



SPACE FOR SUSTAINABLE DEVELOPMENT

RS Health Applications

Prof. Lic. Mario Alberto Lanfri

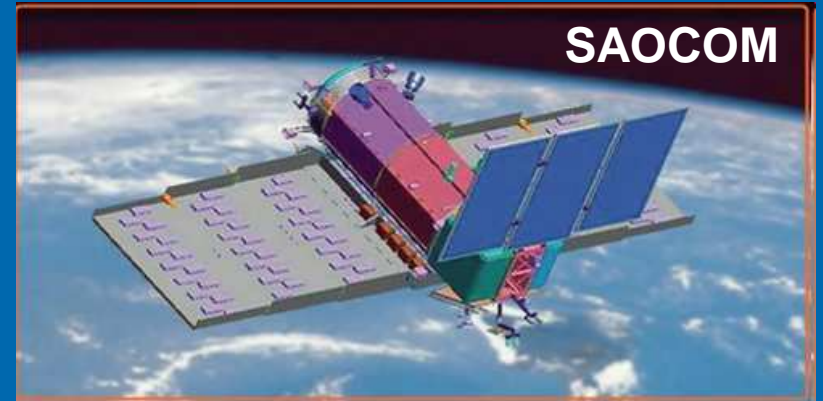
Gulich Institute (CONAE-ASI-UNC)

CONAE Argentinean Space Agency
ASI Italian Space Agency
UNC Cordoba National University, Argentina

Side Event, Rio + 20 Conference
June 19 2012, Riocenter, Rio de Janeiro, Brazil.



SAC-C

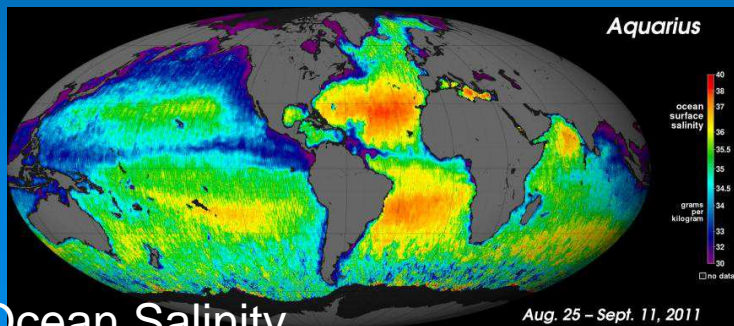
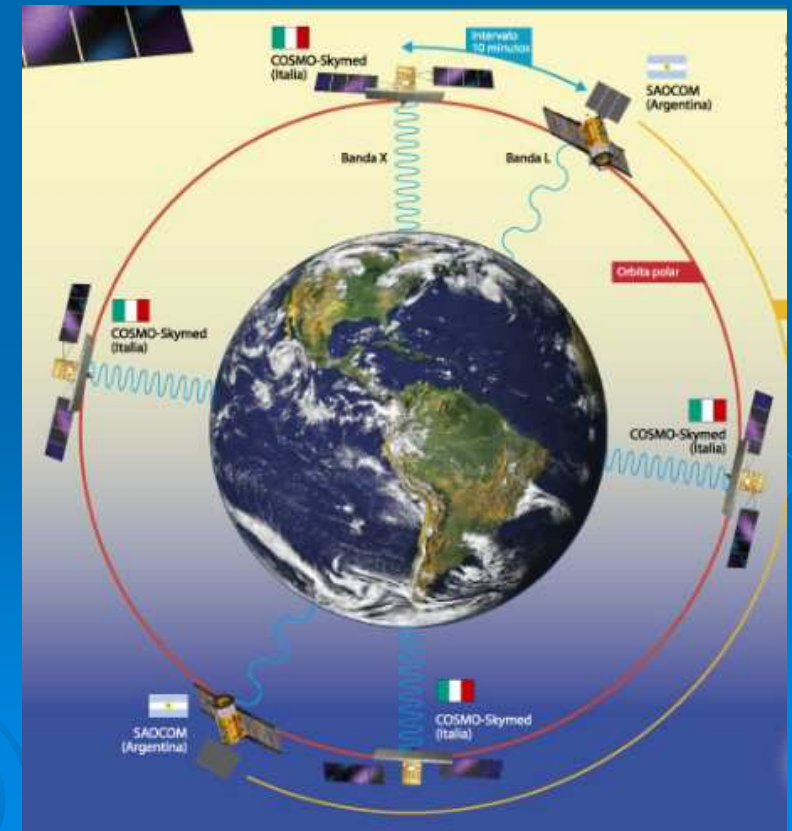


SAOCOM

SIASGE Constellation



SAC-D



Ocean Salinity

Aug. 25 - Sept. 11, 2011

Argentine
Space
Agency



Mario
Gulich
Institute



UNC

National University of Córdoba

Applications
developing

objectives

Training

Natural Disasters

SIFEM

Landscape Epidemiology

Health
Ministry



Landscape Epidemiology

- ✓ Landscape Epidemiology involves the characterization of eco-geographical areas where diseases develop.
- ✓ It is a holistic approach which takes into account the relationships and interactions between the different elements of ecosystems under the assumption that the biological dynamics of both host and vector population are driven by landscape elements such as temperature and vegetation.

