

LECTURERS

FUNCEME - COSPAR TRAINING AND CAPACITY BUILDING COURSE ON

Earth Observation Understanding of the Water Cycle (Over Land and the Ocean)

**Fundação Cearense de Meteorologia e Recursos Hídricos (FUNCEME)
Fortaleza, Ceará, Brazil, 01 – 12 November 2010**

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Programme

The programme includes scientific and technical lectures related to the remote sensing process, sensors, calibration, validation and algorithm development, tutorials and specific aspects of the ESA SMOS Mission, NOAA and SeaWiFS/MODIS Missions, as well as of the forthcoming NASA AQUARIUS missions. The emphasis will be on the practical hand-to-hand characteristics of these missions. The contents of the Course are:

Programme Contents

- (i) **General Introduction on Water Cycle Study Guidance**
 - a. The Water Cycle Processes. The Earth's Water Balance
 - b. The Global Water Cycle
 - Terrestrial Water Cycle and the Impact of Climate Change
 - The Ocean Component of the Global Water Cycle
 - Key Remote Sensing Hydrological Observations

- (ii) **Introducing Satellite Remote Sensing**
 - a. Principles of Remote Sensing
 - b. Interaction of Electromagnetic Energy with Particles in the Atmosphere, Surface and near Surface
 - c. Remote Sensing in the Solar and Thermal parts of the Electromagnetic Spectrum

- (iii) **Digital Image Processing Techniques**
 - a. Preprocessing
 - Radiometric Correction
 - Geometric Rectification
 - b. Image Enhancements
 - c. Spectral Transformations
 - d. Atmospheric Corrections
 - e. Image Classification Techniques

- (iv) **Statistical Data Analysis**
 - Frequency distributions, Histograms
 - Measures of Central Tendency (Mean, Median, Mode)
 - Measures of dispersion (range, variance, standard deviation)
 - Covariance & Correlation Matrices
 - Time series analysis
 - Correlation (Understanding and Interpreting the correlation coefficient: scatterplots, slope of the regression line and z-scores, variance interpretation, calculation of the correlation coefficient, outliers and its effects)
 - The t Distribution , ANOVA

- (v) **Physical Principles in Microwave Radiometry**
 - a. Passive Microwave Systems
 - Microwave Emission Models
 - Land-surface Applications
 - Oceanographic Applications
 - b. Radar Systems
 - Radar Altimetry
 - c. Microwave Scatterometry
 - Microwave Scatterometry over Ocean Surfaces

- Microwave Scatterometry over Land Surfaces
- (vi) **Remote Sensing Applications for Land, Ocean and Atmosphere**
- a. **Land Applications**
 - Earth Radiation Balance, Precipitation, Vegetation Dynamics (General, Biophysical Parameters), Surface Energy Balance (Soil heat flux, sensible and latent heat fluxes, and evapotranspiration) and Radiation Balance (albedo and net radiation)
 - Studies on the Spatial Variability of Soil Moisture in Semiarid Northeast Brazil.
 - b. **Ocean Applications: Sea Surface Temperature and Ocean Color**
 - Fundamentals of satellite oceanography: ocean color and thermal infrared
 - Sensors for observing ocean color and sea surface temperature
 - Space and time scales in satellite oceanography
 - Web-based satellite data sources
 - Examples of Applications and Case Studies
 - c. **Earth's Radiation Balance**
 - Surface Energy Budget
 - Bowen ratio-energy balance method
 - Eddy correlation
 - Evapotranspiration
 - Radiative transfer codes to study the Earth's radiation budget
 - d. **Remote Sensing Applications for Land and Ocean. Hydrological Balance**
 - Clouds and cloud properties
 - Surface wetness and soil moisture retrieval
 - Snowpack and snowfall properties
 - GOES-R (the next generation of GOES)...next-generation algorithms and new products
- (vii) **Validation of Remote Sensing Data and Products**
- a. Land Products
 - i. CBERS, LANDSAT, MODIS, NOAA, SMOS, ...
 - ii. NDVI, Soil Moisture, Vegetation Water Content
 - b. Ocean Products
 - i. NOAA, SeaWifs, SMOS, ...
 - ii. Sea Surface Salinity
- (viii) **The SMOS Mission**
- a. Land and Ocean Products
 - b. SMOS Level 1, 2 and 3 and SMOS CAL&VAL
 - c. ESA Toolboxes and Data Use
- (ix) **Assimilation of Remote Sensing Data and Products in Numerical Prediction Models**
- a. **Basic Concepts**
 - i. **General Introduction to Data Assimilation**
 - ii. Direct Insertion and Nudging
 - iii. Optimal Interpolation
 - iv. Variational DA (1,2,3 and 4-DVar)
 - v. Kalman Filters
 - b. Operational Data Assimilation
 - i. Worldwide
 - ii. CPTEC/INPE
 - c. Local Ensemble Transform Kalman Filter
 - d. Land Data Assimilation Systems
 - i. NLDAS

