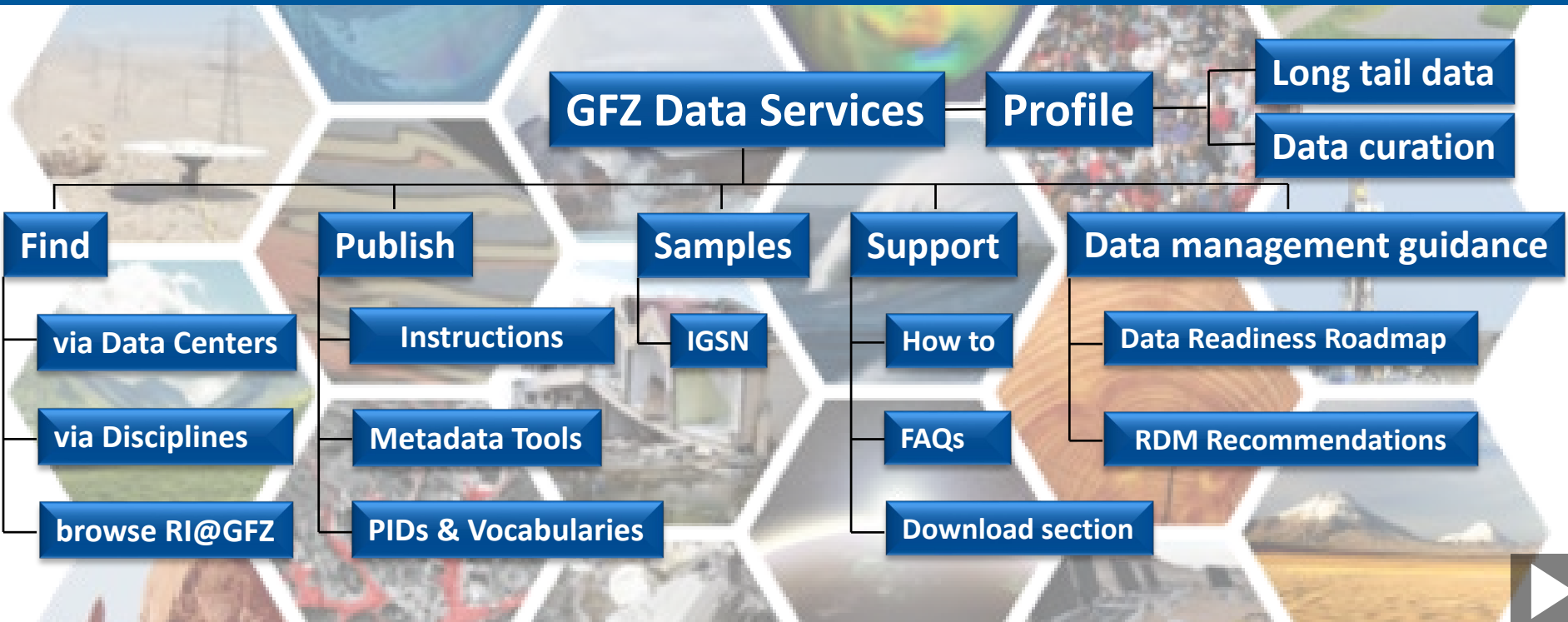


Curating geosciences data in the Earth, Space and Environmental Sciences – new developments of GFZ Data Services

Florian Ott^{id}, Kirsten Elger^{id}, Damian Ulbricht^{id}
GFZ German Research Centre for Geosciences, Potsdam, Germany