Applied Landscape Epidemiology objectives

To develop a set of numerical tools devoted to the surveillance of a population under risk (early warning):

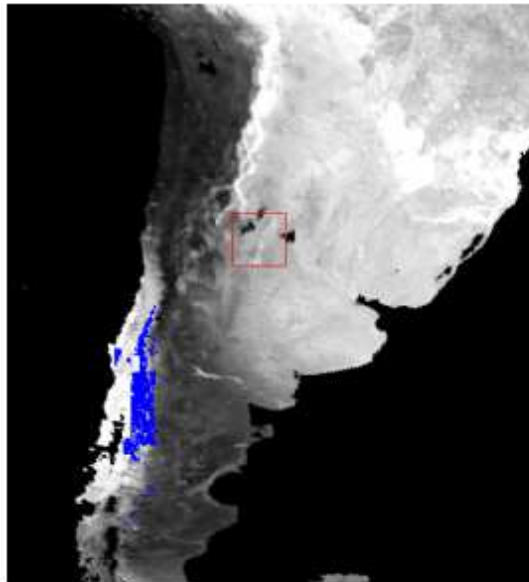
- **Development of a health information system:** satellite communication, data collection and decision making.
- **Cartography of Risk Factors** : fusion of epidemiological, biological and remote sensing data
- **Space-temporal modeling of epidemics:** hosts, vectors, reservoirs, ecosystem.



Potential distribution of rodent of epidemiological interest

*

- 1) AVHRR serie → Ts, NDVI
- 2) Precipitation
- 3) DEM



Oligoryzomys longicaudatus
Host of Hantavirus Pulmonary Syndrome

Calomys musculus and
Oligoryzomys Flavescens

Host of Argentine Hemorrhagic Fever

Fig 1: distribución potencial de *O. longicaudatus* por método del Paralelepípedo

