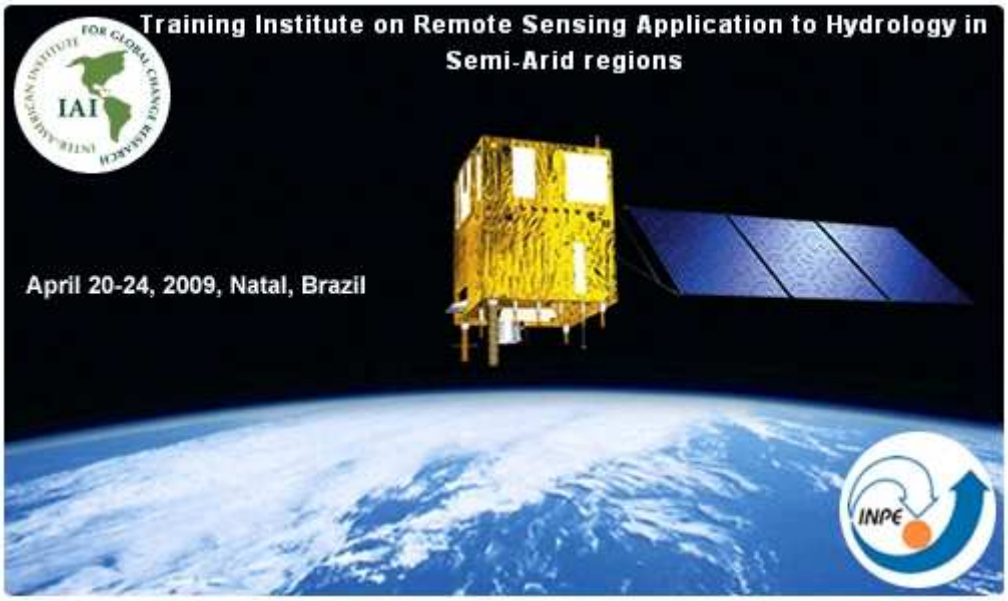
Final Report



Report compiled by

Prof. Dr. Humberto A. Barbosa
Universidade Federal de Alagoas - UFAL
7th May of 2009

Table of Content

I - Executive Summary

This document presents the report of the Training Institute on Remote Sensing Application to Hydrology in Semi-Arid regions (**TIRSAHSA**) and includes the views and inputs made by the participants held at the meeting, April 20-24, 2009.

Souvenir photo of all participants of the TIRSAHSA together with the speakers and the host in front of the INPE-NATAL building.

1 – Introduction and Background

The Training Institute on Remote Sensing Application to Hydrology in Semi-Arid regions (**TIRSAHSA**) was held in Natal, Brazil, that convened a panel of experts to consider the issues that confronted semi-arid lands. The meeting was organized by the Inter-American Institute (IAI) for Global Change Research, carried out in cooperation with Brazil's National Institute for Spatial Research (INPE), Federal University of Rio Grande do Norte (UFRN) and the Brazilian Agriculture Research Institute (EMBRAPA). The participants have different expertise in private sector, hydrology, social sciences, meteorology, agriculture and so forth. They were interested in employing these multidisciplinary approaches to learn, contribute, compare and collaborate. As a result, they made statements about needs for the future in terms of describing their own research interests and what they felt was needed. They also stressed the importance of supplying data exchange as many participants have had difficulty obtaining satellite records for integrating with ground observations. In this context, it was recommended that IAI should continue to support the development of programmes for the training and regional strategy workshops on applications of satellite remote sensing for further development of activities in close cooperation with the South American semi-arid institutions.

2 – Activities of the TIRSAHSA

Day 1: 20 April 2009
On the first day of the meeting, the session was opened by briefing with the INPE and IAI Team leader at the INPE-Natal building. They welcomed the participants and set the scene for the infrastructure-related presentations for enhanced applications of satellite remote sensing in the Brazilian semi-arid region. Short discussions during the presentations addressed, amongst others, the following issues: 1) general characteristics of caatinga vegetation; 2) hydrology resources in Rio Grande do Norte's semi-arid; 3) land use systems in semi-arid Northeastern Brazil; 4) applications of satellite remote sensing to semi-arid ecosystems; 5) remote sensing potential in identifying and monitoring desertification in the semiarid region of Brazil; 6) assessing temporal changes in superficial and groundwater storage through remote sensing; and 7) update methodology of classification in Northeastern semi-arid caatinga for the management and combat desertification.

Day 2: 21 April 200
The second day was dedicated to the infrastructure-related practical training. The participants were trained in using Shuttle Radar Topographic Mapping mission (SRTM) data and satellite remote sensing applications to map the Seridó Potiguar. An opening software was employed. It reviewed its advantages and disadvantages. It also reviewed several existing satellite data base that were highly successful for mapping the Brazilian semi-arid region.

