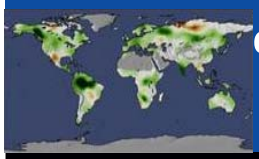
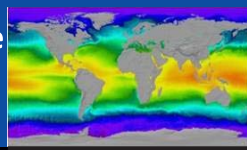
FUNCEME - COSPAR TRAINING AND CAPACITY BUILDING COURSE ON EARTH



Observation Understanding of the Water Cycle

(Over Land and Ocean)



Fundação Cearense de Meteorologia e Recursos Hídricos (FUNCEME)
(Ceara's Foundation for *Meteorology and Water Resources)*

FORTALEZA, CEARÁ, BRAZIL, 01 – 12 NOVEMBER 2010

http://www.funceme.br/eos.cospar

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

Ernesto López-Baeza
Climatology from Satellites Group
University of Valencia, Spain
Ernesto.Lopez@uv.es
Chair Sub-Commission A3 on *Land Processes and Morphology*

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Jerome.Benveniste@esa.int
Chair of Sub-Commission A2 on *Ocean Dynamics and Productivity*

FUNCEME-COSPAR Training and Capacity Building Course on Earth Observation Understanding of the Water Cycle Over Land and Ocean

The *FUNCEME-COSPAR Training and Capacity Building Course on Earth Observation Understanding of the Water Cycle Over Land and Ocean* took place in Fortaleza, Brazil from 1st to 12th November 2010 (http://www.funceme.br/eos.cospar). FUNCEME (*Fundação Cearense de Meteorologia e Recursos Hídricos*), the host institution, is a nonprofit regional Institute, linked to the State Government of Ceará and located in the city of Fortaleza, that develops activities in the areas of Meteorology, Environmental Resources and Water Resources (*http://www.funceme.br*). The lectures, both theoretical and practical, were developed at the *Instituto Aldys Mentor* from Fortaleza (*http://www.aldymentor.org.br/src/frmPrincipal.aspx*). This Institute is a non-profit institution dedicated to promote human and social development and integrate less educated citizens in the digital world. The Institute has a first-class infrastructure in lecture rooms and computing and audiovisual equipment which was lent to the Course in an altruistic way. Students and lecturers were accommodated at the *Hotel Beira Mar Fortaleza*, Fortaleza.

The main aim of the two-week COSPAR *Panel on Capacity Building Course* was to train postgraduate students and young researchers from different countries of the world, especially from Latin America, to improve their understanding and observations of the Water Cycle from space. The activities of this educational project were framed within the COSPAR Scientific Commission A on *Space Studies of the Earth's Surface, Meteorology, and Climate*, and more specifically within Sub-Commissions A2 on *Ocean Dynamics and Productivity* and Sub-Commission A3 on *Land Processes and Morphology*.

The postgraduate students and young researchers proceeded from a variety of scientific backgrounds from different Earth Science disciplines and wished to expand and improve their knowledge and skills on remote sensing techniques applied to water cycle studies.

The web site of the course received 70 applications from: Argentina, 7; Austria, 1; Belgium, 3; Brazil, 27; Canada, 1; Chile, 1; China, 2; Colombia, 1; Denmark, 1; Egypt, 1; Germany, 3; India, 7; Indonesia, 1; Japan, 1; Mexico, 4; Nepal, 2; Netherlands, 1; Russia, 3; USA, 2; and Vietnam, 1. After the detailed analysis and study of the Scientific Committee, 30 students were selected, many of them from less developed countries, and who fulfilled the main requirements for capacity building, that is, to be able to transfer the knowledge they would acquire to their respective institutions. See the final list of attendants in Appendix 1a.

The main goals of the course were to improve our understanding of the hydrological cycle, using data obtained by satellites. In addition, the course also was seeking to:

i. increase the knowledge on how to access and use public archives of data generated from satellite sensors depending from different Agencies such as ESA, INPE, NASA and NOAA
ii. instruct the participants, through theoretical and practical lectures to use specialized toolboxes to extract data from satellite images and generate products with a special attention given to soil moisture and ocean salinity, and
iii. promote professional and institutional relationships between students and experienced lecturers from the institutions mentioned in the attachment

The course included lectures covering issues related to a general introduction on water cycle studies, both over the land and over the ocean, statistical data analysis as well as an introduction/revision of remote sensing concepts, principles, methodologies, and applications, such as: Introducing Satellite Remote Sensing; Digital Image Processing Techniques, Remote Sensing Applications for Land, Ocean and Atmosphere, Validation of Remote Sensing Data and Products, and Assimilation of Remote Sensing Data and Products in Numerical Prediction Models. Special attention was dedicated to train the students in the knowledge of SMOS (*Soil Moisture and Ocean Salinity*) ESA's Water Mission, by means of a thorough explanation of the different SMOS

data and products, as well as the training on the different ESA toolboxes. The Programme Contents and the Detailed Programme of the Course is given in Appendix 2. The students had the opportunity to present their work during a special session (Appendix 3).

