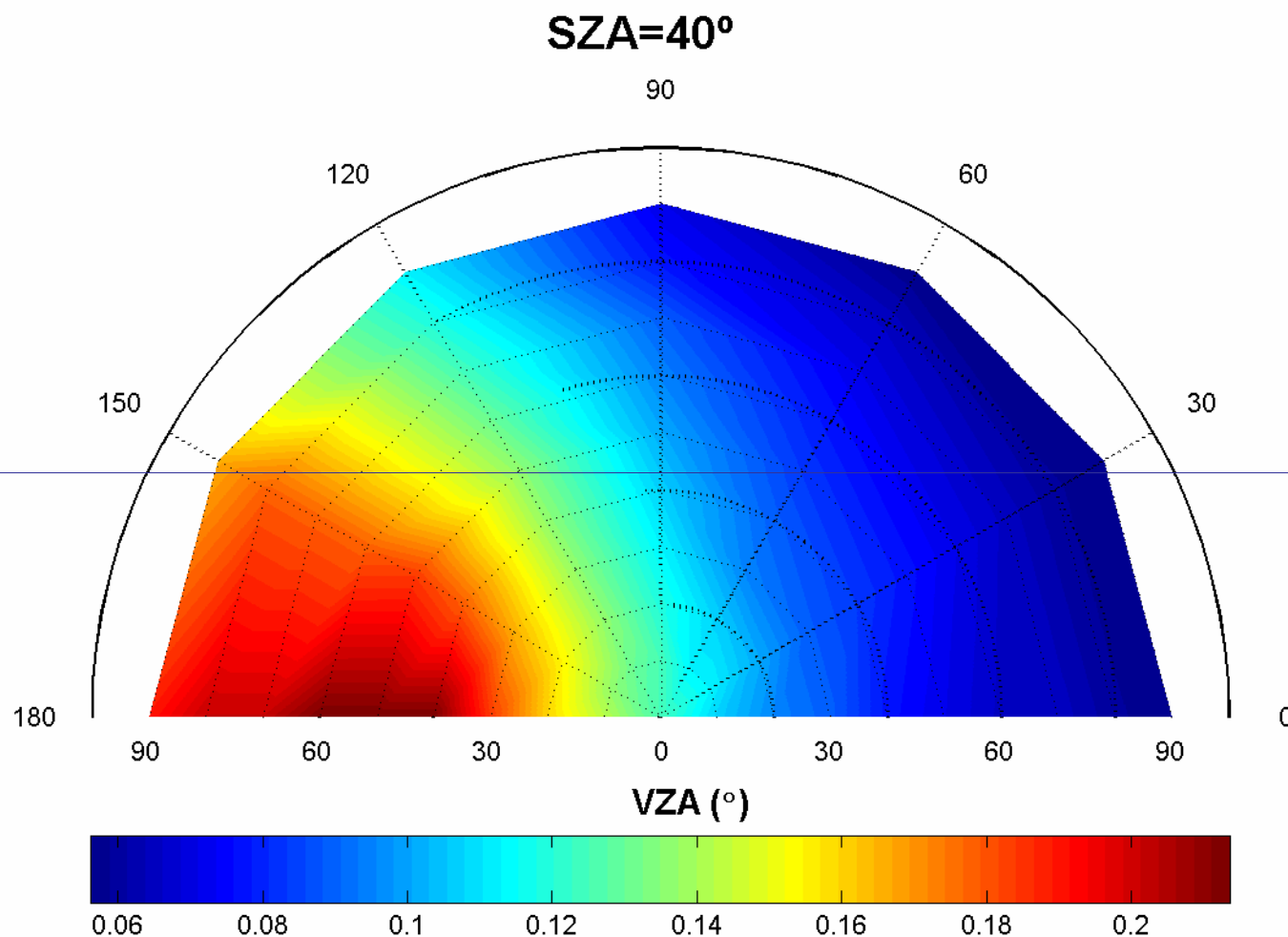
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Research Unit
Climatology from Satellites Group

