M³G
Metadata Management and Distribution System for Multiple GNSS Networks

Belgian National Committee for Geodesy and Geophysics

Belgian metadata catalogue for permanently tracking GNSS stations in Europe

Introduction

The Metadata Management and Distribution System for Multiple GNSS Networks (M³G, https://gnss-metadata.eu), hosted by the Royal Observatory of Belgium (ROB), is one of the services of the European Plate Observing System (EPOS, https://www.epos-eu.org) and EUREF Permanent GNSS Network (EPN, https://epncb.oma.be).

The system has been developed by ROB to gather and distribute information about permanently tracking GNSS stations and apply the most recent standards. In the past years, M³G has been adapted to comply with EU GDPR regulations, respond to the need for FAIR data, and lay the basis for applying Linked Data Principles.
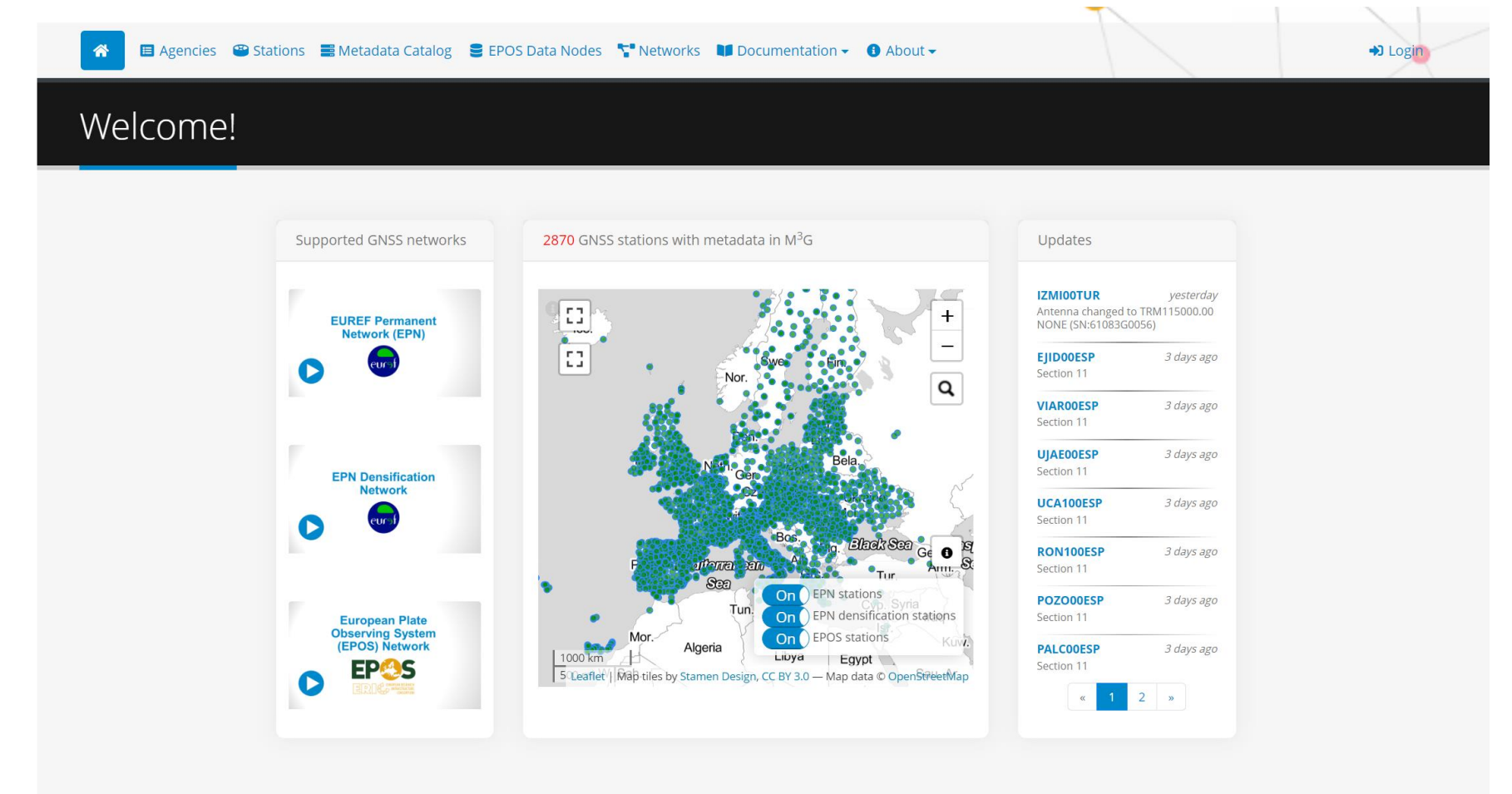