Lecturers of the Course were researchers specialists in the different topics (see Appendix 1b and the Detailed Programme of the Course in Appendix 2) and proceeded from:

- **AEB – *Agência Espacial Brasileira* – Brazil**
- **CESBIO – *Centre d' Etudes Spatiales de la BIOsphère* – France**
- **CONAE – *Comision Nacional de Actividades Espaciales* – Argentine**
- **ECMWF – *European Centre for Medium-Range Weather Forecasts* – United Kingdom**
- **ESA-ESRIN – *European Space Agency* – Italy**
- **FUNCEME – *Fundação Cearense de Meteorologia e Recursos Hídricos* – Brazil**
- **ICM – *Institut de Ciències del Mar* – Spain**
- **INPE – *Instituto Nacional de Pesquisas Espaciais* – Brazil**
- **IOUSP – *Instituto Oceanográfico da Universidade de São Paulo* – Brazil**
- **ITIC – *Instituto de Tecnologia da Informação e Comunicação* – Brazil**
- **IRD – *Institut de Recherche pour le Développment* – France**
- **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**
- **UVEG – *Universitat de València – Estudi General* – Spain**

Finally, we would like to emphasize that the Course was programmed very timely in correspondence with ESA's SMOS Mission. We all know about the recent launch and successful development of the mission, so that we appropriately dedicated special attention to the training of the ESA Toolboxes related to the mission and to the use and exploitation of the different SMOS land and ocean data and products. Moreover, we would like to highlight the contributions of ESA, CESBIO, ICM, ECMWF and the University of Valencia that showed their recent activities in their respective mission assignments, namely retrieval and validation of land and ocean products and their assimilation in ECMWF CMEM (*Community Microwave Emission Model*).

We would like to thank COSPAR for the support, guidance, assistance and help provided in all the phases of the Course, and ESA, for the continuous collaboration in its organization. Especially, we would like to thank Dr. Volker Liebig, Director of ESA's *Earth Observation Programmes,* ESA/ESRIN, Frascati, Italy, for the significant financial support provided which upgraded and raised the standard of the Course. The soul of this activity has undoubtedly be A. Geraldo Ferreira who, with FUNCEME, poured himself out and dedicated all his efforts and time to the 100% success of the activity. We also acknowledge the support provided by AEB (*Brazilian Space Agency*), INPE (*Brazilian National Institute for Space Research*) and *Aldy Mentor Institute*.

All participants, lecturers and students, recognize the success of the Course. The lecturers had a splendid collaboration, dedication and interaction with the students, at all times, which easily helped us achieve the Course goals. The Appendix 4 contains the outcome of a Questionnaire circulated to the students to give their evaluation of the Course. The missing questions correspond to more elaborated suggestions from the students. But, the last thought and consideration on the Course should be dedicated to the students themselves. From the very beginning to the last instant they all have shown an extraordinary good spirit of companionship that still continues while trying to define and establish some sort of professional networks for further collaboration and true friendship. The Appendix 5 contains a very small sample of the hundreds of pictures taken by the them where one can see that everyone –students and lecturers- is always smiling. Their gratitude was finely expressed in the document (file: FUNCEME_COSPAR_Fortaleza_Brazil_2010_Movie.wmv) that can be freely downloaded from ftp://ftp.funceme.br/FUNCEME_COSPAR/ and which was shown by the students at the Closing Ceremony.