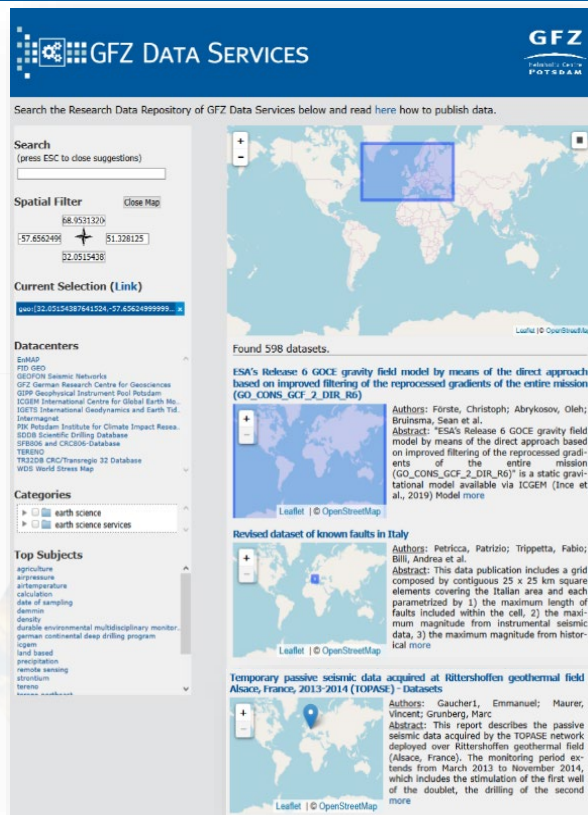


Profile

Profile

- Domain repository for the Geosciences
- DOIs for Data and Software
- Data: real-time data streams (observational data), tables, maps, model data, ...
- Data reports optional (internal review)

Layout
New Website



<https://dataservices.gfz-potsdam.de>

Technical „Highlights“

- International metadata standards (human & machine readable)
- Vocabularies for „rich“ metadata
- PIDs (DOI, ORCiD, Fundref, IGSN)
- Open Licences for data and software
- OAI-PMH interface
- schema.org → Google Dataset Search

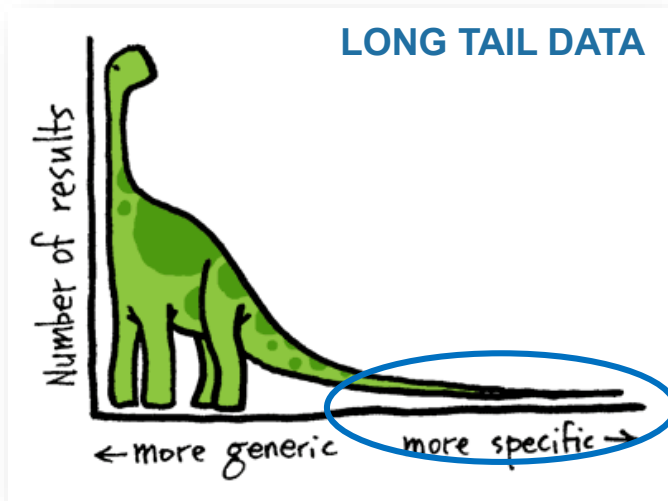
More on data
repositories





Profile

DOMAIN REPOSITORY FOR GEOSCIENCES DATA



GLOBAL NETWORKS, SERVICES, PROJECTS



GFZ Data Services is a **domain repository for geosciences data** since 2004. It has a focus on the **curation of long-tail data** on one hand, but also **provides DOI minting services** for several global monitoring networks/observatories in geodesy and geophysics and collaborative projects.



Profile



GFZ DATA SERVICES
GEOSCIENCES DATA PUBLISHER

Supplementary material for analogue experiments on the interactions of two indenters, and their implications for curved fold-and-thrust belts

Cite as:
Reiter, Karsten; Kukowski, Nina; Ratschbacher, Lothar; Rosenau, Matthias (2016): Supplementary material for analogue experiments on the interactions of two indenters, and their implications for curved fold-and-thrust belts. GFZ Data Services. <http://doi.org/10.5880/GFZ.4.1.2016.007>

Data Files

is191115 view online / download xml
datacite: view inline / download xml
dif: view inline / download xml
escidoc: view inline / download xml