M³G Web portal welcome page (https://gnss-metadata.eu)

The provided GNSS station information services

M³G provides the scientific as well as the non-scientific community with a state-of-the-art archive of information on permanently tracking GNSS stations. In M³G the GNSS station metadata include the station description, station location, the GNSS networks the stations contribute to, network information with DOI (Digital Object Identifier), station pictures, and GNSS data license. All this information is openly available and M³G provides a wide range of services to download it:

- Metadata Catalogue (https://gnss-metadata.eu/site/metadata)
- FTP (ftp:\\gnss-metadata.eu)
- Representational state transfer API (REST API, https://gnss-metadata.eu/site/api-docs)

The use of the system has increased significantly since the first version, released in 2018. Currently more than 130 agencies all over Europe use M³G to maintain their GNSS station description. The system includes presently the metadata of 2870 GNSS stations.
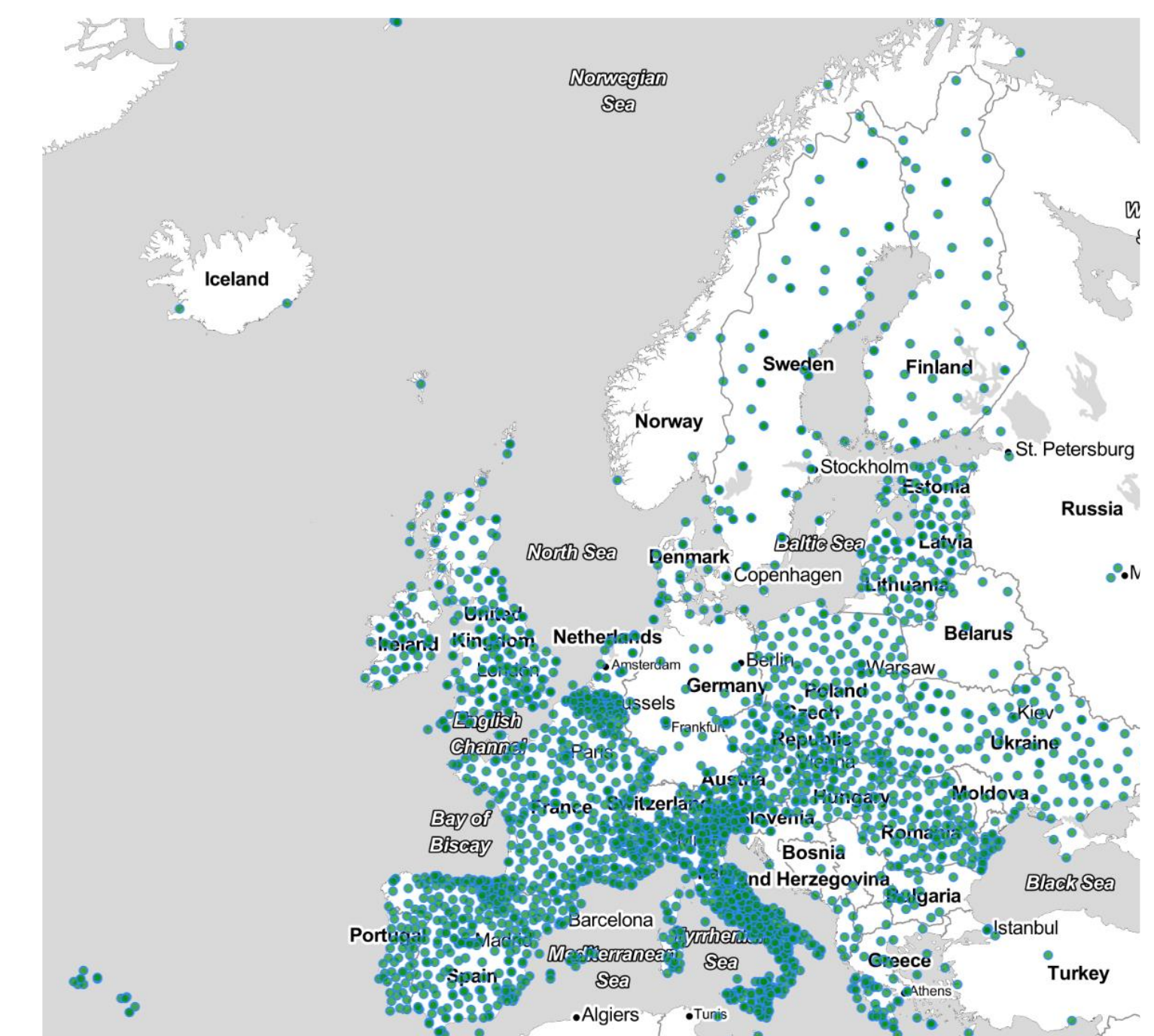