Appendix 1a: Participants

01	Alejandra Molina	Chile
02	Aline de Matos Valerio	Brazil
03	Carlos Eduardo Fagiolo	Brazil
04	Eduardo da Silva Gigliotti	Brazil
05	Eli Rafael Perez Ruiz	Mexico
07	Hesong Wang	China
08	João Bosco Passos Accioly Filho	Brazil
09	João Carlos Carvalho	Brazil
10	John Richard Otukei	Austria/Uganda
11	Julio Alberto Garcia Leal	Colombia
12	Khalid Guma Biro Turk	Germany/Sudan
13	Kleber Renato Da Paixao Ataide	Brazil
14	Maria Eugenia Dillon	Argentina
15	Pablo Christian Spennemann	Argentina
16	Pamela Alejandra Dominutti	Argentina
17	Peng Jilong	China
18	Rafael Castelo Guedes Martins	Brazil
19	Rodrigo Cauduro Dias de Paiva	Brazil
20	Romina Carla Ruscica	Argentina
21	Sara Hamdy Abd el Mawla el Adham	Egypt
22	Svetlana Karimova	Russian
23	TonantzinT. Terrazas	Mexico
24	Venkata Mahalakshmi	India
25	Veronica Daniela Barraza Bernadas	Argentina
26	Vinicius Gomes Costa Junior	Brazil
27	Wagner Luiz Barbosa Melciades	Brazil
28	Sergio Masuelli	Argentina
29	Anabel Lamaro	Argentina
30(*)	Raul Fritz Bechtel Teixeira	Brazil
31(*)	Valdenor Nilo de Carvalho Junior	Brazil

Appendix 1b: Lecturers

- Benveniste, Jérôme (European Space Agency - ESA - ESRIN, Italy)
- Coelho, Simone Marilene Sievert da Costa (National Inst. for Space Research - INPE, Brazil)
- Dinardo, Salvatore (European Space Agency - ESA - ESRIN, Italy)
- Gonçalves, Luis Gustavo (National Institute for Space Research - INPE, Brazil)
- Kampbell, Milton (National Institute for Space Research - INPE, Brazil)
- Kuligowski , Bob (National Occeanic and Atmospheric Administration - NOAA, USA)
- Lentini, Carlos (Federal University of Bahia - UFBA, Brazil)
- Lopez-Baeza, Ernesto (Climatology from Satellites Group, Univ. of Valencia - UVEG, Spain)
- Mialon, Arnaud (CESBIO - France)
- Muñoz Sabater, Joaquín (European Centre for Medium-Range Weather Forecast, ECMWF, UK)
- Sato, Olga T. (IOUSP, Brazil)
- Silva, Bernardo (UFCG - Brazil)
- Sobreira Rocha, Carlos Artur (Inst. de Tecnologia da Informação e Comunicação - ITIC, Brazil)
- Talone, Marco (Instituto de Ciencias del Mar - ICM, Spain)
- Velazquez-Blazquez, Almudena (Royal Meteorological Institute of Belgium - RMIB)

Appendix 2: 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 was put on the practical hands-on dedication to the characteristics of these missions. The contents of the Course are:

I. 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

a. Frequency distributions, Histograms
b. Measures of Central Tendency (Mean, Median, Mode)
c. Measures of dispersion (range, variance, standard deviation)
d. Covariance & Correlation Matrices
e. Time series análisis
f. Correlation (Understanding and Interpreting the correlation coefficient: scaterplots, slope of the regression line and z-scores, variance interpretation, calculation of the correlation coefficient, outliers and its effects)
g. 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 BudgetBowen 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
   - Precipitation
   - Retrieval Theory and Combination Algorithms
   - Surface Conditions
   - Algorithms and Products
   - GOES-R (the next generation of GOES)...next-generation algorithms and new products

(vii) Validation of Remote Sensing Data and Products

a. Land Products
   - CBERS, LANDSAT, MODIS, NOAA, SMOS, ...
   - NDVI, Soil Moisture, Vegetation Water Content

b. Ocean Products
   - NOAA, SeaWifs, SMOS, ...
   - 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
   - General Introduction to Data Assimilation
   - Direct Insertion and Nudging
   - Optimal Interpolation
   - Variational DA (1,2,3 and 4-DVar)
   - Kalman Filters

b. Operational Data Assimilation
   - Worldwide
   - CPTEC/INPE

c. Local Ensemble Transform Kalman Filter

d. Land Data Assimilation Systems
   - NLDAS
   - GLDAS
   - The South American Land Data Assimilation System

II. Detailed Programme Finally Developed

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	Jérôme Benveniste *ESA*
11:45 – 12:30	The Brazilian Space Programme	Carlos Eduardo Quintanilha *AEB*
12:30 – 14:15	Lunch	
14:15 - 15:00	CONAE and SAC-D Space Plan	Mónica Rabolli *CONAE*
15:00 – 15:30	Course Introductory Talk	Course Organization
15:30 – 17:00	Introducing Satellite Remote Sensing	Simone M. S. da C. Coelho *INPE*
19:30 – 21:30	Ice Breaker (*Hotel Beira Mar*)	