Abstract
This data publication includes animations and figures of eight scaled analogue models that are used to investigate the evolution of a curved mountain belt akin to the Pamir and Hindu Kush orogenic system and adjacent Tadjik basin. Crustal deformation is simulated by means of indentation of two basement blocks into a sedimentary sequence and the formation of a curved fold-and-thrust belt. The experimental set-up has two adjacent rigid indenters representing the basement blocks moving in parallel with a velocity difference (Figure 1). The slow indenter moves with a relative velocity ranging from 0 to 80% of that of the fast one. A layer of quartz sand in front of the indenters, 1 by 1 meter in size and 1.5 cm thick, represents the sedimentary basin infill. A basal detachment layer is made up of low-friction glass beads or viscous silicone oil representing weak shale or evaporates layers, respectively. The surface evolution by means of topography and strain distribution is derived from 3-D particle image velocimetry (PIV). This allows visualizing and analysing the development of the model surface during the complete model run at high spatial-temporal resolution. All details about the model set-up, modelling results and interpretation can be found in Reiter et al. (2011).

Contributors
GFZ German Research Centre for Geosciences

Keywords
Key words: tectonics, analogue experiments, fold-and-thrust belts, Tajik basin, Pamir, 4D analogue experiments, PIV, European Plate Observing Systems, mountain building, continental collision, sandbox model, digital elevation model, analogue model, tectonic setting, collisional setting, foreland setting, crust setting, upper continental crust setting, tectonic process, detachment fault, oblique slip fault, reverse fault, thrust fault, tectonic and structural features, mountain, Microsphere, Glassy, Silicon, Sand, Quartz, Sandbox, Sandbox (cm scale), Time lapse camera, Sectioning, tectonics, fault, geological process, digital land model

GFZ Data Services Keywords
EARTH SCIENCE > SOLID EARTH > TECTONICS > PLATE TECTONICS > CRUSTAL MOTION > CRUSTAL MOTION DIRECTION
EARTH SCIENCE > SOLID EARTH > TECTONICS > PLATE TECTONICS > CRUSTAL MOTION > CRUSTAL MOTION DIRECTION
EARTH SCIENCE > SOLID EARTH > GEOMORPHIC LANDFORMS/PROCESSES > TECTONIC LANDFORMS > MOUNTAINS
EARTH SCIENCE > SOLID EARTH > GEOMORPHIC LANDFORMS/PROCESSES > TECTONIC LANDFORMS > FOLDS
EARTH SCIENCE > SOLID EARTH > GEOMORPHIC LANDFORMS/PROCESSES > TECTONIC PROCESSES
EARTH SCIENCE > LAND SURFACE > TOPOGRAPHY
EARTH SCIENCE SERVICES > MODELS > DIGITAL ELEVATION/DIGITAL TERRAIN MODELS

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Location
Click here to see location in bounding boxes to see related details. Click here to see details to see related material in bounding box.

Dataset

Supplementary material for analogue experiments on the interactions of two indenters, and their implications for curved fold-and-thrust belts

Cite as:
Reiter, Karsten; Kukowski, Nina; Ratschbacher, Lothar; Rosenau, Matthias (2016): Supplementary material for analogue experiments on the interactions of two indenters, and their implications for curved fold-and-thrust belts. GFZ Data Services. <http://doi.org/10.5880/GFZ.4.1.2016.007>

Data Files

Explanations_Reiter-et-al-2016.pdf 527520 Bytes
list-of-files-Reiter-et-al-2016.pdf 238166 Bytes
Experimenting.avi 8247450 Bytes
g070-pictures.pdf 509070 Bytes
g040-3Dview-30-34.avi 6096554 Bytes
g050-3Dview-30-35.avi 5947146 Bytes
g055-3Dview-30-32.avi 6397110 Bytes
g060-3Dview-30-29.avi 6697512 Bytes
g070-3Dview-30-30.avi 6247434 Bytes
g080-3Dview-30-31.avi 6187996 Bytes
g00-3Dview-30-38.avi 5941054 Bytes