GNSS stations registered in M³G

Provided GNSS station metadata

The metadata publishers (agencies with an M³G login) have the rights to upload/edit GNSS station metadata. M³G validates the provided information using three levels of validation rules, which combine general rules (minimal requirements), network-dependent rules (different rules for international GNSS networks), and station-dependent rules (exceptions to the previous rules). Once M³G has validated the information, the metadata publisher will be able to submit it so that it is included in the M³G database. The database was designed to easily map the database to metadata object such as station information, instruments, station location and use a serializer to transform the GNSS station metadata objects into the latest GNSS station metadata standards such as IGS site log, GeodesyML.

M³G has been used operationally in both the EPN and EPOS. For stations belonging to the EPN or EPN densification network, the system automatically sends the updated site log/GeodesyML to the EPN Central Bureau (EPN CB). For stations belonging to the EPOS network, M³G sends the GeodesyML file to the EPOS-GNSS Data Gateway (EPOS DGW). M³G provides a Representational state transfer API (REST API) (https://gnss-metadata.eu/site/api-docs) service to share GNSS metadata which are not included in the metadata standards such as station pictures, network information, data license and data embargo periods.
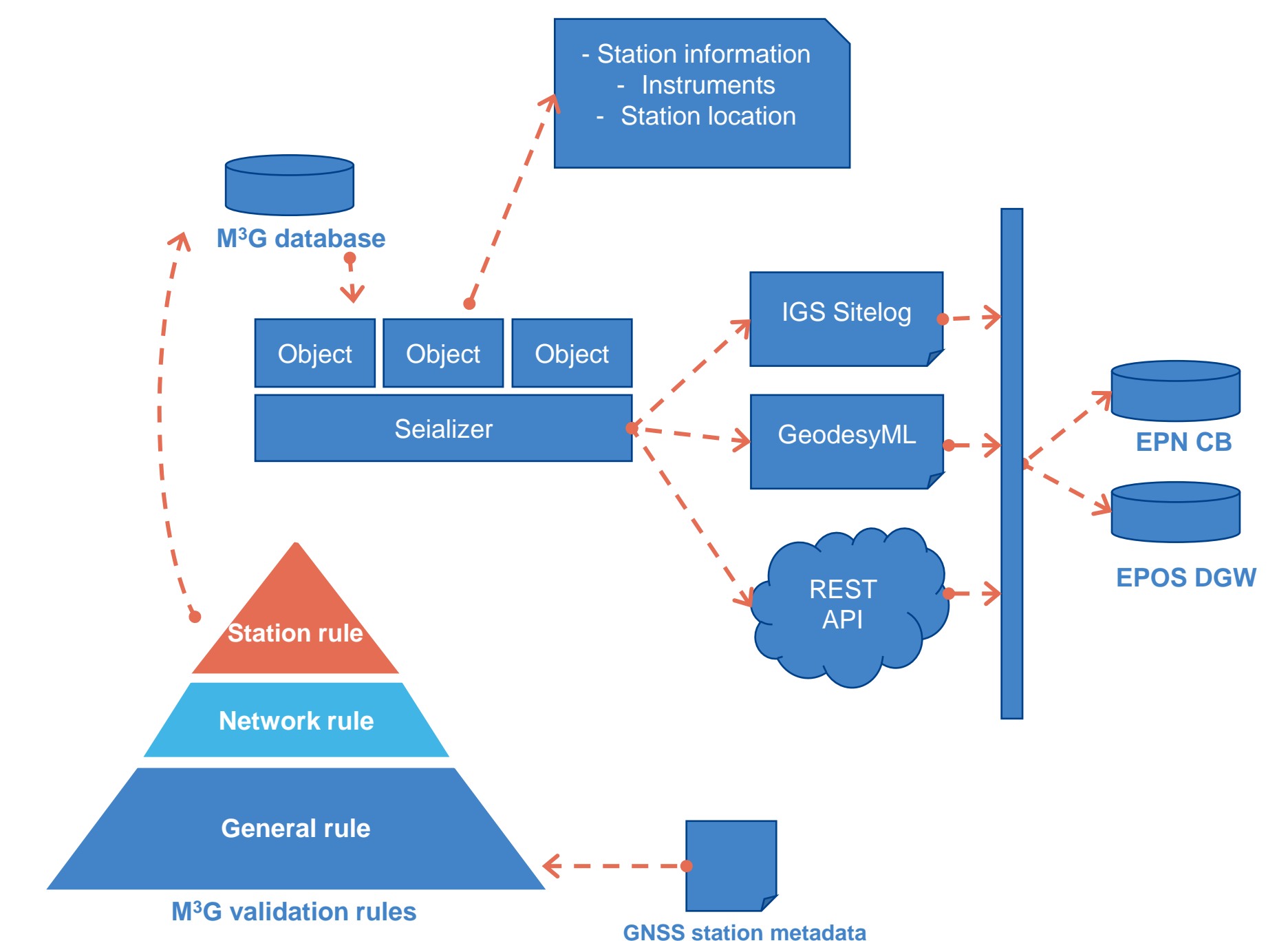
The working logic of M³G