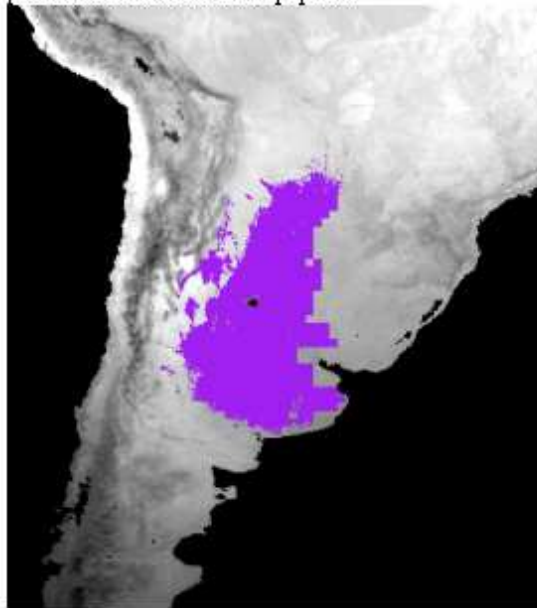


Fig 2: distribución potencial de *C. musculus* por método del Paralelepípedo

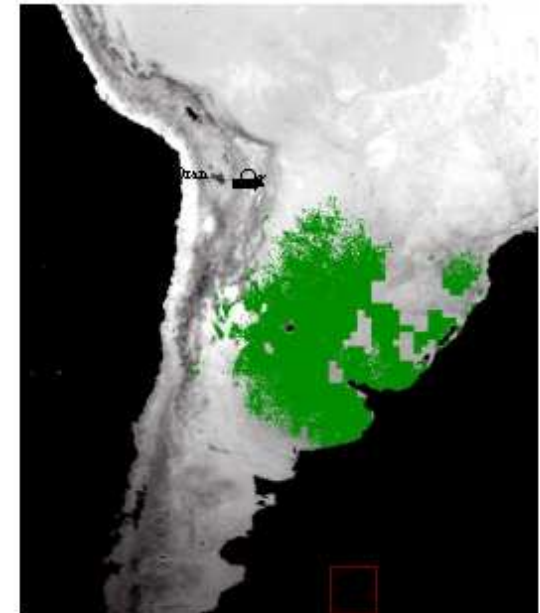
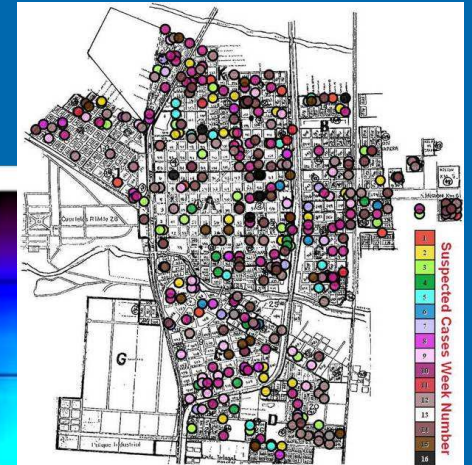
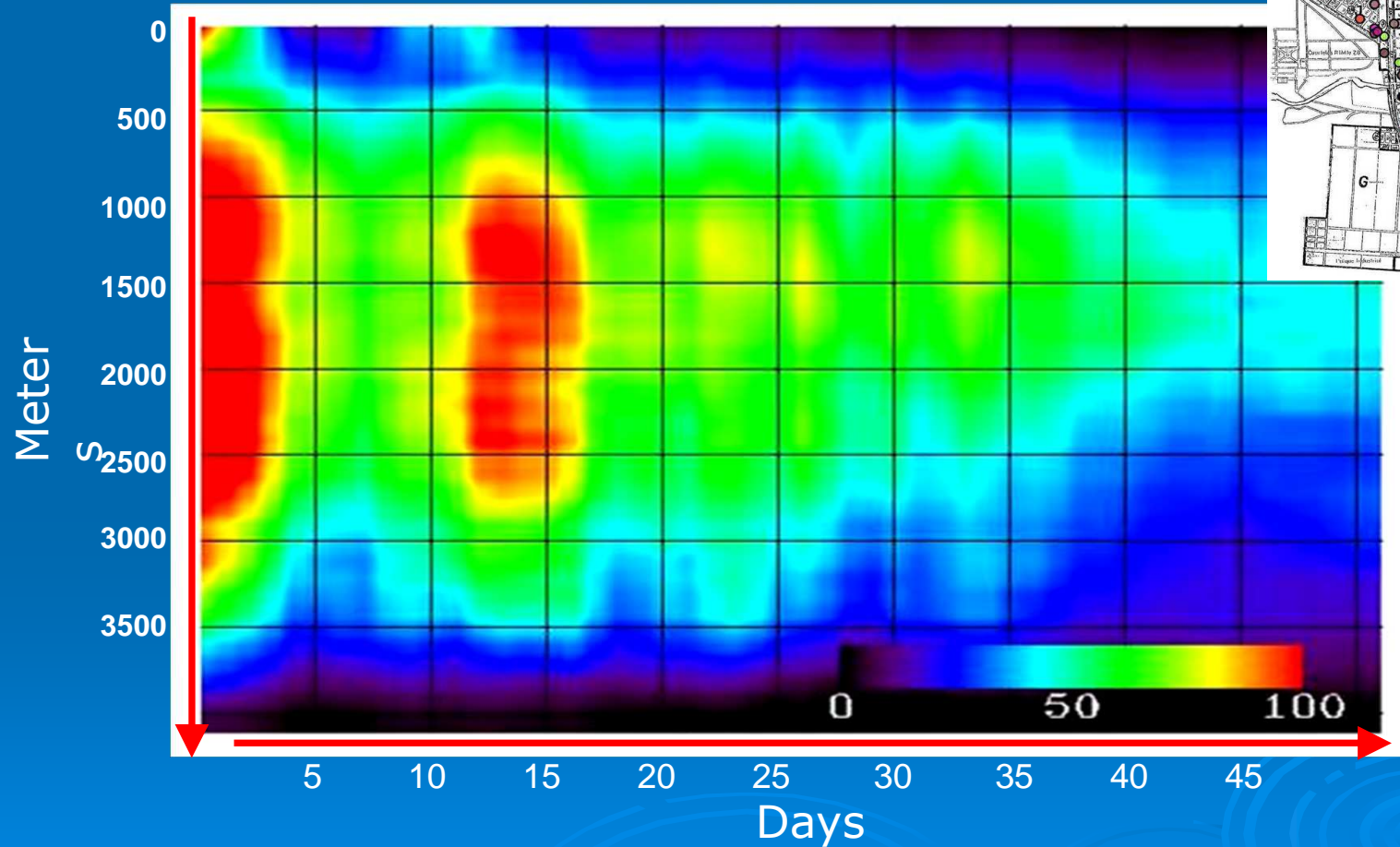