Abstract
This data publication includes animations and figures of eight scaled analogue models that are used to investigate the evolution of a curved mountain belt akin to the Pamir and Hindu Kush orogenic system and adjacent Tadjik basin. Crustal deformation is simulated by means of indentation of two basement blocks into a sedimentary sequence and the formation of a curved fold-and-thrust belt. The experimental set-up has two adjacent rigid indenters representing the basement blocks moving in parallel with a velocity difference (Figure 1). The slow indenter moves with a relative velocity ranging from 0 to 80% of that of the fast one. A layer of quartz sand in front of the indenters, 1 by 1 meter in size and 1.5 cm thick, represents the sedimentary basin infill. A basal detachment layer is made up of low-friction glass beads or viscous silicone oil representing weak shale or evaporates layers, respectively. The surface evolution by means of topography and strain distribution is derived from 3-D particle image velocimetry (PIV). This allows visualizing and analysing the development of the model surface during the complete model run at high spatial-temporal resolution. All details about the model set-up, modelling results and interpretation can be found in Reiter et al. (2011).

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EARTH SCIENCE > SOLID EARTH > GEOMORPHIC LANDFORMS/PROCESSES > TECTONIC PROCESSES
EARTH SCIENCE > LAND SURFACE > TOPOGRAPHY
EARTH SCIENCE SERVICES > MODELS > DIGITAL ELEVATION/DIGITAL TERRAIN MODELS

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escidoc: view inline / download xml

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<http://bib.tegrafenberg.de/finden/datenbanken/for-schungsdaten/>

Data Description

Reiter, K., Kukowski, N., & Ratschbacher, L. (2011). The interaction of two indenters in analogue experiments and implications for curved fold-and-thrust belts. *Earth and Planetary Science Letters*, 302(1-2), 132-146. doi:10.1016/j.epsl.2010.10.022

Related Work
References
Adam, J., Ursi, J. L., Wernicke, B., Oncken, O., Pfaffner, K., Kukowski, N., & Schatz, J. (2005). Shear localisation and strain distribution during tectonic faulting—new insights from granular-flow experiments and high-resolution optical image correlation techniques. *Journal of Structural Geology*, 27(2), 283-301. doi:10.1016/j.jsg.2004.08.008

Find More Research Data
<http://bib.tegrafenberg.de/finden/datenbanken/for-schungsdaten/>

DOI Landing Pages – data access:

- **Citation and Licence** information
- **Controlled Vocabularies:**
NASA GCMD Science Keywords,
GeoSciML
- **Related References** to papers, reports, data, software, IGSNs (via PIDs)
- **Map**
- **XML metadata for download:**
ISO19115, DataCite, Dublin Core
- **schema.org (JSON LD)**

<http://doi.org/10.5880/GFZ.4.1.2016.007>



Pathways for Open Science

Recent agreements between publishers, repositories, funders (2015-today)



- **Data availability statement** required for articles
- **Citation of data in reference lists** allowed by journals
- Recommendation to use **domain repositories**
- **No data supplements** anymore (→ data publication via repositories)

ENABLING FAIR DATA COMMITMENT
STATEMENT IN THE EARTH, SPACE,
AND ENVIRONMENTAL SCIENCES

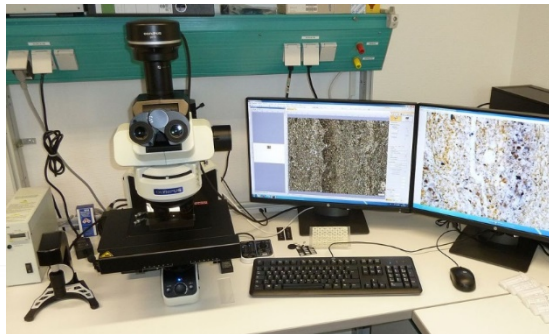
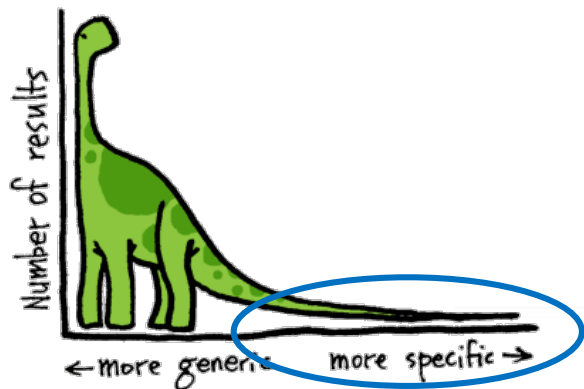
2018