DAY 2 - Tuesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Key Concepts in Remote Sensing	Simone M. S. da C. Coelho *INPE*
10:00 – 10:30	Coffee break	
10:30 – 12:30	Key Concepts in Remote Sensing	Simone M. S. da C. Coelho *INPE*
12:30 – 14:00	Lunch	
14:00 – 16:00	Statistical Data Analysis	Carlos Arthur S. Rocha *ITIC*
16:00 – 16:30	Coffee break	
16:30 – 18:30	Statistical Data Analysis	Carlos Arthur S. Rocha *ITIC*
	Free time	

DAY 3 - Wednesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Statistical Data Analysis	Carlos Arthur S. Rocha *ITIC*
10:00 – 10:30	Coffee break	
10:30 - 11:30	The Global Water Cycle (i) Terrestrial Component: Soil Moisture	Ernesto Lopez-Baeza *UVEG*
11:30 – 12:30	Remote Sensing Applications for Land/Atmosphere: Earth Radiation Balance (Part I)	Ernesto Lopez-Baeza/Antonio Geraldo Ferreira *UVEG/FUNCEME*
12:30 – 14:00	Lunch	
14:00 – 16:00	Remote Sensing Applications for Land/Atmosphere: Earth Radiation Balance (Part II)	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*
	Free time	

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

DAY 5– Friday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Remote Sensing Applications for Ocean: SST	Milton Kampbell / Carlos Lentini *INPE / UFBa*
10:00 – 10:30	Coffee break	
10:30 – 12:30	Remote Sensing Applications for Ocean: Ocean Colour	Milton Kampbell / Carlos Lentini *INPE / UFBa*
12:30 – 14:00	Lunch	
14:00 – 16:00	Remote Sensing Applications for Ocean: SST (Practical Part) (ctd.)	Milton Kampbell / Carlos Lentini *INPE / UFBa*
16:00 – 16:30	Coffee break	
16:30 – 18:30	Remote Sensing Applications for Ocean: Ocean Colour (Practical Part) (ctd.)	Milton Kampbell / Carlos Lentini *INPE / UFBa*
20:30 – 23:30	Formal Dinner (Sal e Brasa Churrascaria)	

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
	Free time	

DAY 7- Sunday	
TIME	TOPIC
	Free time

**** Participants interested in these events must cover their own expenses.**

DAY 8 - Monday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Physical Principles in Passive Microwave Radiometry	Ernesto Lopez-Baeza *UVEG*
10:00 – 10:30	Coffee break	
10:30 – 12:30	Physical Principles in Active Microwave Radiometry. Radar Systems	Olga T. Sato *IOUSP*
12:30 – 14:00	Lunch	
14:00 – 16:00	ESA Toolboxes and Data Use (SAR)	Salvatore Dinardo *ESA-ESRIN*
16:00 – 16:30	Coffee break	
16:30 – 18:30	Radar Altimetry	Salvatore Dinardo *ESA-ESRIN*
21:00	** One night at 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 *ESA-ESRIN*
10:00 – 10:30	Coffee break	
10:30 – 12:30	Microwave Scatterometry	Salvatore Dinardo *ESA-ESRIN*
12:30 – 14:00	Lunch	
14:00 – 16:00	The SMOS Mission (Introd. Products Orbit. Level1)	Arnaud Mialon *CESBIO*
16:00 – 16:30	Coffee break	
16:30 – 18:30	SMOS Level 2 Land Products	Arnaud Mialon *CESBIO*
	Free time	

DAY 10- Wednesday		
TIME	TOPIC	TEACHER
08:00 – 10:00	SMOS Level 2 Ocean Products	Marco Talone *ICM*
10:00 – 10:30	Coffee break	
10:30 – 11:30	SMOS Level 3 Ocean Products	Marco Talone *ICM*
11:30 - 12:30	SMOS Level 3 Land Products	Ernesto Lopez-Baeza / Dr.Arnaud Mialon *UVEG / CESBIO*
12:30 – 14:00	Lunch	
14:00 – 15:00	SMOS Cal/Val Land Products	Ernesto Lopez-Baeza *UVEG*
15:00 - 16:00	SMOS Cal/Val Ocean Products	Marco Talone *ICM*
16:00 – 16:30	Coffee break	
16:30 – 18:30	ESA Toolboxes and Data Use (BEAM, SMOS, …)	Salvatore Dinardo *ESA-ESRIN*
21:00	** Typical Brazilian Show	