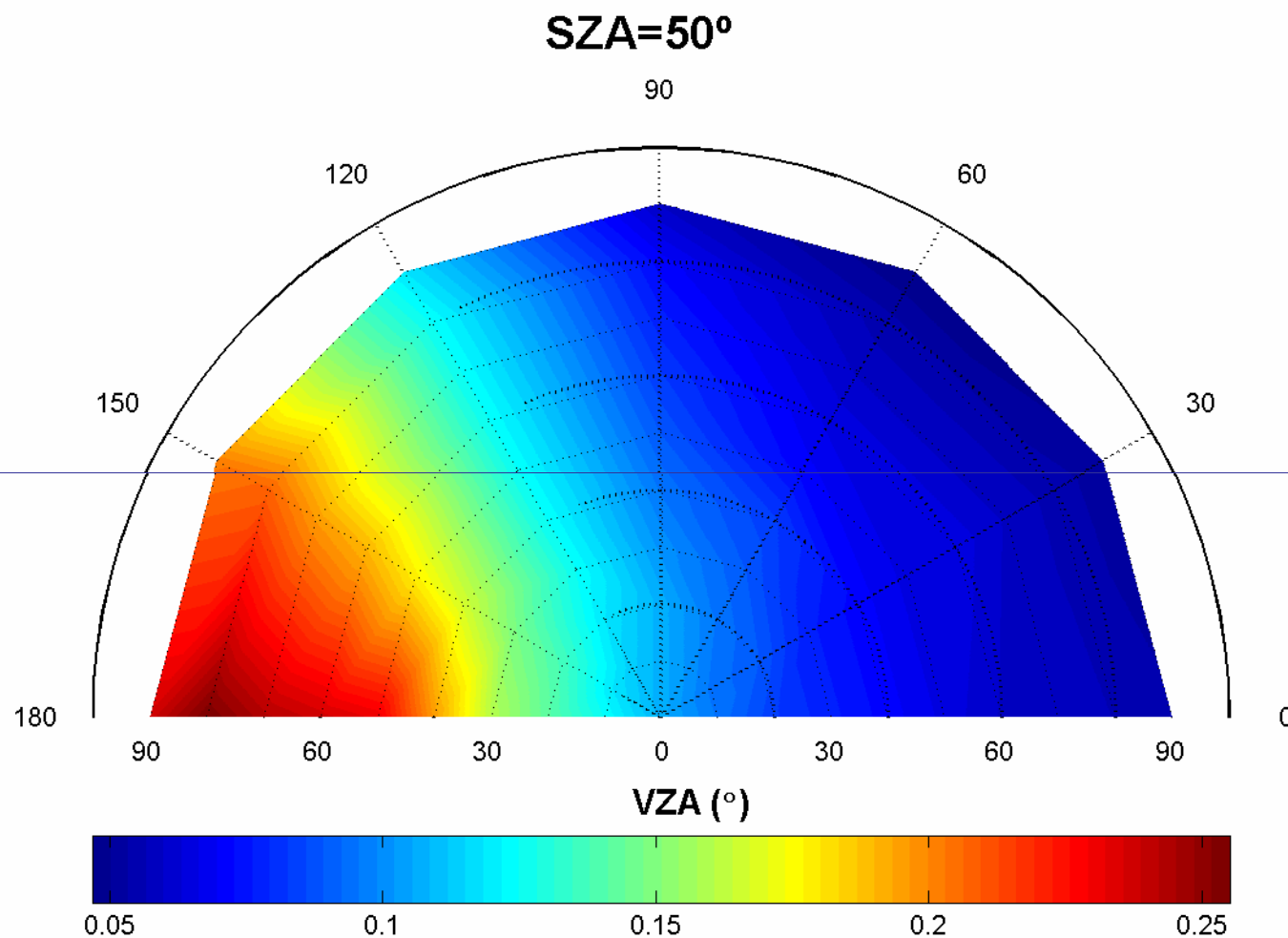
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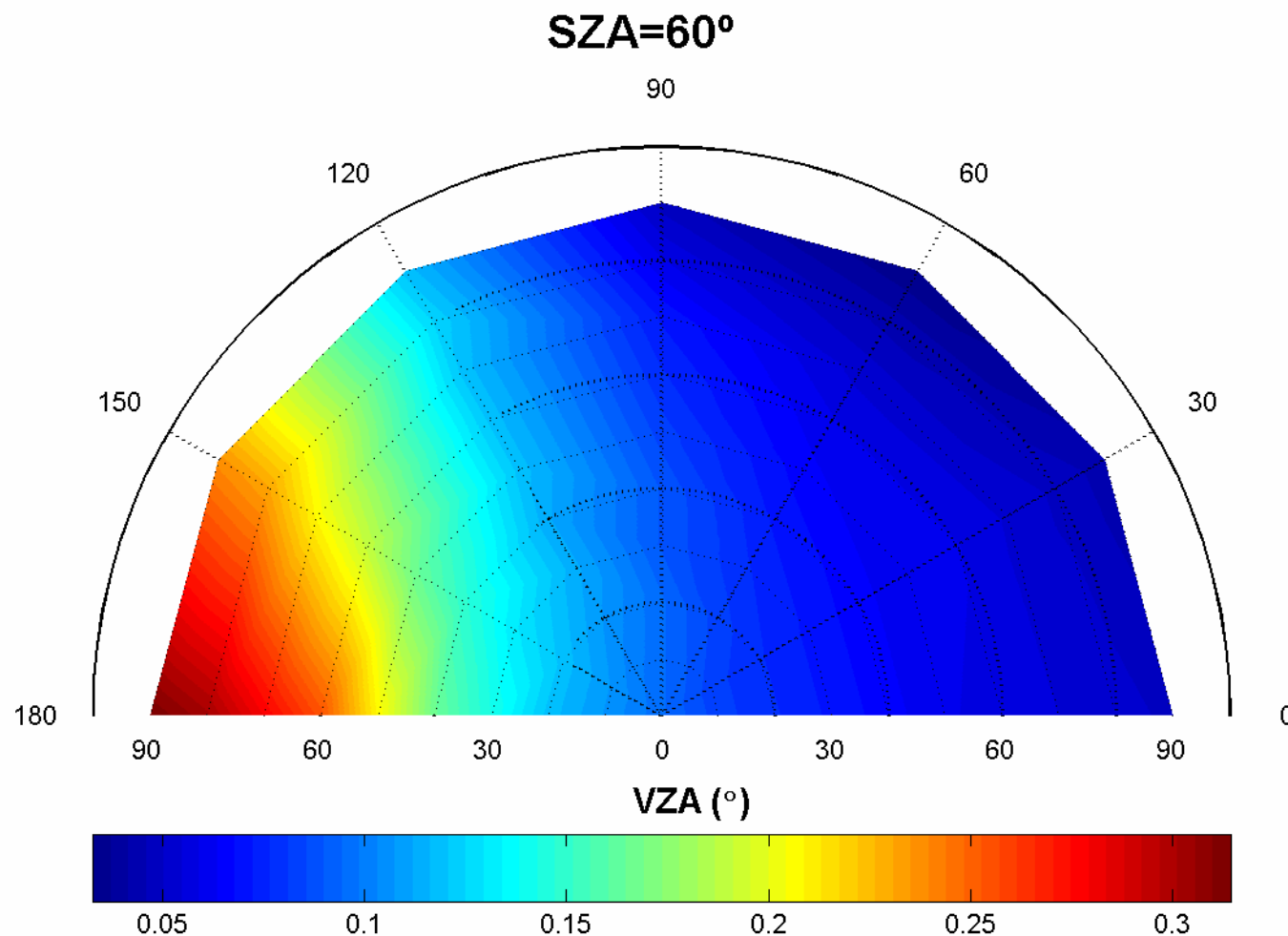