- ii.** GLDAS
- iii.** The South American Land Data Assimilation System

ProgrammeCalendar

Day 1Nov MON	Day 2Nov TUE	Day 3Nov WED	Day 4Nov THU	Day 5Nov FRI	Day 6Nov SAT	Day 7Nov SUN	Day 8Nov MON	Day 9Nov TUE	Day 10Nov WED	Day 11Nov THU	Day 12Nov FRI
Registration Opening Ceremony Introductory Talks	Theoretical Lectures	Theoretical Lectures	Theoretical Lectures	Theoretical Lectures	Visit to FUNCEME Satellite Reception System and Met Radar	Visit to LABOMAR And Scientific Ship	Theoretical Lectures	Theoretical Lectures	Theoretical Lectures	Theoretical Lectures	Theoretical Lectures
Visit FUNCEME Introduction to the Course	Practical Lectures	Practical Lectures	Practical Lectures	Practical Lectures	Visit to Soil Moisture and Energy Budget Validation Site (Typical Meal from Ceará Countryside)	Free	Practical Lectures	Practical Lectures	Practical Lectures	Practical Lectures	Closing Ceremony
IceBreaker	Free	Free	Typical Night in the FUTURE BEACH	Formal Dinner	Free	Free	Bar PIRATA (Genesis of the Pirata Project over the Atlantic Ocean)	Free	Typical Brazilian Show	Visit to the Beach Park	Free

Detailed Programme

DAY 1 - Monday		
TIME	TOPIC	TEACHER
08:30 – 9:30	Registration	
9:30 – 10:30	Opening Ceremony	Organizers and Authorities FUNCEME, COSPAR, ESA, INPE, ...
10:30 – 11:00	Coffee Break	
11:00 – 11:45	ESA Living Planet Programme	Dr Jerome Benveniste ESA
11:45 – 12:30	The Brazilian Space Programme	Brazilian Space Agency (AEB)
12:30 – 14:15	Lunch	
14:15 - 15:00	CONAE	Comision Nacional de Actividades Espaciales (Argentina Space Agency) (to be confirmed)
15:00 – 15:30	Course Introductory Talk	Course Organization
15:30 – 17:00	Visit-Tour to FUNCEME	Dr Eduardo Sávio FUNCEME (President)
17:00 – 17:30	Coffee Break	
17:30 - 18:30	Introducing Satellite Remote Sensing	Dr Carlos Frederico Angelis INPE
20:30	Ice Breaker (<i>Hotel La Orla Maritima</i>)	

DAY 2 - Tuesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Key Concepts in Remote Sensing	Dr Carlos Frederico Angelis INPE
10:00 – 10:30	Coffee break	
10:30 – 12:30	Key Concepts in Remote Sensing	Dr Carlos Frederico Angelis INPE
12:30 – 14:00	Lunch	
14:00 – 16:00	Statistical Data Analysis	Dr Dirceu Reis FUNCEME
16:00 – 16:30	Coffee break	
16:30 – 18:30	Statistical Data Analysis	Dr Dirceu Reis FUNCEME
	Free time	