DAY 11- Thursday		
TIME	TOPIC	TEACHER (tbc)
08:00 – 10:00	Assimilation of SMOS Data and Products in Numerical Prediction Models	Joaquin Muñoz *ECMWF* (Video Conference)
10:00 – 10:30	Coffee break	
10:30 – 12:30	Visit to FUNCEME	Antonio Geraldo Ferreira *FUNCEME*
12:30 – 14:00	Lunch	
14:00 – 16:00	Assimilation of Remote Sensing Data and Products in Numerical Prediction Models	Luis G. G. de Gonçalves *INPE*
16:00 – 16:30	Coffee break	
16:30 – 18:30	Assimilation of Remote Sensing Data and Products in Numerical Prediction Models	Luis G. G. de Gonçalves *INPE*

DAY 12- Friday		
TIME	TOPIC	TEACHER
08:00 – 10:00	Remote Sensing for Hydrometeorological Applications	Bob Kuligowski *NOAA*
10:00 – 10:30	Coffee break	
10:30 – 12:30	Remote Sensing for Hydrometeorological Applications	Bob Kuligowski *NOAA*
12:30 – 14:00	Lunch	
14:00 – 15:00	The PIRATA Program: History, Accomplishments and Current Results	Jacques Servain *IRD-FUNCEME*
15:00 – 16:00	Closing Ceremony	*FUNCEME*, Course Organizers
	Free time	

III. Acronyms

AEB – Agência Espacial Brasileira – Brazil
CESBIO – Centre d' Etudes Spatiales de la BIOsphère – France
CONAE – Comision Nacional de Actividades Espaciales – Argentine
ECMWF – European Centre for Medium-Range Weather Forecasts – United Kingdom
ESA-ESRIN – European Space Agency – Italy
FUNCEME – Fundação Cearense de Meteorologia e Recursos Hídricos – Brazil
ICM – Institut de Ciències del Mar – Spain
INPE – Instituto Nacional de Pesquisas Espaciais – Brazil
IOUSP – Instituto Oceanográfico da Universidade de São Paulo – Brazil
ITIC – Instituto de Tecnologia da Informação e Comunicação – Brazil
IRD – Institut de Recherche pour le Développment – France
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
UVEG – Universitat de València – Estudi General – Spain

Appendix 3: Students Presentations

Verónica Barraza Bernadas
Analysis of Floods and Droughts Events in the Bermejo River Basin: Contribution of Microwave Remote Sensing in Monitoring and Prediction

Khalid Guma Biro
Manifestation of Land Use/Land Cover Change Analysis and Its Impacts on Soil Properties in Gadarif Region, Sudan

Joao Carlos Carvalho
Retrieve of Temperature and Moisture Vertical Profile from Satellites Data
Quantitative Analysis Techniques to Water Quality Monitoring

Maria Eugenia Dillon
Application of the Latest Developments in Numerical Models Oriented to Weather Forecasting in the National Weather Service. Environmental Vulnerability and Socioeconomic Impact Studies

Pamela Dominutti
Environmental Risk Assessment by Floods in the North Area of Concepción del Uruguay City Using Geographical Information Tools

Carlos E. Fagiolo
Development of a Set of Surface Data for Modeling the Earth System

Julio A. García Leal
Precipitation Statistical Characterization Series in Bogotá Towards the Implementation of Mathematical Models for Completing Missing Data Using Weather radar and Satellite Technology

Sara Hamdy Abd el Mawla el Adham

Svetlana Karimova
Satellite Observations of the meso- and submesoscale eddies in the Baltic and Black Seas

Anabel Lamaro
Use of Remote Sensing in Monitoring Algal Blooms in Inland Water Bodies

Venkata Mahalakshmi
Influence of Land Use Land Cover (LULC) on Cyclone Track Prediction – A Study During AILA Cyclone

Sergio Masuelli
Modelado Espacio-Temporal de la Densidad de Culicidos en Escenarios Heterogéneos Derivados de Información de Sensores Remotos

Wagner Melciades
MSG2 Image Reception System at FUNCEME

Alejandra Molina
In the Search for Non Conventional Energy Sources in Chile

J. Richard Otukei
Analysis of Polarimetric SAR data for Land cover mapping in Mountainous Landscape

Rodrigo C.D. Paiva

Hydrological and Hydrodynamic Modelling in the Amazon River Basin

Kleber R. da Paixão Ataíde
Meteorological and Environmental Data in Data Base PostgreSQL (PostGIS / WKT Raster) and Querying by Web