Research Unit
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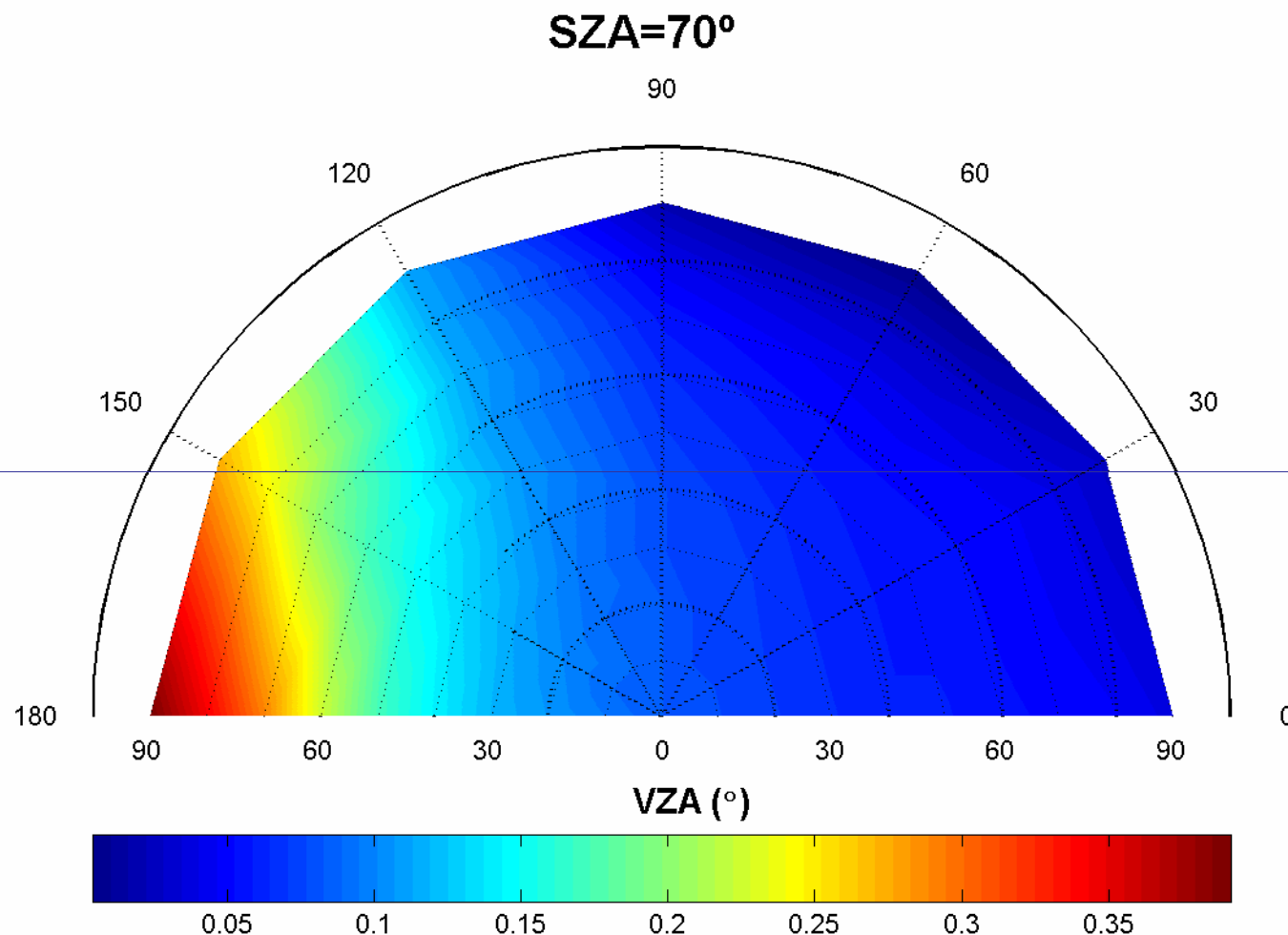
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