REST API service in M³G

ROB published a REST API to POST, PUT and GET GNSS metadata and documented it on https://m3g-rob.github.io/doc4m3g/.

The new service enables the users to:

- request network, data license and other metadata information, e.g. list all of the stations from Belgian GNSS network WALCORS:

```
> curl -X GET "https://gnss-metadata.eu/v1/network/view?id=WALCORS" -H  "accept: application/json"
```

- find and filter GNSS metadata. The filters are flexible, customizable and allow operators (=,<,!=,>), e.g. list the stations of the Belgian GNSS network FLEPOS network whose metadata has been updated within a month:

```
>curl -X GET "https://gnss-metadata.eu/v1/sitelog?page=1&network=FLEPOS&filter[dateUpdate][gt]=2022-10-04T00:00Z" -H  "accept: application/json"
```

- pass information to M³G using command-line instructions. For that purpose, metadata publishers have a specific token permitting them to make changes to their metadata in M³G, e.g. upload a site log from local disk for a specific station:

```
> curl -X PUT "https://gnss-metadata.eu/v1/sitelog/upload-sitelog?id=AILT00FRA" -H  "accept: application/json" -H  "Authorization: Bearer <agency token>"  -H "Content-Type: text/plain; charset=utf-8" --data-binary "@ailt_20210415.log"
```

References

1. Bruyninx, C., Fabian, A., Miglio A., Legrand, J., "How to Integrate a GNSS Station in EPOS", EPOS-GNSS Webinar, 18-19 January 2021 DOI:10.24414/ROB-EPOS-GNSS.PR.01.2021
2. Bruyninx, C., Legrand, J., Fabian, A. and Pottiaux, E. "GNSS metadata and data validation in the EUREF Permanent Network", GPS Solutions. 23 (2019) DOI:10.1007/s10291-019-0880-9
3. Wilkinson, MD, Dumontier, M, Aalbersberg, IjJ, et al. 2016. The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data, 3: 160018. DOI: https://doi.org/10.1038/sdata.2016.18

"Belgian contributions to Earth Sciences in a Changing World" study day

Royal Observatory of Belgium
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