Fig 3: distribución potencial de *O. flavescens* por método del Paralelepípedo

Spatial Statistic Epidemiology: Tartagal Dengue Outbreak

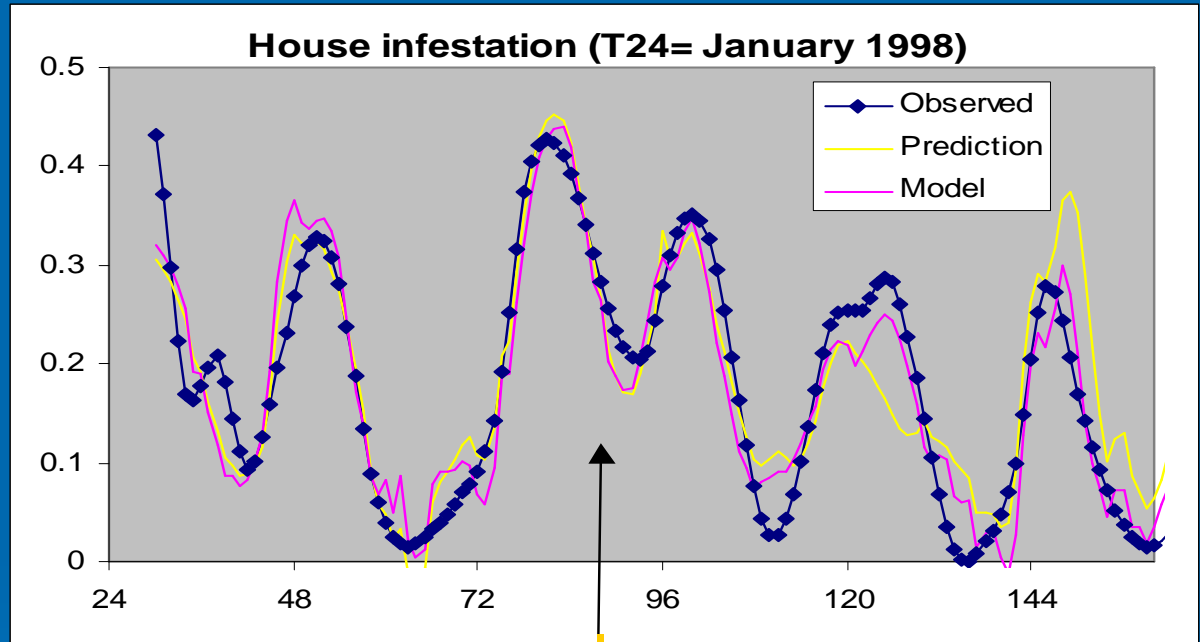
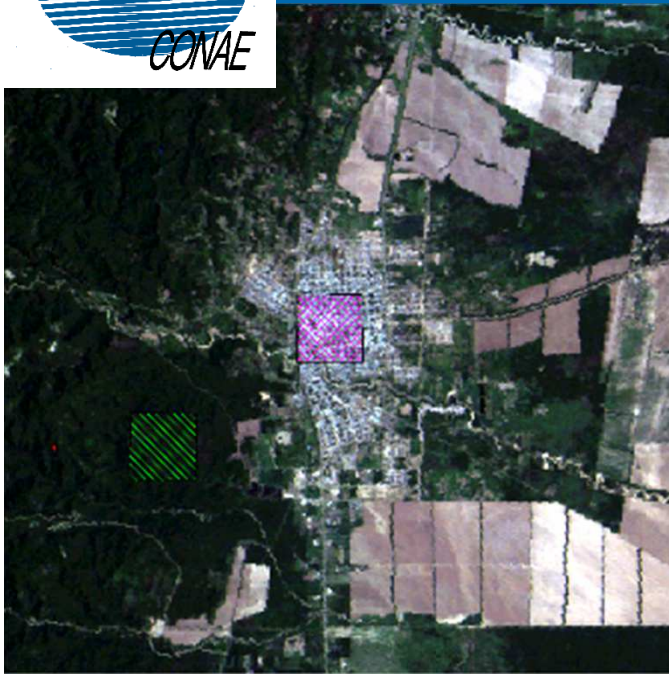


X axis: time between a pair of cases (days)

Y axis: distance between a pair of cases (m)