Jilong Peng
X-ray and EUV CCD Camera

Eli Pérez
Seasonal and Interannual Variation of Gas Exchange (Carbon Dioxide and Water Vapour) Between the Biosphere and the Atmosphere of Seasonally Dry Ecosystems in Arid and Semi-arid Zones

Romina Ruscica
Atmosphere-Soil Moisture Interaction Over the La Plata Basin in South-Eastern South America

Pablo Spennemann
Characterization of the Hydrological Cycle over South America, Using Analysis and Regional Models

Eduardo da Silva Gigliotti
Interannual Marine Variability on Southeast Brazilian Bight and its Relationship to the Spawning Habitats of Brazilian Sardine (Sardinella braziliensis)

Tonantzin Tarin Terrazas
Vegetation Responses to Precipitation Pulses. Relationship Between the Availability of Rain and Ecosystem Production

Aline Valério
The Use of MOD09 Product and In Situ Data in a Reservoir

Hesong Wang

Appendix 4: Students Course Evaluation

Outcome of the Evaluation Questionnaire circulated among the students to gather their suggestions for further editions of this Course. The questions missing were more elaborated answers which will be included at a later stage

QUESTIONS / STUDENT NUMBER		COURSE EVALUATION QUESTIONNAIRE																													
		S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11	S 12	S 13	S 14	S 15	S 16	S 17	S 18	S 19	S 20	S 21	S 22	S 23	S 24	S 25	S 26	S 27	S 28	AVERAGE
1. Valoration of the local organization in general	Q1	5	5	4	4	4	5	5	5	5	5	5	5	5	5	4	5	5	4	5	5	5	5	5	5	4	5	4	4	5
2. Valoration of the overall technical programme	Q2	5	5	4	4	2	4	4	5	5	4	5	5	5	5	4	5	4	4	3	5	5	5	4	4	4	5	4	3	4
3. Valoration of the social program	Q3	5	5	4	4	3	5	4	5	5	5	5	5	5	5	5	4	5	4	2	5	5	5	5	5	5	5	4	3	5
4. Valoration of the theoretical lectures (contents)	Q4	5	5	5	5	4	4	4	4	4	4	5	5	5	3	4	4	4	4	4	5	4	5	4	4	3	5	4	3	4
6. Valoration of the theoretical lectures (lecturers)	Q6	5	5	4	4	3	5	4	3	5	4	4	4	4	4	4	4	4	4	4	5	4	5	4	5	4	5	5	4	4
7. Valoration of the practicals (contents)	Q7	4	5	5	5	2	5	3	5	4	3	4	3	4	4	3	4	4	4	3	5	4	5	5	4	3	4	4	4	4
8. Valoration of the practicals (lecturers)	Q8	5	5	3	3	3	5	3	4	5	4	4	3	4	3	3	4	4	3	2	5	4	4	3	5	3	4	4	4	4
9. Valoration of the availability and accesibility of the lecturers	Q9	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	4	5	4	4	5	5	5	5	5	5	4	5	5	5
10. Valorate the relation with the whole group (students and lecturers)	Q10	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5	3	5	5	5	5	5	5	5	5	5	5
11. How useful do you consider the course will be for your research?	Q11	5	5	4	4	4	4	5	5	4	4	5	3	5	4	5	4	3	4	4	5	5	5	4	4	4	5	5	3	4
13. Valoration of the schedule	Q13	5	5	3	3	4	4	4	4	5	5	4	4	5	4	5	5	4	3	5	5	5	5	5	5	3	5	5	3	4
14. Valoration of the materials provided	Q14	4	5	5	5	3	5	4	5	4	4	5	5	5	4	3	5	5	4	5	5	5	4	5	5	5	5	5	5	5
15. Valoration of the infrastructure (conference room, lab, computers)	Q15	5	5	5	5	4	4	4	4	4	5	5	5	3	5	5	5	5	4	5	5	4	5	5	5	5	5	5	5	5
17. Would you recommend this course to your colleagues	Q17	5	5	5	5	5	5	5	5	5	4	5	4	5	5	5	5	Y	5	5	5	5	5	4	5	4	5	5	3	5
18. Would you repeat this experience?	Q18	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
LEGEND:																														
S = Student																														
Q = Question																														

