FAIR Digital Objects for 5D imagery of our and other planet(s)

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Introduction

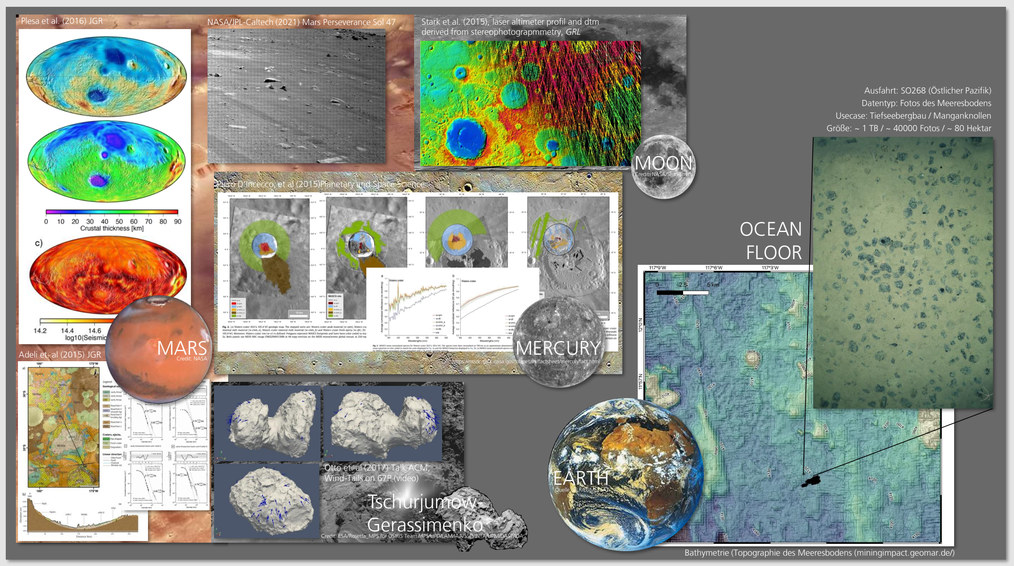
Imaging the environment is an essential method in *spatial* science when studying the Earth or any other planet. In both domains, this is applied at various scales – from microscopy through ambient imaging to remote sensing – and provides rich information for science.

Due to recent advances in imaging capabilities and the increasing number of platforms that acquire imagery and related research data, data volume is further increasing at an exponential rate. While many data sets have been acquired and analyzed, a systematic standardized and comparable metadata description for describing research data in both domains is still lacking. It is thus crucial to achieve more effectiveness and efficiency in managing, publishing and interpreting imaging research data.

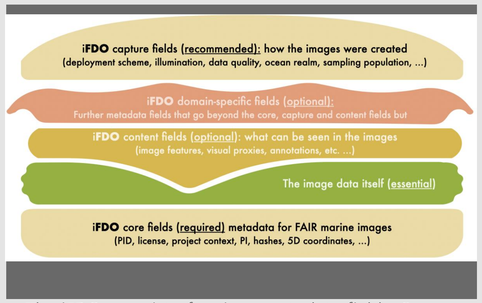
In order to achieve FAIRness and Openness for research data, structured, standardized and interoperable metadata for imaging data itself and visual and semantic research data content is needed.

This metadata shall be provided in the form of FAIR digital objects (FDOs). An iFDO is a human and machine-readable file format for an entire image set, except that it does not contain the actual image data, only references to it through persistent identifiers! (FAIR marine images, https://marine-imaging.com/fair/ifdos/iFDO-overview/).

Through this our motivation is to use planetary and oceanic sample data sets, both remote sensing and rover data, to develop methods for describing research data by metadata using FDOs for both planetary and oceanic domain.



Overview of the great value, variety and comparability of planetary and oceanic imaging research data.



The iFDOs consist of various metadata fields. Some are required, some are recommended, some are optional. https://marine-imaging.com/fair/ifdos/iFDO-overview/

Goal

FDOs for spatial sciences are characterized at their core by 5D navigation data (i.e. x, y, z, time, spatial reference) which discriminates them from imagery of other domains (e.g., medical). Apart from metadata for imaging data (iFDOs), further FDOs are required to describe and quantify the semantic content of imaging research data. Such semantic FDOs (sFDOs) are similarly domain-specific but again synergies are expected between Earth and planetary research. By developing ontologies for these two imaging domains, scientific analogies and causal connections between the two research domains can be revealed.

Therefore our goals are

(1) to develop imaging FDOs and enriching exemplary datasets of oceanic and Martian origin;

(2) to implement a tool for FDO creation, e.g., in GIS; and

(3) to outline an automatic metadata generation during acquisition of future datasets – for marine robots on Earth and a rover on Mars.

Integration of FDO-5DI

For Oceanic Research Data:
MareHub / DataHub
(https://gitlab.hzdr.de/datahub/marehub/ag-videosimages)
and
MOSES (implementation of FDOs on autonomous robots)

For Planetary Research Data:
VESPA - Virtual European Solar Planetary Access (http://www.europlanet-vespa.eu/)
and
ESA's ExoMars (FDOs in processing pipeline for rover mission)

Benefit

(1) improve the quality and reusability of future research data

(2) support a sustainable research data environment by closing the life cycle of the research data

(3) increase the inter- and transdisciplinary comparability of data sets

(4) vocabularies and ontologies can be transferred to other natural science applications

Linkage in- and outside HMC

We aim for a solution for the fields of earth & environment and space but would like to exchange results and ideas with other imaging and scientific domains.

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