

The Rosetta Science Archive: Enhancing the Scientific 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 that have been completed in 2018, and those that are planned / ongoing this year with the various instrument teams on Rosetta.

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 to this, ESA is working with a number of instrument teams to produce new and enhanced data products and to improve documentation in an effort to provide the best long-term archive possible for the Rosetta mission.

2. Rosetta Science Archive Status

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 May 2019, and had a focus on corrected deliveries from the enhanced archiving

effort of the mission described in the following section. The outcome of the review was generally very positive, indicating that the latest new and improved data and documentation from most instrument teams are in good scientific shape. There were nevertheless several issues raised by the reviewers, and the instrument teams and the PSA will be working very hard to implement the fixes requested this year. This was one of the final reviews for Rosetta, although a number of individual instruments and data sets will be assessed separately later this year. This process will ensure that the archive is ready for the long-term.

It should be noted that, with the updates being made to the data pipelines as a result of these reviews, teams have been asked to re-run all of 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, and is expected to be completed this year.

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. However, there is always more to do!

Once the resources from the operational mission came to an end, ESA established a number of joint activities with the Rosetta instrument teams to allow them to continue to work on enhancing their archive content. The updates planned were focused on key aspects of an instrument's calibration or the production of higher-level data / information, and are therefore very specific to each instrument's needs. Several of these activities have already been running for 2017/2018, and a number are in the process of being extended. They will run for various lengths depending upon the activities to be undertaken. The full 'archive enhancement' process will run until

December 2019, when the post operations activities for Rosetta will come to a close. This presentation will highlight just a few of the activities within the archive enhancement to give a flavour of the updates that have already been completed and those that are expected in the coming months.

Almost all instrument teams have now provided a *Science User Guide* for their data, which have been highly appreciated by the scientists in the recent reviews. Most teams are also updating calibrations for their data, and some will generate and deliver higher level processed data and derived products.

For example, we have recently released new data from the OSIRIS team with improved calibrations, as well as straylight corrected, I/F corrected data and three-dimensional georeferenced products. OSIRIS has also added data in FITS format, and now provide JPG quicklook (browse) versions of their products, to allow an end-user to more easily sift through the data and select the images they may be interested in. The VIRTIS team has also been working to update both their spectral and geometrical calibrations, with the aim to deliver mapping products to the final archive in the coming year.

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 or flagging of spacecraft noise from the MAG instrument). The RPC team has also produced an illumination map of the comet to help with their cross-calibration work, and this will be prepared for delivery to the archive this year as well. The MIDAS team has similarly been working on instrument cross-calibrations and has produced a dust particle catalog from the comet coma.

The GIADA team has started to produce higher-level products in the form of dust environment maps, with omnidirectional plus time products being developed. Initial samples were included in the recent review.

The COSIMA team recently delivered a ground-based catalog of spectra for comparison to help calibrate and understand their in-flight data.

A separate activity has also been established to produce and deliver data set(s) containing supporting ground-based observations of the comet. These data

were taken simultaneously with Rosetta operations and could provide some important contextual information. Samples of these products were included in the recent scientific review, and it is clear that the development is on the right track. This is an enormous data set and will take considerable effort this year to close this out.

In addition to these activities, the Rosetta ESA archiving team will produce calibrated data sets for the NAVCAM instrument, will archive the radiation monitor data produced by the SREM instrument on Rosetta and will be working to include the latest shape models from the comet into the final Rosetta archive. The Rosetta ESA archiving team is also working on producing a spacecraft housekeeping volume with key parameters from the operations, and will be providing a centralized solution to the problem of geometry on the comet for implementation within the final Rosetta data holdings.

4. Final Archive Reviews

The latest ‘mission archive review’ was held with independent reviewers in May 2019 to assess the final deliverables from the archive enhancement phase. A number of additional small reviews will be needed for upcoming deliveries such as the Spacecraft Housekeeping and SREM data. Together, these reviews will ensure that the ultimate Rosetta archive within the PSA will allow for scientists to fully exploit the data holdings for decades to come.

5. Summary

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 activities underway for enhancement of the archive content will be provided. With the support of the instrument teams and the completion of the archive enhancement, the Rosetta archive can become an immensely valuable resource for scientists in years to come, and the full scientific potential of the mission can be realized.

References

- [1] Besse, S. et al., (2018) Planetary and Space Science v150, 131-140.
- [2] Barthelemy, M. et al., (2018) Planetary and Space Science v150, 91-103.