DAY 3 - Wednesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Statistical Data Analysis	Dr Dirceu Reis FUNCEME
10:00 – 10:30	Coffee break	
10:30 - 11:30	The Global Water Cycle (i) Terrestrial Component: Soil Moisture	Dr Ernesto Lopez-Baeza UVEG
11:30 – 12:30	The Global Water Cycle (i) Ocean Component: Salinity	Dr Carlos Lentini UFBa
12:30 – 14:00	Lunch	
14:00 – 16:00	Remote Sensing Applications for Land/Atmosphere: Earth Radiation Balance	Almudena Velazquez Blazquez RMIB
16:00 – 16:30	Coffee break	
16:30 – 18:30	Remote Sensing Applications for Land/Atmosphere: Earth Radiation Balance (Practical Part)	Almudena Velazquez Blazquez RMIB

21:30	Typical Night in the <i>Future Beach</i>
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DAY 4 - Thursday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Remote Sensing Applications for Land: Vegetation Dynamics (General, Biophysical Parameters), Surface Energy Balance (I)	Dr Bernardo Silva <i>UFCEG</i>
10:00 – 10:30	Coffee break	
10:30 – 12:30	Remote Sensing Applications for Land: Vegetation Dynamics (General, Biophysical Parameters), Surface Energy Balance (II)	Dr Bernardo Silva <i>UFCEG</i>
12:30 – 14:00	Lunch	
14:00 – 16:00	Remote Sensing Applications for Land: Vegetation Dynamics (Practical part) (I)	Dr Bernardo Silva <i>UFCEG</i>
16:00 – 16:30	Coffee break	
16:30 – 18:00	Remote Sensing Applications for Land: Vegetation Dynamics (Practical part) (II)	Dr Bernardo Silva <i>UFCEG</i>
	Free time	

DAY 5- Friday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Remote Sensing Applications for Ocean: SST	Dr Milton Campbell / Dr Carlos Lentini <i>INPE / UFBA</i>
10:00 – 10:30	Coffee break	
10:30 – 12:30	Remote Sensing Applications for Ocean: Ocean Colour	Dr Milton Campbell / Dr Carlos Lentini <i>INPE / Univ. Bahia</i>
12:30 – 14:00	Lunch	
14:00 – 16:00	Remote Sensing Applications for Ocean: SST (Practical Part) (ctd.)	Dr Milton Campbell / Dr Carlos Lentini <i>INPE / UFBA</i>
	Coffee break	
16:30 – 18:30	Remote Sensing Applications for Ocean: Ocean Colour (Practical Part) (ctd.)	Dr Milton Campbell / Dr Carlos Lentini <i>INPE / UFBA</i>
	Formal Dinner	

DAY 6- Saturday		
TIME	TOPIC	
08:00 – 10:00	Oral Presentation (10 min each)	Students
10:00 – 10:30	Coffee break	
10:30 – 12:30	Oral Presentation (10 min each)	Students
	Trip to Experimental Site	
12:30 – 13:30	Lunch (Typical Ceará Country Side Food)	
13:30 – 14:30	Lunch (Typical Ceará Country Side Food)	
14:30 – 17:00	Visit to Soil Moisture and Energy Budget Validation Site	
17:00 – 18:00	Trip Back to Hotel	
	Free Time	
DAY 7- Sunday		
TIME	TOPIC	