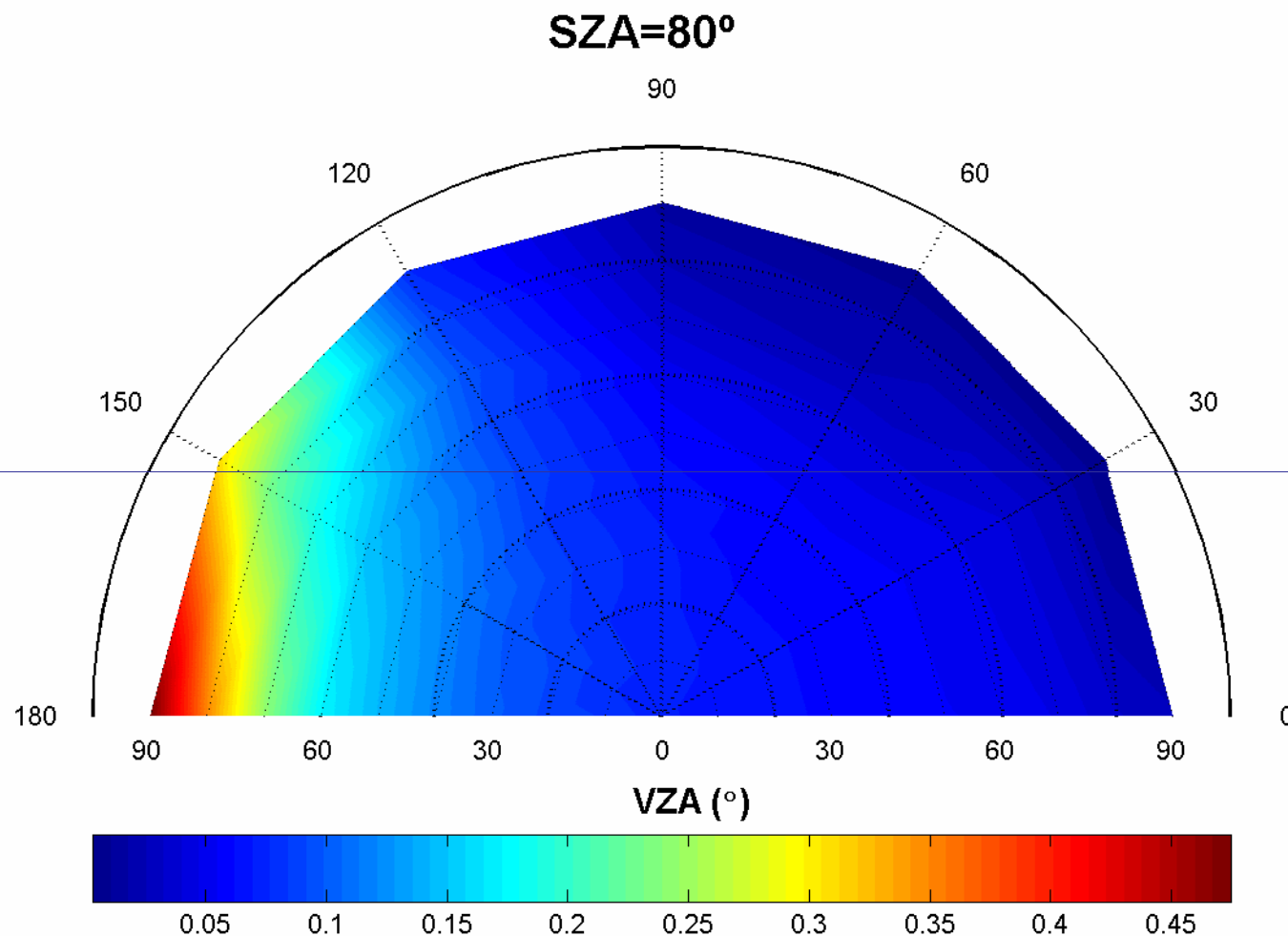
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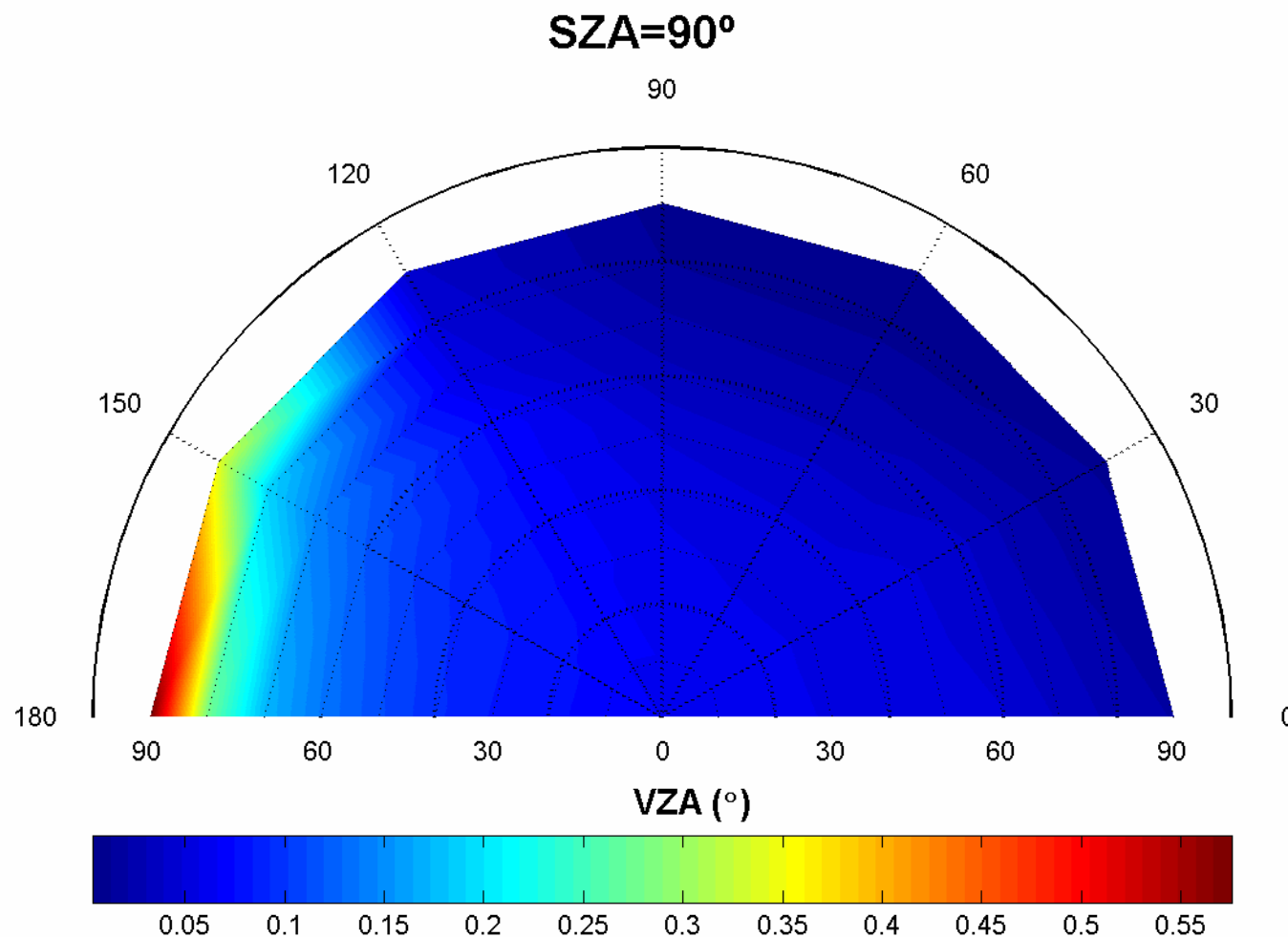
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Radiative Transfer Simulations of the CERES TOA Radiances (Feb. 2004 Campaign)