Prediction of entomological indexes



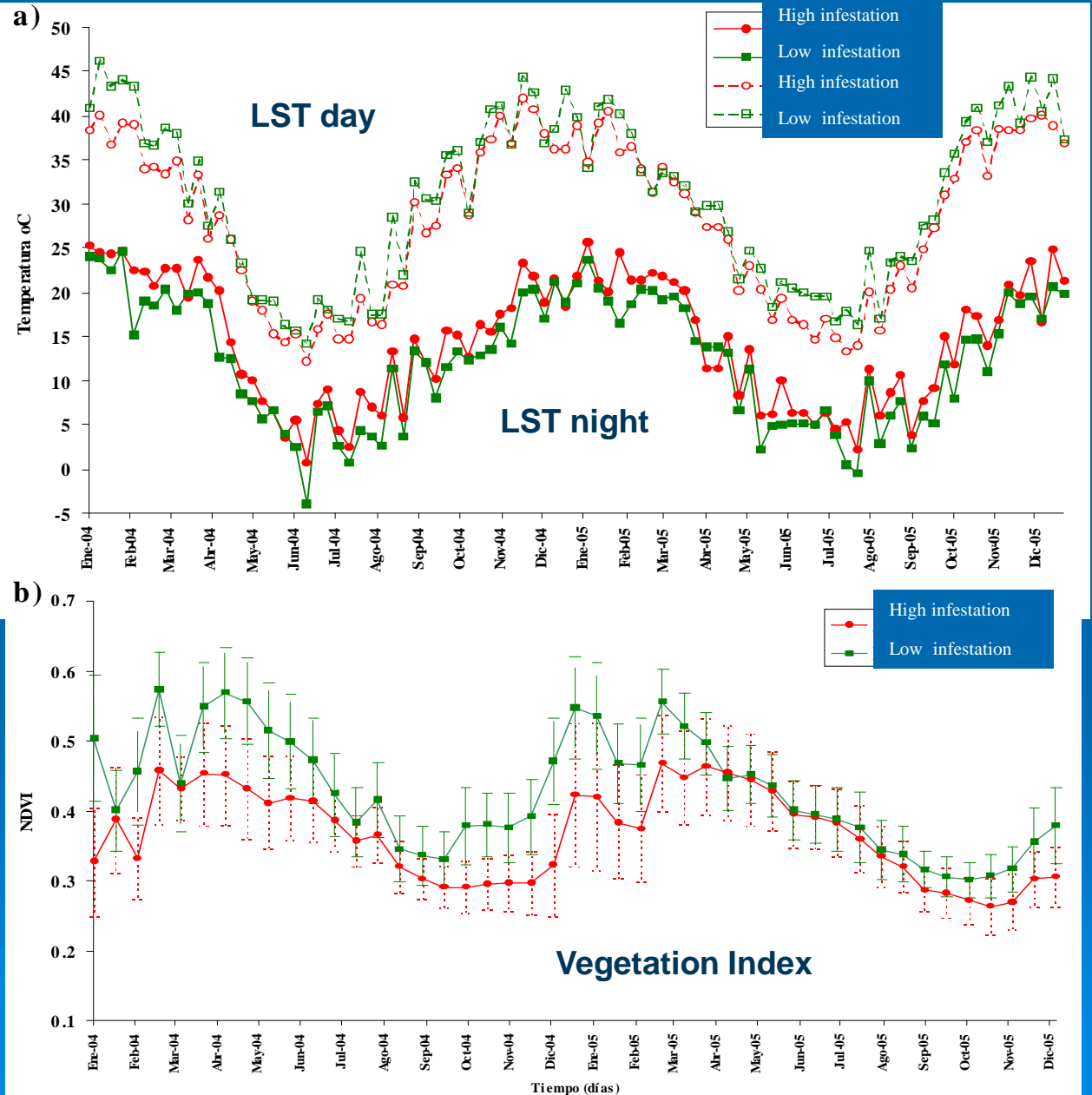
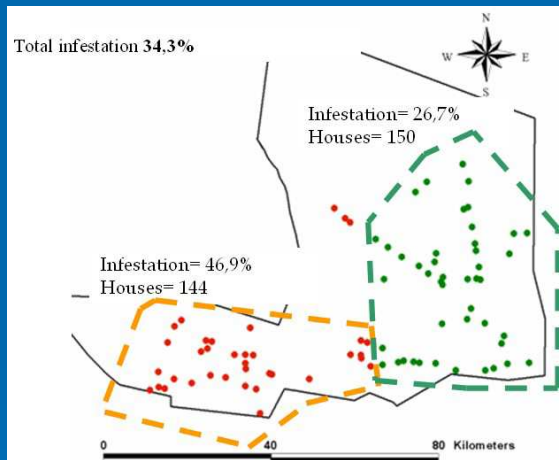
AREA	Variable	Statistic
FOREST	NDVI	AVG
		VAR
	TEMPERATURE	AVG
		VAR
CITY	NDVI	AVG
		VAR
	TEMPERATURE	AVG
		VAR
	RAINFALL	
	CONTROL	
	INTERVENTION	



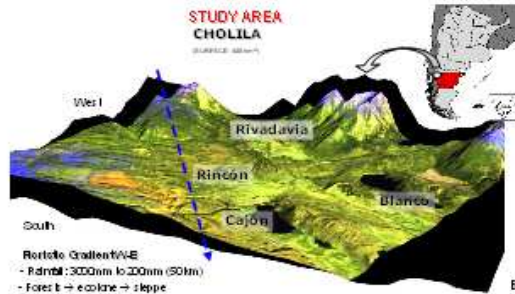


Spatial analysis in Gral. San Martín, La Rioja Province – Argentina

Temporal variation in environmental variables



Identification of vegetation cover types associated with reservoir of Hantavirus (*O. longicaudatus*) in Patagonia



O. longicaudatus is the reservoir of Hantavirus in southern Argentina. An ecology group of Rio IV has been studying its population dynamics since 2004, showed inter-annual fluctuations and differences in abundance between habitats. The fluctuations have been related partially with NDMI and other variable extracted from RS data in temporal analysis. Mai habitats are forest and scrublands and forest, but they are patchily distributed among Patagonia, which important features to identify over this wide area.