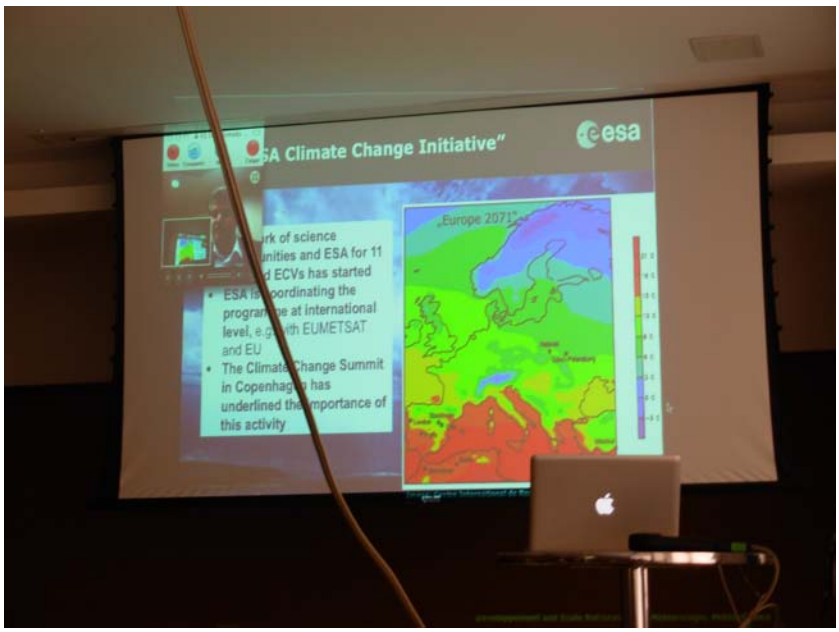
FUNCEME-COSPAR TRAINING COURSE
EVALUATION

	Q1	Q2	Q3	Q4	Q6	Q7	Q8	Q9	Q10	Q11	Q13	Q14	Q15	Q17
S 1	5	5	5	5	5	4	5	5	5	5	5	4	5	5
S 2	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S 3	4	4	4	5	4	5	3	5	5	4	3	5	5	5
S 4	4	4	4	5	4	5	3	5	5	4	3	5	5	5
S 5	4	2	3	4	3	2	3	5	4	4	4	3	4	5
S 6	5	4	5	4	5	5	5	5	5	4	4	5	4	5
S 7	5	4	4	4	4	3	3	5	5	5	4	4	4	5
S 8	5	5	5	4	3	5	4	5	5	5	4	5	4	5
S 9	5	5	5	4	5	4	5	5	5	4	5	4	4	5
S 10	5	4	5	4	4	3	4	5	5	4	5	4	5	4
S 11	5	5	5	5	4	4	4	5	5	5	4	5	5	5
S 12	5	5	5	5	4	3	3	5	5	3	4	5	5	4
S 13	5	5	5	5	4	4	4	4	5	5	5	5	3	5
S 14	5	5	5	3	4	4	3	5	5	4	4	4	5	5
S 15	4	4	5	4	4	3	3	5	5	5	5	3	5	5
S 16	5	5	4	4	4	4	4	4	4	4	5	5	5	5
S 17	5	4	5	4	4	4	4	5	5	3	4	5	5	0
S 18	4	4	4	4	4	4	3	4	5	4	3	4	4	5
S 19	5	3	2	4	4	3	2	4	3	4	5	5	5	5
S 20	5	5	5	5	5	5	5	5	5	5	5	5	5	5
S 21	5	5	5	4	4	4	4	5	5	5	5	5	4	5
S 22	5	5	5	5	5	5	4	5	5	5	5	4	5	5
S 23	5	4	5	4	4	5	3	5	5	4	5	5	5	4
S 24	5	4	5	4	5	4	5	5	5	4	5	5	5	5
S 25	4	4	5	3	4	3	3	5	5	4	3	5	5	4
S 26	5	5	5	5	5	4	4	4	5	5	5	5	5	5
S 27	4	4	4	4	5	4	4	5	5	5	5	5	5	5
S 28	4	3	3	3	4	4	4	5	5	3	3	5	5	3
AVERAGE	5	4	5	4	4	4	4	5	5	4	4	5	5	5