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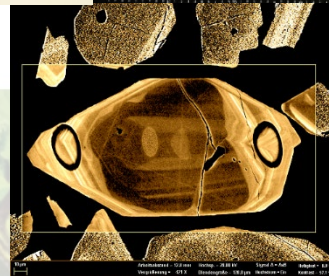
GFZ
Helmholtz Centre
POTSDAM

The long tail of research data



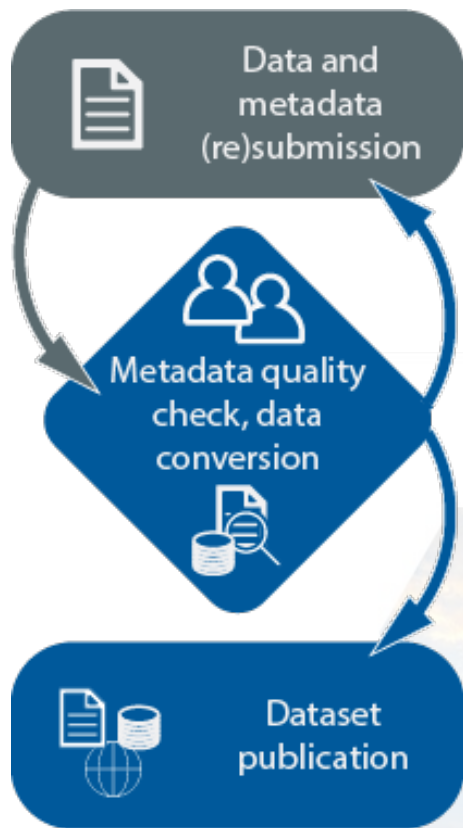
'Long tail of research data' refers to research data that are usually **small in size**, available in **various data formats** and **difficult to standardize** in terms of archiving and data management. However, not in total size but in quantity, long tail data represent a significant portion of research data.

translated from: https://www.forschungsdaten.org/index.php/Long_tail_of_research_data





Data curation workflow



1. Author: Metadata submission through the GFZ Metadata Editor. Data submission via Email or ftp upload link (provided by GFZ Data Services)
2. Curator (domain scientist and data specialist): Metadata and data description: quality control for completeness and consistency
3. Curator: Conversion (if required) and placement of data on GFZ Data Services ftp server
4. Curator: Review link issue for proofreading by author or for reviews of articles
5. Author: Proofreading
6. Curator: Publication of dataset





Via Data Centers

- Development of several **DOI minting services** for larger projects and international services and networks
- Our Data Centers organise data publications according to their projects, networks or services affinity and **may have project-specific landing page designs**
- Among others, GFZ Data Services caters to several international groups, including for **IAG Services (IGETS, ICGEM, ISG)** and **INTERMAGNET**



Geomagnetism



Via Disciplines

USE OF CONTROLLED VOCABULARIES

SEARCH FACETTES



INSPIRE
Infrastructure for Spatial Information in
Europe

ISO 19115/19139
Keywords



**GeoSciML: Geoscience Vocabularies
for Linked Data**

Linked open data vocabularies used in the
geosciences enrich our metadata and are used to create search facets





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Search portal for data and Research Infrastructure at GFZ

RI@GFZ

GFZ Data and Research Infrastructure Search

About/Contact | Impressum

Research Centre Potsdam
GFZ GERMAN RESEARCH CENTRE
FOR GEOSCIENCES

Data Systems (selection)

- Climate Science
- Data Services
- Geochemistry
- Geodesy
- Geology
- Geomagnetism
- Geophysics
- Gravimetry
- Hydrology
- IAIG Services
- Modeling
- Natural Hazards
- Paleogeosciences
- Remote Sensing
- Seismology

Instrument Systems

- Laboratories
- Underground Laboratories
- Observatories and Networks
- Mobile Instruments
- Satellite Systems

Found 29 search results.