Atmospheric Profiles

Water Vapour: Radiosounding ascents scaled to 94-95 atmospheric levels + MLW (to the GPS measurement)

Ozone: MLW atm scaled to TOMS measurement

Aerosols: MLW atm with rural aerosols (background tropospheric aerosols, 50 km visibility, background stratospheric aerosols)

Surface Parameters

Spectral Albedo: ASTER spectral library from John Hopkins University

BRDF from Ammam & Deering (1993) (0.662 & 0.826 μm)

Surface Emissivity from CERES/SARB

Surface Temperature, Albedo, etc. from Valencia *Anchor Station*

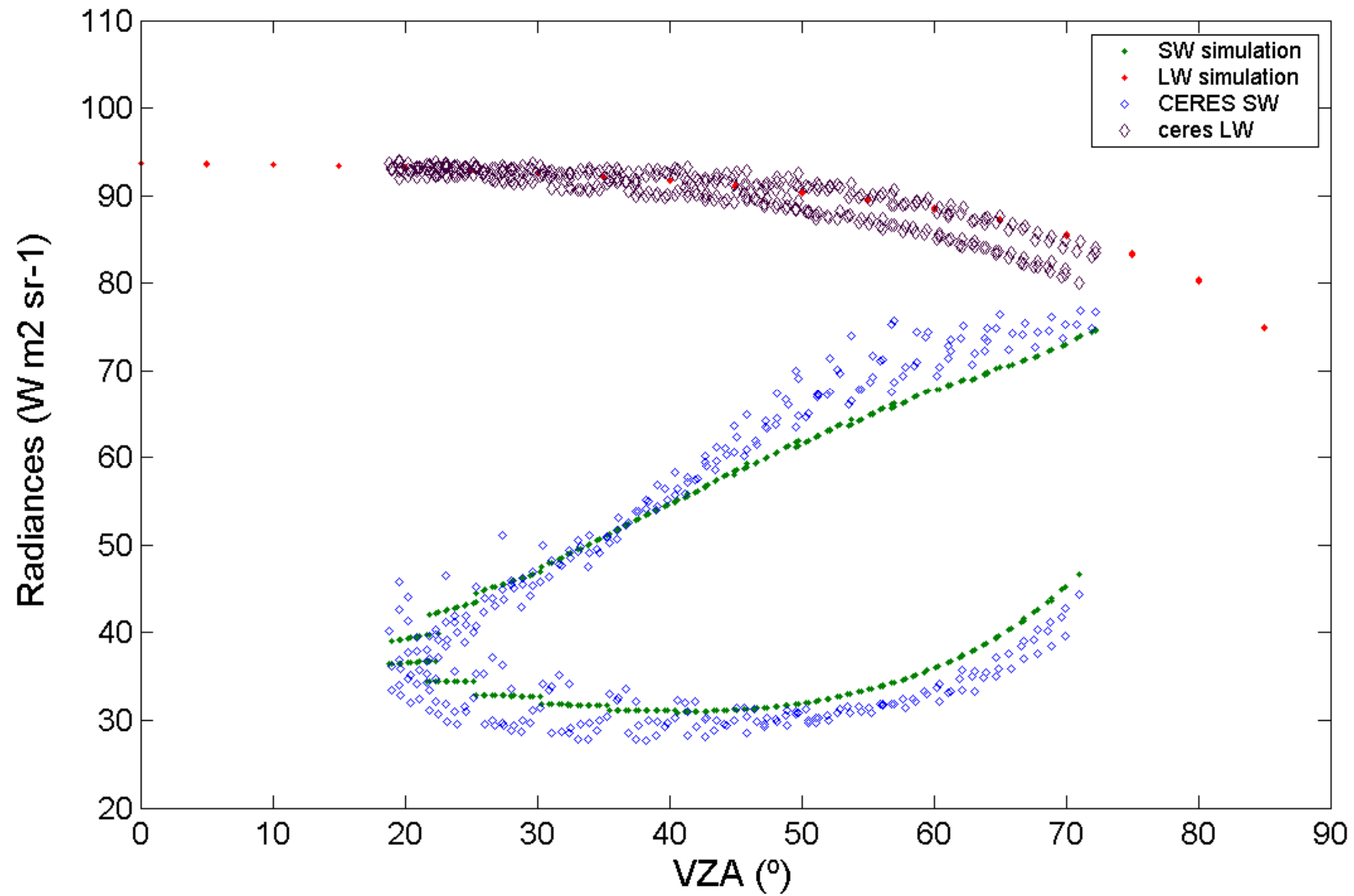
Land uses: 76.6 bare soil + 23.4 vegetation