Day 3: 22 April 2009
The third day was dedicated to the infrastructure-related participant presentations. The presentations consisted of distinguished applications bringing their high levels of

expertise to the challenging requirements for the development and implementation of satellite remote sensing applications to hydrology in semi-arid regions, assuring therefore a constructive and comprehensive outcome from the meeting.

Day 4: 23 April 2009
The fourth day was dedicated to the infrastructure-related expert presentations. Short discussions during the presentations addressed, amongst others, the following issues: 1) early warning systems for drought and desertification; and 2) using MODIS vegetation indices for operational drought monitoring and soil moisture.

Day 5: 24 April 2009
Recommendations were made by the participants, which consisted of gather opinions, criticism and suggestions on the workshop conducted. After productive discussions and contributions, several participants together with the IAI Team concluded that the proposed project concept document is very important and every effort should be pursued to ensure its full completion and implementation. Based on the outcomes of that meeting, Professor Dr. Humberto Alves Barbosa will continue to work closely with the IAI Team Leader will to finalise the project document. Collect information on the call for proposal (CFP) of potential interest to the participants for next month (s).

3 – IAI blog web page (http://disbr1.iai.int/Blog/)

This blog was created to establish a fine bridge between all participants and speakers, act as an effective information portal.

4 – Recommendations

The following summing up is a brief account of the feedback given by all participants during the TIRSAHSA. In addition to the focus on the scientific content of the workshop, the feedback also included comments on practical issues concerning the organization and planning of the course, and on the way the course was carried out.

With regard to the preparations to the course, it was commented that the preliminary program should be available at the time of enrollment at least at a general level, to be able to select the right person to take the course. It would be an advantage to know on beforehand that individual presentations would be required. This argument was supported by several participants, suggesting the use of the form of petition/enrolment to inform the workshop-participants. On the other hand, this group found the course impeccable in terms of logistics, flexibility in the agenda, and willingness to change and improve.

The great variety of participants at the conference (private sector, hydrology, social sciences, meteorology, agriculture and so forth), was pointed out as an asset. However, it was also commented that the variety of participants imply an integration of the appliance of remote-sensing systems, raising the question if there should be more focus on investigation. As mentioned, the participants had mainly focused on the actual content of

the course, and on the particular issues addressed through the presentations and workshops.

Due to the short time available to carry out the workshop, it was suggested that the programs should be presented as lectures or talks, emphasizing their potential in relation to the objectives of the course in general, for instance theme on hydrology. It was pointed out that contextual presentations concerning the semi-arid were very well presented through the personal presentations.

Several participants chose to focus on a summing up of the current status within the field.

1**) Existing knowledge and expertise:**

a) Database of soil attributes under different land use and –management in the semiarid Pampa;
b) Monitoring of soil moisture in long-term experiments under different crop sequences and management;
c) Modeling of soil-crop systems, evaluation of sustainability of land use systems;
d) Recently starting: monitoring of water table dynamics in plains for development of a hydrological model (small scale).

When it came to actual research-topics, several participants defined the following challenges:

2) Land cover and land-use (LCLU) change:

a. Conversion of natural savanna to agriculture, grazing effects on savanna vegetation and soil quality;
b. Effect of forestation with exotic species (Pine, Eucalypt) on soil morphological, chemical, physico-chemical and physical properties in Haplustolls;
c. Production systems changes in the semiarid central Pampa: impacts of cash crop systems versus mixed crop-livestock systems on resource quality and socio-economic conditions.

With regard to the practical training during the workshop, focused on the carrying out of the “SPRING” software in their feedback on the content of the workshop:

- The great software potential, focused on regional problems. Free software;
- Inadequate methodology when it came to the presentation of the software, suggesting to show the potential and use, and then afterwards carry out the specific training on the program:
- Massive extension and previous use, to then afterwards have feedback and correction;
- Perfection of the core of the software - resolve downfalls in the processing, etc;
- Highly necessary pre-processing at project-level;

- The impossibility to re-define the area of the study - on the other hand, this avoids an excess of information processed;
- Good support/help-systems and the existence of video-tutoring;
- The necessity to modify two key-points;
- Interface;
- Facility of exportation at project-level.

Concerning the question about future possible events, the need for feedback in time was pointed out. The difficulties in getting connected quickly lead to a motion towards an available platform after the course to keep in touch (blog-page, Web, forum, etc) (both suggestions, group. Pointing towards future events, the feedback also focused on knowledge gaps and lacking expertise.

1. **Hydrological models for semi-arid regions and for plains with no defined watersheds;**
2. **Estimation of crop evapotranspiration by satellite remote sensing (small scales < 500m);**
3. **Application of satellite remote sensing tools to detect site quality (potential primary productivity, water availability, soil profile depth) in semi-arid regions.**

5 – Concluding remarks

In summary, this workshop was a productive one. It provided a framework that brought together experts from private sector, hydrology, social sciences, meteorology, and agriculture in the satellite remotely sensed applications in semi-arid lands. The workshop was very well attended (see the list of participants and speakers attached) and opened opportunities for collaboration with the South American host institutions within the satellite applications. From the feedback given by all participants, it appeared that common challenges are: inadequate access for data and information management and exchange; scarce observations and inadequate resources for complementing satellite observations with ground-based observations to produce sophisticated information products for users. The participants expressed a high appreciation the good results of this workshop in an environment with excellent working logistics provided by the IAI. There is the need to implement of South American strategy to enhance the use of satellite remotely sensed data for the purpose of sustainable management of natural resources including water, ecosystems and biodiversity. It is expected that the future workshop and trainings will ensure leadership of satellite remotely sensed applications in South American semi-arid lands.