	Free Time	
DAY 8 - Monday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Physical Principles in Passive Microwave Radiometry	Dr Ernesto Lopez-Baeza <i>UVEG</i>
10:00 – 10:30	Coffee break	
10:30 – 12:30	Physical Principles in Active Microwave Radiometry. Radar Systems	Salvatore Dinardo <i>ESA-ESRIN</i>
12:30 – 14:00	Lunch	
14:00 – 16:00	ESA Toolboxes and Data Use (SAR)	Salvatore Dinardo <i>ESA-ESRIN</i>
16:00 – 16:30	Coffee break	
16:30 – 18:30	Radar Altimetry	Salvatore Dinardo <i>ESA-ESRIN</i>
21:00	One night @ Bar PIRATA "The Craziest Monday in the World"	
DAY 9- Tuesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	ESA Toolboxes and Data Use (Radar Altimetry)	Salvatore Dinardo <i>ESA-ESRIN</i>
10:00 – 10:30	Coffee break	
10:30 – 12:30	Microwave Scatterometry	Salvatore Dinardo <i>ESA-ESRIN</i>
12:30 – 14:00	Lunch	
14:00 – 16:00	The SMOS Mission (Introd. Products. Orbit. Level1)	Arnaud Mialon <i>CESBIO</i>
16:00 – 16:30	Coffee break	
16:30 – 18:30	SMOS Level 2 Land Products	Arnaud Mialon <i>CESBIO</i>
	Free time	
DAY 10- Wednesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	SMOS Level 2 Ocean Products	Marco Talone <i>ICM</i>
10:00 – 10:30	Coffee break	
10:30 – 11:30	SMOS Level 3 Ocean Products	Marco Talone <i>ICM</i>
11:30 - 12:30	SMOS Level 3 Land Products	Arnaud Mialon <i>CESBIO</i>
12:30 – 14:00	Lunch	
14:00 – 15:00	SMOS Cal/Val Land Products	Dr Ernesto Lopez-Baeza <i>UVEG</i>
15:00 - 16:00	SMOS Cal/Val Ocean Products	Marco Talone <i>ICM</i>
16:00 – 16:30	Coffee break	
16:30 – 18:30	ESA Toolboxes and Data Use (BEAM, SMOS, ...)	Salvatore Dinardo <i>ESA-ESRIN</i>
	Typical Brazilian Show	

DAY 11- Thursday		
TIME	TOPIC	TEACHER (tbc)
08:00 – 10:00	Assimilation of SMOS Data and Products in Numerical Prediction Models	Dr Joaquin Muñoz <i>ECMWF</i> (Video Conference)
10:00 – 10:30	Coffee break	
10:30 – 12:30	Assimilation of Remote Sensing Data and Products in Numerical Prediction Models	Dr Luis G. G. de Gonçalves <i>INPE</i>
12:30 – 15:00	Lunch	
15:00 – 17:00	Assimilation of Remote Sensing Data and Products in Numerical Prediction Models	Dr Luis G. G. de Gonçalves <i>INPE</i>
	Visiting the Beach Park	

DAY 12- Friday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Remote Sensing Applications for Land and Ocean. Hydrological Balance	Dr Bob Kuligowski <i>NOAA</i>
10:00 – 10:30	Coffee break	
10:30 – 12:30	Remote Sensing Applications for Land and Ocean. Hydrological Balance (Practical Part)	Dr Bob Kuligowski <i>NOAA</i>
12:30 – 15:00	Lunch	
15:00 – 16:00	Invited Lecture on Remote Sensing Applications for Fisheries	Dr. Paulo Travassos <i>UFPe</i>
16:00 – 17:00	Closing Ceremony	FUNCEME, Course Organizers
	Free Time	

ACRONYMS

CESBIO – Centre d' Etudes Spatiales de la BIOSphère - [French](#)

ECMWF – European Centre for Medium-Range Weather Forecasts – [England](#)

ESA – European Space Agency – [French and Italy](#)

FUNCEME – Fundação Cearense de Meteorologia e Recursos Hídricos - [Brazil](#)

ICM – Institut de Ciències del Mare – [Spain](#)

INPE – Instituto Nacional de Pesquisas Espaciais – [Brazil](#)

NOAA – National Oceanic and Atmospheric Administration - [USA](#)

RMIB - Royal Meteorological Institute of Belgium – [Belgium](#)

UFBa – Universidade Federal da Bahia - [Brazil](#)

UFCG – Universidade Federal de Campina Grande - [Brazil](#)

UFPe – Universidade Federal Rural de Pernambuco- [Brazil](#)

UVEG – Universitat de Valencia – [Spain](#)