ASTRONAUT PHOTOGRAPHY OF THE EARTH: A LONG-TERM DATASET FOR EARTH SYSTEM RESEARCH, APPLICATIONS, AND EDUCATION

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The NASA Earth observations dataset obtained by humans in orbit using handheld film and digital cameras is freely accessible to the global community through the online searchable database at https://eol.jsc.nasa.gov, and offers a useful compliment to traditional ground-commanded sensor data. The dataset includes imagery from the NASA Mercury (1961) through present-day International Space Station (ISS) programs, and currently totals over 2.6 million individual frames. Geographic coverage of the dataset includes land and oceans areas between approximately 52 degrees North and South latitudes, but is spatially and temporally discontinuous.

The photographic dataset includes some significant impediments for immediate research, applied, and educational use: commercial RGB films and camera systems with overlapping bandpasses; use of different focal length lenses, unconstrained look angles, and variable spacecraft altitudes; and no native geolocation information. Such factors led to this dataset being underutilized by the community but recent advances in automated and semi-automated image geolocation, image feature classification, and web-based services are adding new value to the astronaut-acquired imagery.

A coupled ground software and on-orbit hardware system for the ISS is in development for planned deployment in mid-2017; this system will capture camera pose information for each astronaut photograph to allow automated, full georegistration of the data. The ground system component of the system is currently in use to fully georeference imagery collected in response to International Disaster Charter activations, and the autoregistration procedures are being applied to the extensive historical database of imagery to add value for research and educational purposes. In parallel, machine learning techniques are being applied to automate feature identification and classification throughout the dataset, in order to build descriptive metadata that will improve search capabilities. It is expected that these value additions will increase interest and use of the dataset by the global community.

Photography, International Space Station,Time Series, Georeferencing, Classification