Fig. 1: Study area: the region has a marked gradient in height, rain and vegetation cover. Landsat TM over DBM (ASTGM)
By Biol. F. Polop, C. Portes and J. Polop - University of Rio de Janeiro

Fig. 2: Texture filters: mean (R), variance (G) and homogeneity (B) over a terrain corrected Alos Palsar image (HH polarization) over the study area. Symbols represent scrubs, forest, and grasslands sites were *O. longicaudatus* were captured. This polarization is not enough to separate the main vegetation types in which the reservoir of Hantavirus inhabit. Mean backscatter of these areas are shown below.

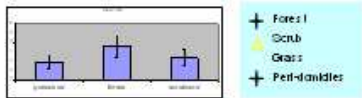


Fig. 3: AFrost filter applied to Cosmos image (HH) showing a partial view. Blocs, rows, water and high vegetation is recognized

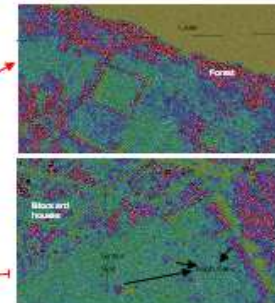


Fig 4: synthetic images generated from fig.3. High trees in grassland (with homogeneous backscatter) are recognized. Forest has heterogeneous backscatter but can also be identified

SAR data combination for evaluation of Leishmaniasis and Dengue vector habitats in Posadas

Leishmaniasis outbreak was registered in Posadas city by the end of 2008. The vector *Lutzomyia* sp. (a fly) infects dogs and they close contact with humans represent a high risk of disease transmission. The eutourism that leads area of Posadas in municipality began an eco-epidemiologic study to monitor the dynamics of vectors for Leishmaniasis and also for Dengue.

Posadas is a tropical forest region, where the frequent acquisition of optical data is very difficult due to clouds, pesticides and rain. *Lutzomyia* sp. habitat wet and dark sites like humid soil under trees shadows. So the combination of L and C band SAR data could be helpful to determine different vegetation structures, and also some indicator of soil moisture.

Positive breeding sites for *A. aegypti* were found over the all city, with some hot areas at central and north areas (Fig. 1), this is mainly because the vector is adapted to human habitats.

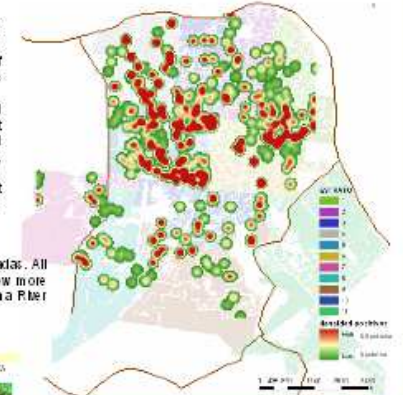


Fig. 1: Density map of positive sites for *A. aegypti* in Posadas. All blocks of the city were randomly sampled. Red color show more positive blocks for *A. aegypti*. Two streams go into the city, with Parana River as north boundary.

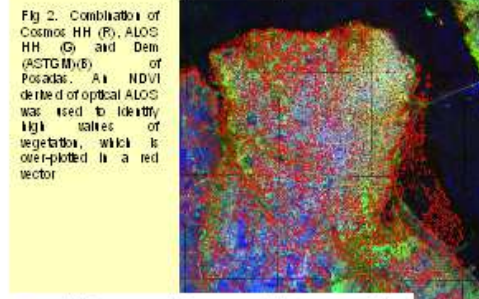


Fig 2: Combination of Cosmos HH (R), ALOS HH (G) and Dem (ASTGM) of Posadas. An NDVI derived of optical ALOS was used to identify high values of vegetation, which is over-plotted in a red vector

Fig. 3: Synthetic color image of Cosmos image over the Leishmaniasis cases area (black circle in Fig. 1). The vegetation, stream, water, and different building structures are discriminated.



Fig. 4: Classification of the basic classes based on Fig. 2 bands. The occurrence of Leishmaniasis cases are plotted in black also the positive blocks for *A. aegypti* in red. The vector of dengue fever is distributed more homogeneously, while Leishmaniasis cases occurred nearby the stream and perforated area.



Dengue Products Generation Project (DPG)

DPG is the first operative component of HAP (Health Applications Project) which is being developed for Chagas, Malaria, Dengue and Leishmaniasis disease