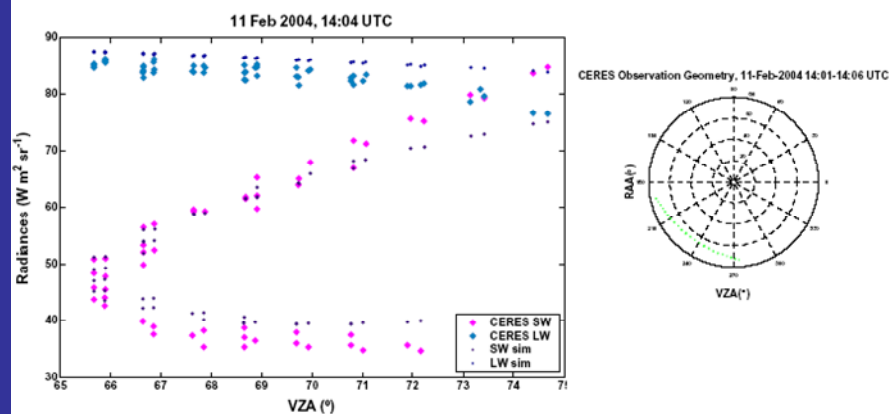
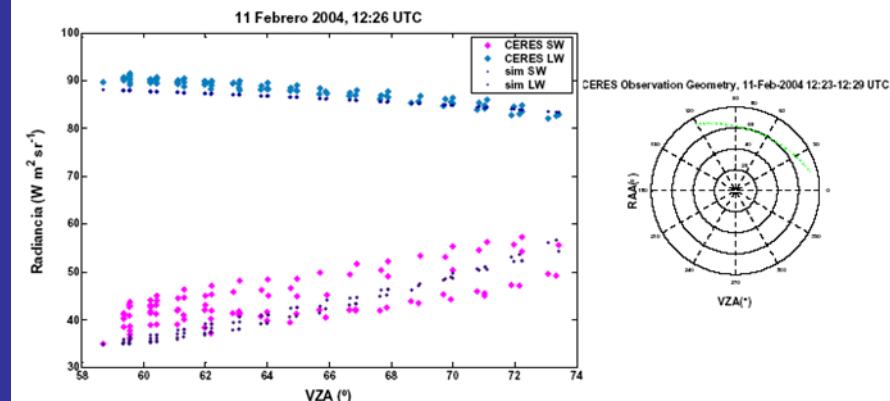
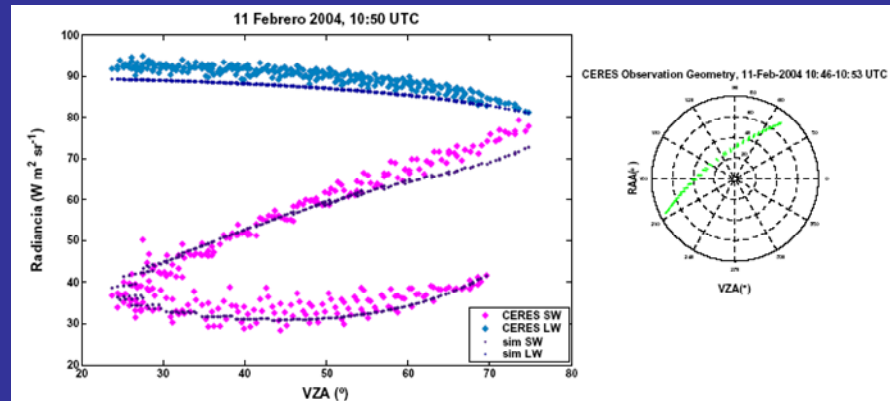
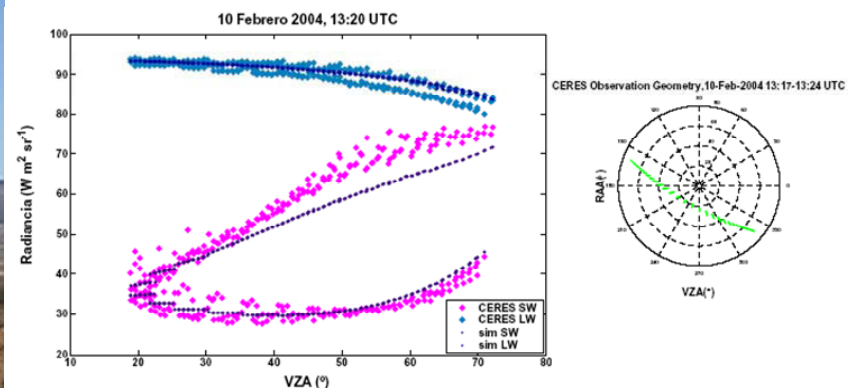
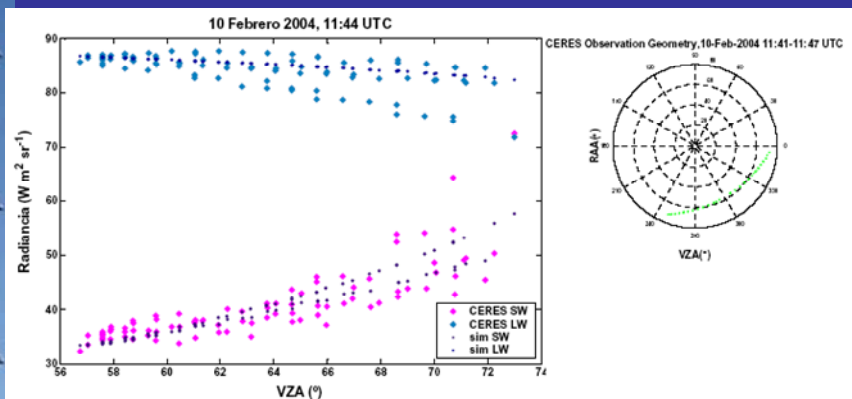
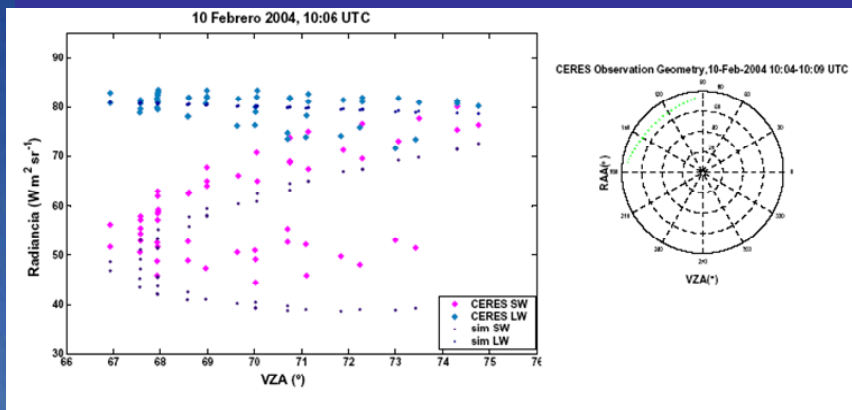