Appendix 5: Some Representative Pictures

Inauguration of the Course

Lecture Room



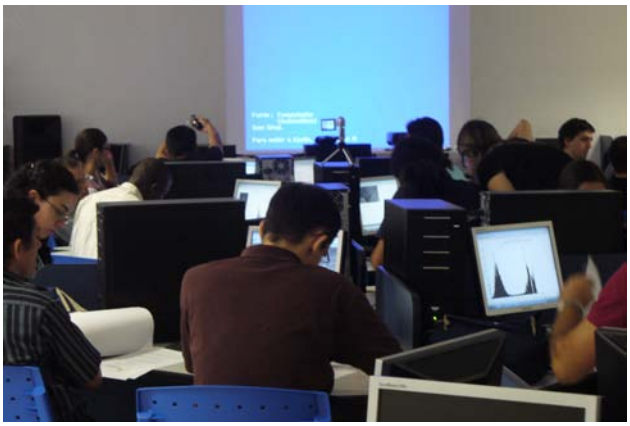
The first lecture was actually given by Jèrôme Benveniste from ESRIN via *skype*. See him on the *skype* window placed on top of the normal screen

Ice breaking cocktail: Always smiling from the beginning. Left: Alejandra (Argentina), Tonantzin (Mexico) and Richard (Uganda). Right: Kleber, Rodrigo and Joao Carlos from Brazil, Biro from Sudan and Carlos Eduardo, also from Brazil

Left: Aline (Brazil) between Peng (China) and Mahalakshmi (India) Right: … and now, between Sara (Egypt) and Richard (Uganda)

Left: Almudena´s practical lecture on radiative transfer. Right: Bernardo's lecture on surface energy balance fluxes

Lecture at FUNCEME



Practical lectures with first-class computers


Visiting FUNCEME



We are in Latin America! … dancing classes for free!: Left: Pamela (Argentina) shows *tango* to Vinicius (Brazil) during a coffee break. Center: Richard (Uganda) was very lucky, Pamela (Argentina) and Tonantzin (Mexico) were his teachers of *salsa* after the formal dinner. Right: Hesong (China) was also learning *salsa* from Aline (Brazil). Afterwards he just could not stop his feet moving and following the rh ythm …


- Let's see, Mr So and So … Why don't you want to come to the lectures today? Just look at me, I am eager to get to the Institute.

Very good atmosphere … always! Waiting for the bus to take us to the Institute. From left to right: Sara (Egypt), Richard (Uganda), Svetlana (Russia) Vinicius (Brazil), Peng (China), Kleber (Brazil) … and reflected in the glass, Joao Carlos (Brazil) and Julio (Colombia)

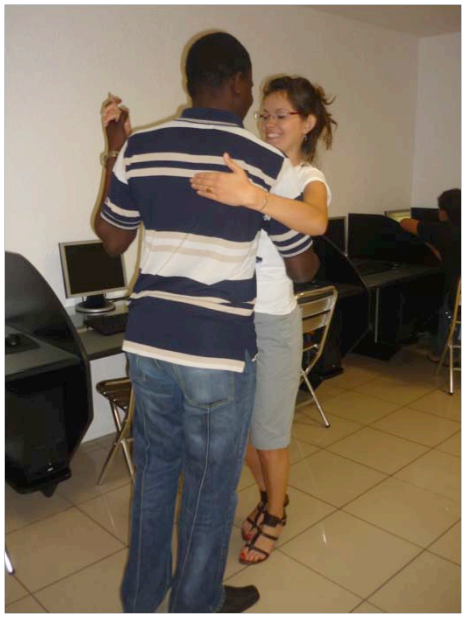
Coffee breaks were always a success and very much appreciated because of the large variety of tropical juices and Brazilian cakes and cookies … But (Right): Sara (Egypt) and Mahalakshmi (India) could also make a good use of time … (Top) Anabel (Argentina). (Left): Nilo (Brazil), Maria Eugenia (Argentina) and Vinicius (Brazil)

Students' presentations: Top: Biro (Sudan). Left: Veronica (Argentina). Right: Mahalakshmi (India)

Nice "family picture" of the Argentinians with their *mate*. Veronica, Pablo, Romina, Pamela and Maria Eugenia

Happy Birthday dear Hesong, … Happy Birthday to you ….

Sunday excursion to … three different beaches!!!



Oh! Sorry, I forgot. In the end, Richard learnt *tango* as much as he understood the water cycle thanks to Pamela's dancing classes every now and then during the coffee breaks …

COSPAR Training and Capacity Building Course on *Earth Observation Understanding of the Water Cycle,* FUNCEME, Fortaleza, Ceará, Brazil, 01 – 12 November 2010


Muito Obrigado ...
Brazil