Objective

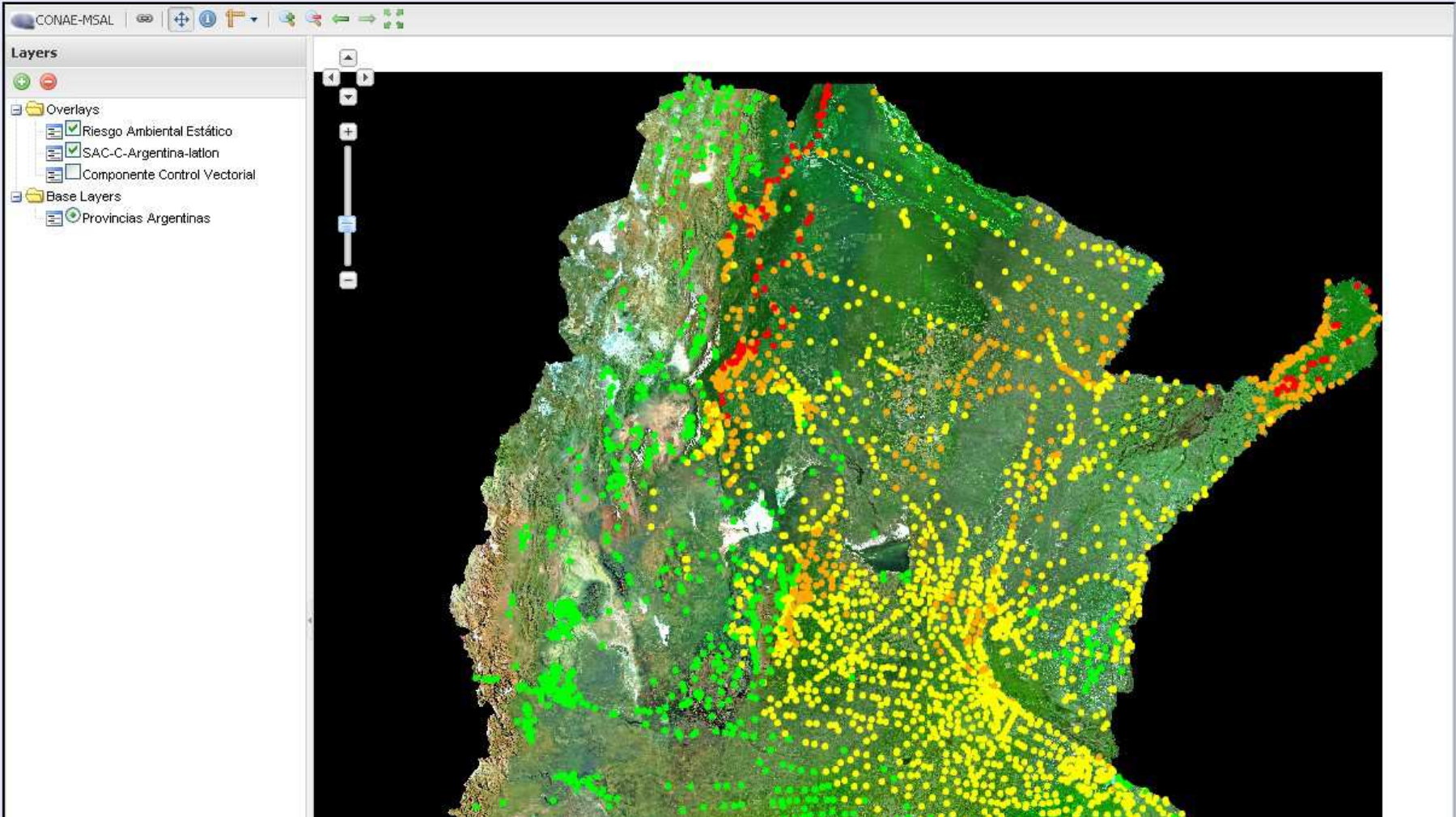
To build a multi-scale and a multifactor system based in RS, virological, entomological data to support the Dengue control actions

INPUT

Process_CONAE

Outputs
Products

Provincias
Localidades



RISK



Naciones Unidas

A/AC.105/860



Asamblea General

Distr. general
9 de febrero de 2006
Español
Original: inglés

Comisión sobre la Utilización del Espacio
Ultraterrestre con Fines Pacíficos

Informe del Curso práctico Naciones Unidas/Agencia
Espacial Europea/Argentina sobre la utilización de la
tecnología espacial para la salud humana, en beneficio de los
países en desarrollo de América Latina y el Caribe

(Córdoba, Argentina, 19 a 23 de septiembre de 2005)

2005: Tele-Epidemiology Pan American Group Foundation

Venezuela

Peru

Colombia

Argentina

Chile

Ecuador

Paraguay

Bolivia



EDICIÓN ESPECIAL 2005

ISSN 0717-2915

Revista
Journal **SELPER**

SOCIEDAD LATINOAMERICANA DE PERCEPCIÓN REMOTA Y SISTEMAS DE INFORMACIÓN ESPACIAL
SOCIEDADE LATINO-AMERICANA EM SENSORIAMENTO REMOTO E SISTEMAS DE INFORMAÇÃO ESPACIAL
LATINAMERICAN SOCIETY FOR REMOTE SENSING AND SPACE INFORMATION SYSTEMS



Workshop on the Use of Space Technology for Human Health

for the benefit of the countries in Latin America and Caribe

Instituto de Altos Estudios Espaciales "Mario Gulich"