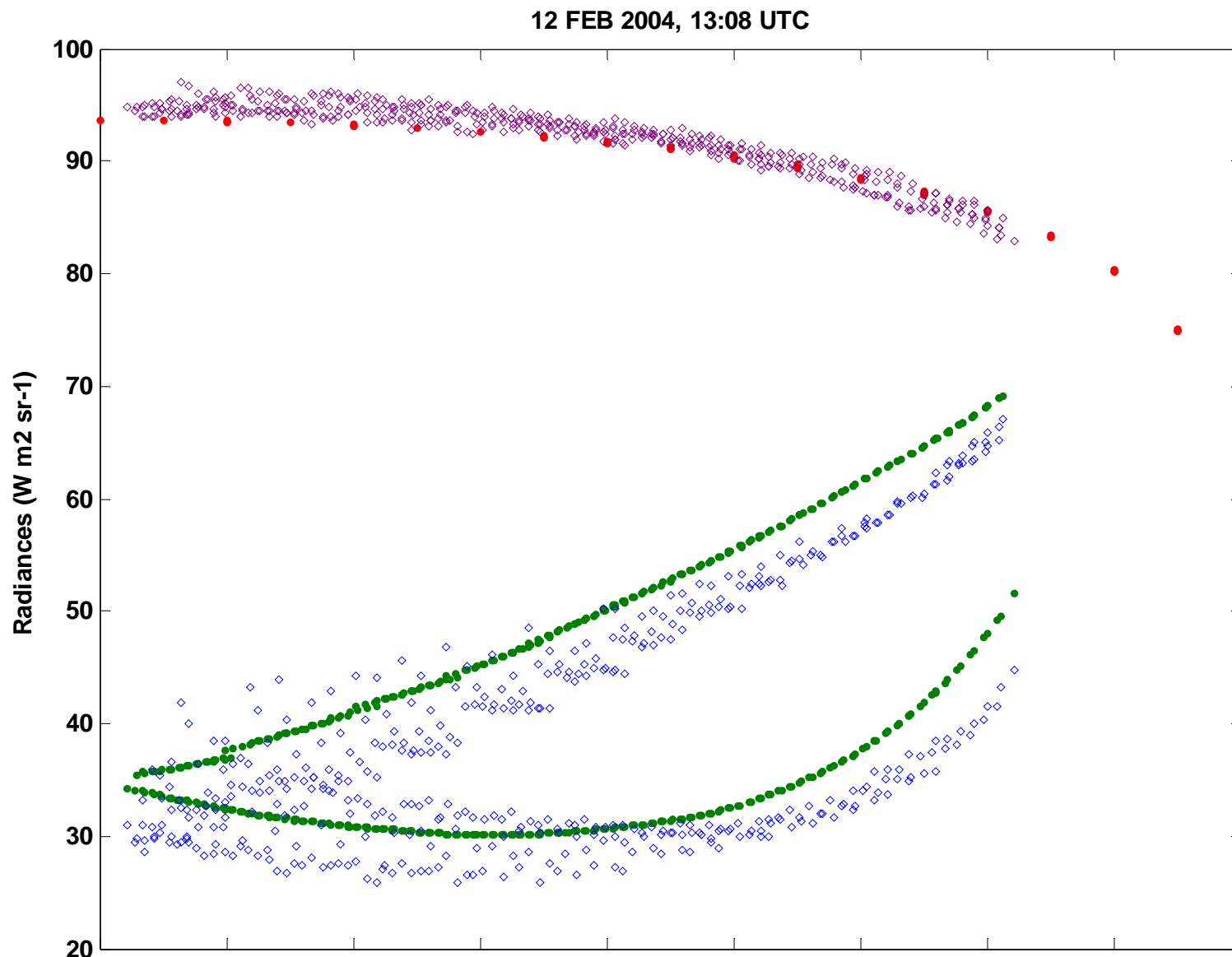
TOA Radiances Comparison

10 FEB 2004, 13:20 UTC





A. Velazquez, E. Lopez-Baeza, G. L. Smith, and Z. P. Szewczyk
CERES operations for the Valencia Anchor Station in support of GERB validation efforts. CERES SCALES campaigns
 13th Conference on Satellite Meteorology and Oceanography, Norfolk, Sept. 2004



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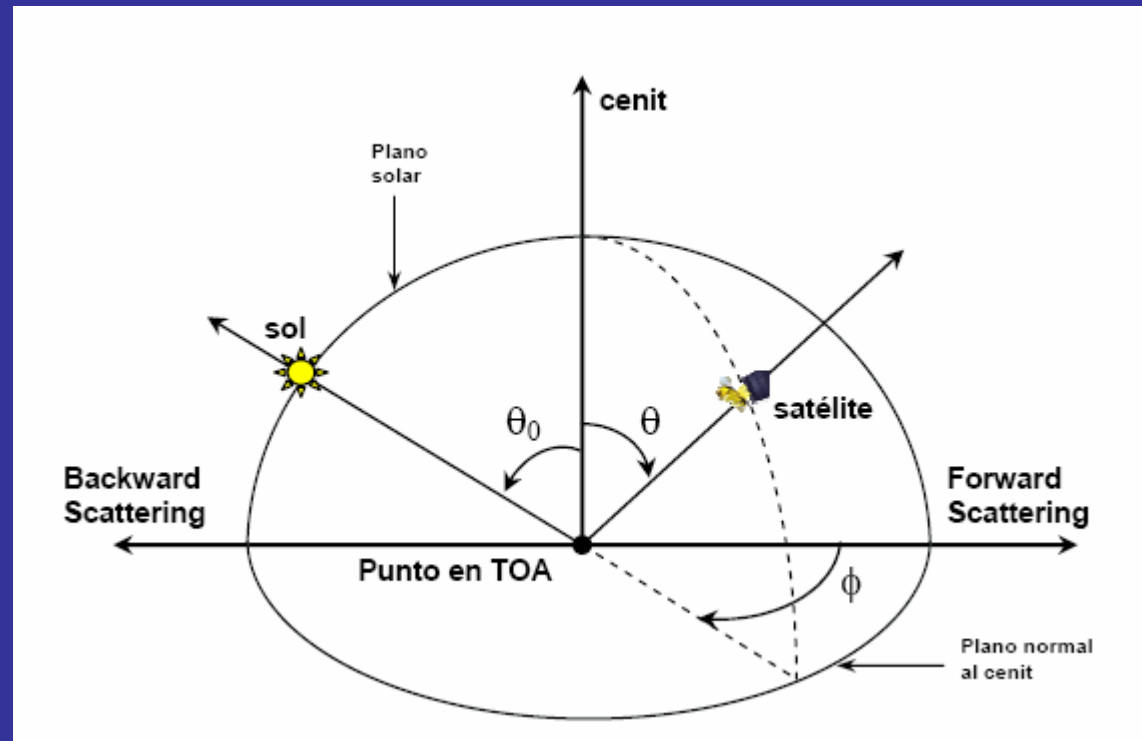
Conclusions and Forthcoming Work

- ✓ Database of surface and atmospheric parameters that has proved to be efficient in the RTM simulations of CERES TOA radiances (homogeneous conditions as regards surface and clear sky)
- ✓ Application to simultaneous observations from Terra, Aqua, METEOSAT (7 & 8), ENVISAT, ERS-2, LANDSAT (-5 TM & -7 +ETM), NOAA (16 & 17), SPOT-5 (VEGETATION) systems
- ✓ Application to Radiative Transfer Code Intercomparisons
- ✓ Approach non-homogeneous case by using MM5 Model simulations

ACKNOWLEDGMENTS

- Spanish Ministry for Science and Technology
- Generalitat Valenciana (Education Dept. + Environment Dept.)
- European Space Agency
- EUMETSAT
- GERB International Science Team
- CERES Science Team (LaRC, SAI, NASA)
- Spanish Institute of Meteorology
- Dep. of Signal Theory and Communications, Group of Electromagnetic Engineering and Photonics (EEF), Lidar Lab., Polytechnic University of Catalonia
- Spanish Institute of Aerospace Techniques
- Utiel Town Council
- Caudete de las Fuentes Town Council
- Bodegas Iranzo, Caudete de las Fuentes
- Artesanías Folkóricas España, S.L., Caudete de las Fuentes
- Town of Caudete de las Fuentes, especially Nicolás Guaita, Rafael Jiménez and José Ponce Irizar

Observation Geometry



θ_0 solar zenith angle (SZA)
 θ viewing zenith angle (VZA)
 ϕ relative azimuth angle (RAA)