Report on the COSPAR Capacity Building Workshop
"Planetary Missions Data Analysis"
Guaratinguetá, São Paulo, Brazil
26 Oct – 06 Nov 2015

1. Introduction

The workshop took place in the Universidade Estadual Paulista – UNESP, from 26 October to 06 November 2015. Primarily organized by COSPAR, it received support from UNESP and some international organizations such as the space agencies ESA and JAXA, and the International Astronomical Union-IAU.

Since 2001 COSPAR has been organizing Capacity Building Workshops to promote the use of data from space missions among the scientists and students, mainly in developing countries. Nowadays there are available several data bases of free access with data from several space missions that have not been widely used, mainly because of lack of knowledge on the existence of the facilities and the way to use them.

Due to the increasing number of scientists working on Planetary Sciences in Latin American countries this Workshop will be devoted to the use of planetary missions databases. The purpose was to increase the use of data obtained from the planetary space missions and promote the collaboration among scientists. There is a large amount of data obtained from the space missions and some of them have free access. This Workshop intended to provide enough information to the participants in order to enable them to use the available tools to analyse the data.

This Workshop was divided into Introductory and Planetary Missions data bases lectures, and the development of a research project using the data. There were some introductory lectures about the present knowledge of the Solar System and its formation and the space missions. The participants worked with computers with INTERNET access in order to download and work with the data.

2. Participants

This Workshop was oriented to participants from Latin American countries (Brazil, Argentina, Uruguay, Colombia, Peru, Paraguay, Chile, Mexico...) interested in Planetary Sciences. The level of the participants was MSc and PhD students, Postdocs and also young professionals. The following criteria was adopted in order to select the participants: i) background in the area; ii) experience in data reduction techniques, and iii) possibility to continue the research in their home institutes.

A total of 33 applicants were selected out of a total of 43 candidates. The selected participants were from Latin American countries (11 from Argentina, 17 from Brazil, 1 from Chile, 1 from Mexico and 3 from Uruguay). Some undergraduate students were also selected to participate since they were working in the area of Planetary Sciences.

3. Lecturers

The Introductory lectures were given by Dr Gonzalo Tancredi (*Facultad Ciencias, Uruguay*), Dr Tabaré Gallardo (*Facultad Ciencias, Uruguay*) and Dr Rodney Gomes (*Observatório Nacional, Brazil*). The Planetary Missions data bases lectures were given by D. Makoto Yoshikawa (JAXA), Dr Radwan Tajeddine *(Cornell University, USA), Dr* Bernhard Geiger (*ESA/ESAC, Spain*) and Dr Alejandro Cardesín Moinelo (*ESA/ESAC, Spain). T*he following missions data were analysed: Cassini Mission, Hayabusa, Rosetta and Venus Express. All the lectures can be seen in the

program (fig. 1, next section).

4. Program

The final program can be seen in Fig.1 which shows the title of each lecture given in the first week. The second week of the Workshop was dedicated to the preparation and presentation of the projects.

Program of the COSPAR Capacity Building Workshop on Planetary missions data analysis

Guaratinguetá, Brazil , October 26 to November 6, 2015

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1st Week			
08:00 - 09:30	T. Gallardo Some topics on Solar System dynamics	G. Tancredi Six decades of Planetary Exploration	A. Cardesin Introduction to Venus and Venus Express	B. Geiger Rosetta - Philae lander status and results	B. Geiger Presentation of projects related to Rosetta	B. Geiger Presentation of projects related to Rosetta
09:30 - 10:00	Coffee	Coffee	Coffee	Coffee	Coffee	Coffee
10:00 - 11:30	R. Gomes Solar System formation	B. Geiger Rosetta: Mission Overview to comet 67P/Churyumov-Gerasimenko	R. Tajeddine Saturn's rings	M. Yoshikawa Asteroid Sample Return Mission Hayabusa-2	M. Yoshikawa Solar Power Sail & PROCYON	M. Yoshikawa Presentation of projects related to Hayabusa
11:30 - 13:30	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13:30 - 15:00	A. Cardesin European Exploration of Planet Mars	M. Yoshikawa Lunar and Planetary Missions of Japan	B. Geiger Rosetta Orbiter Science Results	A. Cardesin VIRTIS Venus Express Visible InfraRed Thermal Imaging Spectrometer	A. Cardesin Access to Venus Express data - Presentation of projects	
15:00 - 15:30	Coffee	Coffee	Coffee	Coffee	Coffee	
15:30 - 17:00	R. Tajeddine Cassini-Huygens: Introduction to the mission to Saturn region	G. Tancredi Craters and boulders – Size distribution	M. Yoshikawa Asteroid Sample Return Mission Hayabusa	R. Tajeddine Saturn's rings	R. Tajeddine Saturn's rings	
			2nd Week			
08:30 – 10:00	A. Cardesin Access to VIRTIS Venus Express data	Project	Project	Project	Presentations	
10:00 - 11:30	R. Tajeddine Opus, Spice library & Kernels, Image Processing	Project	Project	Project	Presentations	
11:30 - 13:30	Lunch	Lunch	Lunch	Lunch	Lunch	
13:30 – 18:00	Project	Project	Project	Project	Presentations	

Total duration of the course: 70 hours
Every student made a presentation of the results of a data reduction project developed during the course.
Chairman of the Organizing Committee: Silvia Giulatti Winter

LECTURERS: T. Gallardo - Facultad Ciencias, Uruguay; R. Gomes - Observatório Nacional, Brazil; G. Tancredi - Facultad Ciencias, Uruguay; M. Yoshikawa - JAXA, Japan; R. Tajeddine - Cornell University, USA; B. Geiger - ESA/ESAC, Spain; A. Cardesín - ESA/ESAC, Spain; SOFTWARE ADVISOR R. Sfair - UNESP, Brazil

Figure 1

5. Projects

The lecturers presented several projects and the participants could choose which one they would like to develope. There were 13 groups working in the following projects: a) Astrometry of Daphnis based on Cassini's ISS images, b) Classification of gravity waves in VIRTIS data, c) Characterization of dust grains around comet 67P as seen in Rosetta navigation camera images, d) What about Enceladus' plumes? Analysis of images from Cassini ISS, e) Surface thermal emission in Venus, f) Propellers morphology, g) Correlation between gravitational potential and roughness of Itokawa, h) Venus, revealing the hell, i) Near-IR oxygen nightglow and altitude-intensity profile for Venus, j) Analysis of the Venus' southern pole vortex, k) Reconstruct the light curve of Itokawas by using the Hayabusa AMICA, l) Comparison of Rosetta navigation camera and OSIRIS images taken at comet approach in August 2014 and m) Calculate the orbital evolution of ejecta and debris caused by the impactor .

In the last day the participants presented the project and some results.

6. Results

At the end of the workshop each group gave a short presentation of 15-20minutes (plus 5

minutes for discussion) summarizing their results. For some students was the first time they gave a talk in English. Most of the results were good, and it seemed that all the participants understood the methodologies developed in the project. Most of them were able to continue the project in their home university/institute.

7. Venue

The Workshop took place in the Universidade Estadual Paulista-UNESP in Guaratinguetá, in the Campus of the Faculty of Engineering. The host department was the Mathematics Department, which recently moved to a new building. In fact, the Workshop was the first event, which inaugurated the facilities of this new building. The lectures were presented in the auditorium and the practical activities took place in the laboratory, both located in the same floor. The auditorium and the laboratory had enough space to comfortably accommodate the participants and lecturers. The lecturers also had their own room in the department.

The campus is connected to the RNP ("Rede Nacional de Pesquisa" – National Research Network) which provided a fast and reliable link. There was full Internet coverage via Wi-Fi within the building. Most of the participants brought their own computers, and the organization also provided a number of desktops to be used in the laboratory during the developing of the projects. Dr. Rafael Sfair was the software advisor and was present, helping the participants, during the 2 weeks. Figure 2 shows the participants, the lecturers and some organizers during the coffee break.

Figure 2

8. The Hotel

After visiting several hotels in the city of Guaratinguetá, we choose the Lótus Hotel. It offered single room for the lecturers and double and triple rooms for the non-local participants. A bus was offered by the University in order to take the participants and lecturers to the Workshop every morning and take them back in end of the day.

The participants and the lecturers took the breakfast and the dinner in this hotel. The dinner was pre-arranged for a fixed price. Different salads, soups, meats and vegetables were served each night.

The lunch was served in the Cafeteria of the University. All the participants (local and non-local) and the lecturers choose its own meal (self service) and the total amount was paid in the end of the Workshop.

In the first week of the event we had a special dinner with all the lecturers in a different restaurant, and in the second week the lecturers, local and non-local participants went to a restaurant for a celebration, tasting local food and enjoying local music. It was a very nice night.

9. The Excursion

On Sunday the group went to a very nice place, the National Park of Itatiaia. It is a very beautiful region with lakes, rivers and waterfalls. It was a great opportunity to see a wide variety of different species of birds. The group also stopped in a very nice town called Penedo to have lunch and walk around. Penedo is a town founded by Finnish settlers in Brazil and has approximately 5000 inhabitants. It has several restaurants, pubs and bars. Figure 3 shows the Park.

Figure 3

10. General Evaluation

From the opinion of most of the participants the Workshop was a success. The hotel and the dinner were very good. The meals in the Cantine were satisfactory.

Despite the hotel was not close to the university, the bus took less than 20minutes to bring participants and the lecturers to the University. Guaratinguetá is a small town, which was good for the Workshop, surrounded by very nice places.

The lecturers were excelent profissionals and helped the participants all the time. The Workshop had full support from the Facultaty, which make possible the realization of the event.

The Local Organizing, the Scientific Organizing Committee, and the institutions UNESP, COSPAR, IAU, ESA and JAXA, were responsible for the success of this event.

Dr Silvia Maria Giuliatti Winter