Centro Espacial Teófilo Tabanera, Falda del Carmen, Córdoba, Argentina

19 al 23 de septiembre, 2005





2007
First Advanced Training School on Landscape Epidemiology
 A Further Step in the Regional Cooperation
 UNOOSA-CONAE

2008
Second Advanced Training School on Landscape Epidemiology
 UNOOSA-CONAE

Five weeks training to 2 people from each south American country, one coming from the epidemiology and the other one from GIS or computer science

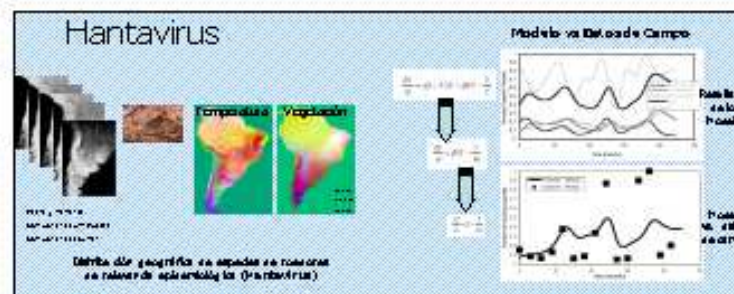
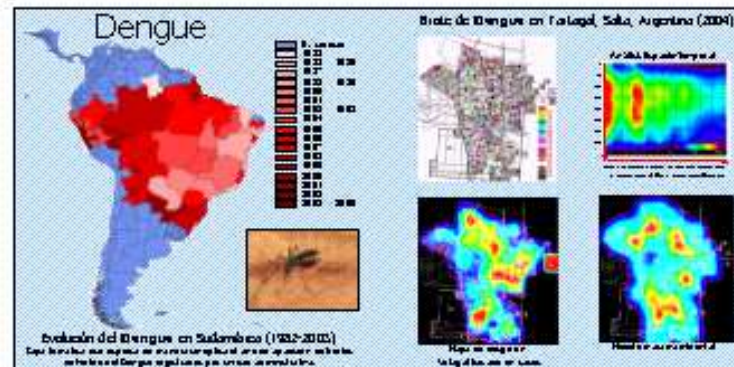
Escuela Avanzada de Entrenamiento en Epidemiología Panorámica para países de América del Sur

14 de mayo al 22 de junio de 2007

Instituto de Altos Estudios Espaciales "Mario Gulich", CONAE-UNC

Objetivo: Generación de Herramientas numéricas para la Vigilancia de Poblaciones en Riesgo

- Desarrollo de Sistemas de Información Geográfica para Salud
- Cartografía de factores de riesgo
- Modelado Espacio-Temporal de Epidemias
- Sistemas de Alerta Temprana
- Desarrollo de proyectos específicos por país



Centro Espacial Teófilo Tabanera, Comisión Nacional de Actividades Espaciales
 Ruta C-45 Km. 8, Falda del Carmen, Provincia de Córdoba - República Argentina



Master Degree on “Space applications of early warning and response to emergencies”

Facultad de Matemática Astronomía y Física
Instituto de Altos Estudios Espaciales
“Mario Gulich”, CONAE - UNCba

Objectives

To specialize professionals for the interdisciplinary managing of emergencies by doing effective use of space technologies, geoprocessing and AI P&S technologies.

To promote research on the factors causing natural disasters including outbreaks of agricultural, animal, or human plagues. This would allow preparing strategies of emergency prevention, monitoring, control and response.

To make possible the application of the most modern technologies to the aims of gathering, summarizing, analysing, and sharing of data.

To generate an academic support to SIASGE.

To coordinate academic actions with national e international institutions in this field.

To offer to the countries of our region the possibility of a formal diploma on the use of RS and space technologies on disasters.

The poster is titled 'IG BECAS' and is for the 'Maestría Aplicaciones Espaciales de Alerta y Respuesta Temprana a Emergencias'. It features a central image of a satellite in orbit over Earth. Text on the poster includes:

- Inscripción Ciclo 2009**
- Dirigida a profesionales de diversas disciplinas.
- Al término de la Maestría estarán capacitados para utilizar información espacial y tecnologías de avanzada para la gestión de emergencias.
- Los seleccionados contarán con becas de estudio de tiempo completo en el Instituto Gulich, y una estancia de 6 meses en un centro de investigación en Italia. Las becas son financiadas por la CONAE.
- La estancia en Italia es cofinanciada por el Gobierno de la Rep. Italiana y la CONAE.
- Duración: 2 años
- Inicio: Agosto de 2009
- Recepción de solicitudes hasta: 30 de Abril de 2009
- Informes: www.conae.gov.ar and ig@conae.gov.ar



Final Remark

RS and GIS offer to Health

- A new vision of the problems
- New tools for a better understanding
- Continuous monitoring of environmental conditions
- Products of Early Warning on Health

Health offer to RS community

- A field of application with a high social impact