Appendix 1. List of the participants and the speakers

Speakers
Arthur Mattos - Universidade Federal do Rio Grande do Norte (UFRN)
André Lima - Instituto Nacional de Pesquisas Espaciais (INPE)
Camilo Rennó- Instituto Nacional de Pesquisas Espaciais (INPE)
Claudia Linhares- Instituto Nacional de Pesquisas Espaciais (INPE)
Edison Crepani - Instituto Nacional de Pesquisas Espaciais (INPE)
José Santino - Fundação de Amparo à Pesquisa de Alagoas (FAPEAL)
Luciano Accioly - Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)
Regina Alvala - Instituto Nacional de Pesquisas Espaciais (INPE)
Roxana Aragón - Universidad de Buenos Aires (UBA)
Humberto Alves Barbosa - Universidade Federal de Alagoas (UFAL)
Rômulo Menezes - Universidade Federal de Pernambuco (UFPE)
Everardo Sampaio - Universidade Federal de Pernambuco (UFPE)
Vinícius Queiroga Duarte - Companhia Hidro Elétrica do São Francisco (CHESF)
Participants
Carine Antunes Correia Marinho - CHESF
Celina Santoni - Universidad Nacional de San Luis/CONICET
Constanza Caride - Universidad de Buenos Aires
Dolores Lettelier - CONICET
Eduardo Bustos - Pontificia Universidad Catolica de Chile
Elke Noellemeyer - Universidad Nacional de La Pampa
Ethel Rubin de Celis - Universidad Nac Agraria La Molina (UNALM)
Francisco Rafael Sousa Freitas - Fundação Norte Riograndense de Pesquisa e Cultura (FUNPEC)
Gustavo Cruz Bello - National Inst Forestry Agr Livestock R.
Iêdo Bezerra Sá - EMBRAPA Semi-Árido
Javier Houspanossian - GEA/CONICET
José Américo Bordini do Amaral - EMBRAPA Agroindústria Trop
Juliano Schirmbeck - SulSoft/UNICEN-IHLLA
Katia Arraes - Instituto Nacional de Pesquisas Espaciais (INPE - Natal)
Lidia Ferri Hidalgo - IANIGLA
Manuel Rodrigues de Freitas Filho - FUNCEME / Univ.Est. Ceará
Maria Carolina da Motta Agra - CHESF
Mariano Oyarzabal - IFEVA
Mayra Milkovic - IFEVA
Moira Doyle - Universidad de Buenos Aires/CONICET
Patrick Debels - Independent Environmental Consultant
Pierre Pitte - IANIGLA / CONICET
Raniere Rodrigues Melo de Lima - Federal University of State Rio Grande do Norte (UFRN)
Raúl Ramirez - Universidad Simón Bolívar
Thaise Emmanuele Andrade de Sales - Federal University of State Rio Grande do Norte (UFRN)

Appendix 2. Information to be gathered in the different existing and potentially useful remote sensing &GIS data sources & products

Plataforma/sensor	products	application fields	spatial resolution	temporal resolution	spectral resolution (raw data)	available from – to	Provider	where to obtain data sets (URL)	cost	more info
MODIS	raw, NDVI y EVI, NDSI, LST, LAI, albedo, surface temperature, …	agriculture, hydrology, meteorology, LUCC, climate change	minimum 250m depending on product	minimum 2 x daily depending on product	36 bands	2000 - ?	USGS	http://modis.gsfc.nasa.gov/data/directbrod/index.php	free	http://modis.gsfc.nasa.gov/
CBERS	?	?					INPE	http://www.dgi.inpe.br/CDSR/	free	
LANDSAT						Since 1973	INPE	http://www.dgi.inpe.br/CDSR/	free	
ALOS		Land use				2006		http://www.alos-restec.jp/index_e.html	pay	

SRTM	DEM		3 sec	-	-	Feb 2000	NASA	ftp://e0srp01u.ecs.nasa.gov/srtm/version2/SRTM3/	free	
Geocover	Mosaic Landsat ETM+		14.25m	-	3 bands	+- 2000	NASA	https://zulu.ssc.nasa.gov/mrsid/ http://www.dpi.inpe.br/cdteca/ (geotiff UTM – grade Landsat)	free	
PRODES										
DETER										

Remote Sensing & GIS Data repository (portal)	products	URL
Global Land Cover Facility, Earth Science Data Interface (University of Maryland)		http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp