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The Rosetta Science Archive: Enhancing the Science Archive Content.

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Abstract

This presentation will outline the current status of the Rosetta archive, as well as highlighting some of the 'enhanced archiving' activities planned and underway with the various instrument teams on Rosetta to ensure the scientific legacy of the mission.

1. Introduction

On 30 September 2016, Rosetta completed its incredible mission by landing on the surface of comet 67P/Churyumov-Gerasimenko. Although this marked an end to the spacecraft's active operations, intensive work is still ongoing, with the instrument teams updating their science data in response to recent scientific reviews and delivering them for ingestion into ESA's Planetary Science Archive (PSA) [1]. In addition, ESA is working with some instrument teams to produce new, enhanced data products, with the aim of providing the best long-term archive possible for the Rosetta mission.

2. Rosetta Data in the PSA

All science data from the Rosetta mission are hosted jointly by the Planetary Science Archive (PSA) at ESA (http://psa.esa.int) [1], and by NASA's PDS Small Bodies Node (SBN).

The long duration of the Rosetta mission, along with its diverse suite of instrumentation and the range of targets observed throughout its lifetime combine to make this an extremely challenging mission to archive [2]. A number of independent data reviews have taken place over the course of the mission in an attempt to track the evolution of the data pipelines from each instrument and ensure that the science data are documented and formatted in the best possible way to allow end-users to exploit them. The last of these took place in October 2017, and had a focus on the science return from the comet phase of the mission. The outcome of the review was generally very positive, indicating that the data from most instrument teams are in excellent scientific shape and the Rosetta science archive is already an extremely powerful scientific resource. There were nevertheless several issues raised, and the instrument teams and the PSA are now implementing the fixes requested. In many cases this work is ongoing, and the review process has understandably resulted in a slow down of the standard delivery schedule. Nevertheless, the majority of teams have delivered all of their data from the entire mission. The aim is to complete the updates requested from the review and to work on delivering samples from the enhanced archiving activities by the end of this summer in preparation for another scientific review in autumn. This final review will assess the complete data holdings from Rosetta, and will review the outputs from the enhanced archiving activities discussed in the following section. This will ensure that the archive is ready for the long-term.

With the updates being made to the data pipelines as a result of the last review, teams have also been asked to re-run their older data through the new pipelines to ensure we have consistently the best and most up to date data available in the final archive. This whole exercise is ongoing for all teams.

3. Rosetta Enhanced Archiving

The nominal archive deliveries from the Rosetta mission are of excellent quality, and will be of immense interest and use for many decades to come thanks to the efforts of all involved in their production, assessment, storage and dissemination.

With the resources from the operational mission now at an end, ESA has established a number of activities with the Rosetta instrument teams to allow them to continue working on enhancing their archive content. The planned updates focus on key aspects of an instrument's calibration or the production of higher-level data, and are therefore specific to each

instrument's needs. Several activities have already been running in 2017, while others are in the process of being kicked off, with their duration varying depending upon the activities to be undertaken. The full 'archive enhancement' process will end September 2019, when the post operations activities for Rosetta come to a close. This presentation will highlight just a few of the archive enhancement activities to give a flavour of the updates being made.

Most instrument teams will be providing a *Science User Guide*, as well as updating calibrations for their data. Several teams will also be delivering higher-level processed and derived products. For example, the VIRTIS team are updating both their spectral and geometrical calibrations, and aim to deliver mapping products to the final archive in the coming year.

Similarly, in addition to their standard PDS3 IMG format science products, the OSIRIS team have recently started delivering data in both FITs and JPG formats, allowing an end-user to more easily view and select the images they may be interested in. Future updates will include the delivery of distortion corrected, straylight corrected and three-dimensional geo-referenced data products.

The Rosetta Plasma Consortium (RPC) instrument suite is working on cross-calibrations that will greatly improve the final data to be delivered from each experiment, as well as a number of activities individual to each instrument (e.g. removal of spacecraft noise from the MAG instrument). An illumination map of the comet has also been produced to help with their cross-calibration work.

The MIDAS team is also working on instrument cross-calibrations and the production of a dust particle catalog from the comet coma, while the GIADA team has started to produce higher-level products in the form of dust environment maps, developed in 3D plus time. Initial samples have already been delivered and are in preparation for inclusion in the PSA.

The NASA-funded ALICE, RPC-IES and MIRO instruments also have some limited enhanced archiving activities, which will wrap-up in Spring 2018, to allow the teams some funded time to respond to a review of their final submissions before the funding runs out at the end of this year.

A separate activity has also been established to produce data set(s) containing supporting ground-based observations from amateur astronomers. These data were taken simultaneously with Rosetta operations and could provide some important contextual information. Initial samples of some of these products were included in the recent scientific review, and the feedback has been extremely helpful in ensuring the development is on the right track.

In addition to these activities, the Rosetta ESA archiving team will internally be producing calibrated data sets for the NAVCAM instrument, and will be working to include the latest shape models from the comet into the final Rosetta archive.

4. Final Reviews

The enhanced data deliveries from the 3 US funded instruments will be reviewed in late Spring 2018. For the remainder of instruments, a final 'mission archive review' will be held with independent reviewers to assess the complete Rosetta data holdings towards the end of 2018.

Summary and Conclusions

This presentation will outline the current status of the Rosetta science archive in ESA's PSA and in NASA's PDS. In addition, an overview of the Rosetta archive enhancement activities will be provided. With the support of the instrument teams and the completion of the archive enhancement, the Rosetta archive will remain an immensely valuable resource for scientists in years to come, and the full scientific potential of the mission can be realized.

Acknowledgements

References

[1] Barthelemy, M. et al., (2018) Planetary and Space Science v150, 91-103.

[2] Besse, S. et al., (2018) Planetary and Space Science v150, 131-140;