PDS ATMOSPHERES NODE: UPDATES TO SERVICES AND PLANNED ARCHIVE UPGRADES

L.D.V. Neakrase, N. Chanover, L. Huber
NASA Planetary Data System Atmospheres Node, Department of Astronomy, New Mexico State University, Las Cruces, NM

Introduction. Archiving is an often overlooked or under-appreciated part of any research study. In recent years NASA programs have placed increasing importance on the dissemination of data to the wider scientific community as part of the responsibilities of publicly funded research [1]. NASA's Planetary Data System (PDS) has often served as the *de facto* archive for mission related data products, and in recent years has expanded to support data including ground-based observations, terrestrial analog field campaigns, and laboratory experiment results.

In aeolian science, analytical and numeric modeling results have been of equal value to the community, providing key pathways to test and validate hypotheses regarding planetary aeolian processes in addition to *in situ* and planetary analog (lab and field) observations. Atmospheric modeling results have not been included as archivable products within the PDS due primarily to rapid superseding of model output and potential for large volumes of data. Common PDS-archivable modeling formats have also presented issues for the PDS archive, with a paucity of common, stable, self-consistent formats suitable to long-term archiving.

The recent (2021) Planetary Data Ecosystem (PDE) Independent Review Board (IRB) presented several findings that certain types of useful data and model output were not being adequately preserved and distributed for community use [2]. Atmospheric model output is one of these identified areas of concern, as atmospheric modeling has no *de facto* home for storage of important results that could be utilized by the wider planetary atmospheric community. The IRB also found that concise, easy-to-use web interfaces for access to data and model output are not homogeneous across the PDE or even the PDS. PDS is beginning a system-wide process to modernize their web-access portals to allow easier data access, and a more unified presence across all the nodes. We present a few ways, specific to the aeolian community, where the PDS Atmospheres Node (ATM) is striving for improvement that should aid data providers and users submit and access data products within the archive.

Atmospheric Modeling Annex. The ATM is beginning the process of establishing a new service for the planetary community called the Atmospheric Modeling Annex. The intent is to provide a repository for relevant planetary atmospheric model output to be housed and served out to the public with less stringent requirements than is necessary for PDS archiving. The new service will require a minimal peer review with PDS4-like metadata control (labels) and would accept a wider range of data formats, including netCDF and HDF, which are common non-archival modeling formats. The end goal is to provide usable output to the community with linkages to the model creators to bolster connectivity within the planetary atmospheric modeling community and associated scientists. The Atmospheric Modeling Annex will be hosted through the ATM via developing cloud storage services, soon to be determined.

Educational Labeling System at Atmospheres (ELSA). ELSA is an ongoing software development initiative at ATM that intends to provide an educational approach to working with PDS4 labels. ELSA provides potential data providers with a clean, online interface with a guided sandbox approach to working with PDS4 label templates that can be tailored to the providers' needs. ELSA walks users through the process of creating PDS4 bundles, allowing selective handling of PDS4 internal references to context objects (investigations, facilities/instrument hosts, telescopes/instruments, and targets). ELSA requires a free login account that provides disk space at ATM to work on labeling projects that can be viewed and downloaded at any time. Public accessibility is planned for end of year 2022.

Renewed Focus on Venus. The recent selection of several missions to Venus (VERITAS, DAVINCI+, EnVision, etc.) has resulted in an increased interest in historical and contemporary Venus atmosphere data. In response to this renewed interest in Venus, ATM is beginning to modernize our data access to historical Venus data including access to data archived with our domestic colleagues (other PDS nodes) and international partners. A comprehensive renovation of the ATM Venus data portal will improve the user experiences of browsing and accessing Venus data spanning the past several decades, including international data from the Venus Express (ESA) and Akatsuki (JAXA) missions, which are either directly linked to or mirrored from the PDS. ATM is also in the process of migrating our Venus data holdings to the PDS4 archiving standard and improving the data indexing to provide easier access and directions for use. [3]

Aeolian Field Data. Surface boundary layer studies on Earth are often used as analogs for planetary environments for the study of sand and dust movement. Dunes and dust devils are dependent on these types of data. ATM is beginning to house more analog laboratory and field data, including terrestrial field analog dust devil and wind tunnel experiment data.[4]

Historical wind tunnel studies of surface threshold speeds have been recorded from many wind tunnels around the world and often represent a large effort to constrain aeolian sand and dust behavior at a range of pressures and temperatures as well as particle sizes and densities. Surface boundary layer experiments are essential for planetary environment comparison, placing constraints on total sand budgets for dune formation, formation and migration times for aeolian bedforms, and limitations on ideal wind-blown particle sizes and densities [5].

Terrestrial dust devil field studies provide an analog environment for studying martian dust devils. Dust devils have been long proven to be the same process on Earth and Mars despite differing environmental conditions [6]. Terrestrial field studies allow more controlled, lower-cost/easy access to the phenomena to produce better data on formation and propagation controls, internal structure, dust lifting potential, and also a potential testbed for new instrumentation and techniques that could be used on Mars. As more and more Mars missions provide *in situ* observations of dust devils, terrestrial analog field data will continue to provide valuable information into this meteorological process alongside related mission data from Mars. [e.g., 7, 8]

ATM Newsletters. For more information regarding new initiatives, policies, and recent archive submissions at ATM please contact PDS-ATM@nmsu.edu to be placed on our mailing list or visit our website: https://pds-atmospheres.nmsu.edu/ and select 'PDS Atmospheres Node Newsletters' near the top of the page.

References: [1]NASA ROSES 2022, https://nspires.nasaprs.com/external/solicitations/summary!init.do?solId=%7B341BDCCE-1F95-D00C-38B3-D9CB183FFEEB%7D&path=open; [2] PDE IRB Report, https://science.nasa.gov/science-pink/s3fs-public/atoms/files/PDE%20IRB%20Final%20Report.pdf; [3] PDS Atmospheres, Venus comparison chart, https://pds-atmospheres.nmsu.edu/data_and_services/atmospheres_data/VENUS/venus_matrix.html; [4] PDS Atmospheres Main Page, Laboratory and Field Data (bottom), https://pds-atmospheres.nmsu.edu; [5] D. Burr, et al. (2020), Wind Tunnel Threshold Speed, NASA Planetary Data System, https://doi.org/10.17189/1518959.; [6] Reiss et al. (Eds.) (2017), *Dust Devils*, Space Science Series of ISSI #59, Springer, Dordrecht, Netherlands (reprinted from *Space Science Reviews*, Vol. 203, Issues 1-4, 2016); [7] Jackson, B. & Lorenz, R. (2021) A multiyear dust devil vortex survey using an automated search of pressure time series data, NASA Planetary Data System.; [8] Jackson, B. (2022), Vortices and Dust Devils as Observed by the Mars Environmental Dynamics Analyzer Instruments on Board the Mars 2020 Perseverance Rover, *The Planetary Science Journal*, Vol. 3, No. 1, https://doi.org/10.3847/PSJ/ac4586.