GFZ Seismological Data Archive (GEOFON DC)

· Data · Services ·

GEOFON operates the GFZ Seismological Data Archive, which facilitates access to data from the GEOFON stations, from passive experiments of the Geophysical Instrument Pool Potsdam (GIPP) and those from plate boundary observatories (IPOC, GONAF, DESERVE, GCO), as well as from many partner more

GEOFON Global Earthquake Monitoring System (GEOFON EQinfo)

· Data · Services ·

All real-time data streams from GEOFON stations as well as >700 additional real-time station terminate rapid automatic earthquakes and most earthquake information



GFZ Seismological Data Archive (GEOFON DC)

Description
GEOFON operates the GFZ Seismological Data Archive, which facilitates access to data from the GEOFON stations, from passive experiments of the Geophysical Instrument Pool Potsdam (GIPP) and those from plate boundary observatories (IPOC, GONAF, DESERVE, GCO), as well as from many partner networks/institutions providing a permanent and secure archive. All waveform data and metadata are provided in standard seismological data formats using standard services alongside with additional meta information about the data, currently more than 100 seismic networks are distributed to thousands of users through the GFZ access point as well as from federated archives at European and Global level. GEOFON also takes care in data management policies fostering the adoption of the FAIR data management principles and the Guidelines for Research Data at GFZ.

Type of Data
permanent seismic networks, temporary seismic networks

Services
Data and metadata provision, quality control of seismological data in the archive, long-term archival of (meta)data

Contact
Angelo Strollo

Sections
Seismology (2.4), Geophysical Deep Sounding (2.2)

Links
• GFZ Homepage: GFZ Seismological Data Archive (GEOFON DC)
• Project Homepage: GEOFON DC Website
• Higher category: GEOFON Program
• Related infrastructure: GIPP
• Data access: via GFZ Data Services (seismic networks with DOI), via GEOFON Data Centre

Structured description with
links to data

RI@GFZ is the one-stop shop for data and research infrastructures at GFZ. It allows searching for disciplines, product categories (data, services, software, infrastructure, people, sections) and provides structured basic information with links to homepages and data.





Publication instructions

- Entry point to the data (or scientific software) publication process is the GFZ Data Services metadata editor.
- Guidance on preparing and describing data; description the data/software publication workflow
- Special services:
- **Timing of data publication:** For most supplementary data to research articles, the publication of the data will be timely correlated with the publication of the article.
- **Review Links:** Review links show a preview of the future DOI Landing Page with the correct citation (the DOI is already reserved and will not change); for **restricted data access during the review period of articles**

[Quick Start Guide for Data Publications at with GFZ Data Services](#)[Metadata Editor](#)[Data Submission Workflow](#)[Data Files Instructions](#)[Show me more](#)



Metadata Tools

DataCite Metadata ISO19115 Metadata Files Related Publications

Resource Information

DOI (will be generated in the publishing process) Publisher Year
10.5880/GFZ.1.4.2016.001 GFZ Data Services 2016

Resource Type Title Language of dataset
Dataset Supplement to: The New World Atlas of Artificial Night Sky Brightness eng

Licenses and Rights

Licence
Please contact the authors for a licence agreement

Authors (Persons and/or Institutions)

Author (Lastname, Firstname)	Role	Author ID Type	Author Identifier (ID)	Affiliation
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Elvidge, Christopher D.				Earth Observation Group, NOAA Natio...
Baugh, Kimberly				Cooperative Institute for Research in th...
Portnov, Boris				Department of Natural Resources & En...
Rybníková, Nataliya A.				Department of Natural Resources & En...
Furgoni, Riccardo				ISTIL - Istituto di Scienza e Tecnologia ...

Contact Person(s) / Point of Contact

right
radiative transfer
Suomi NPP
Sky Quality Meter

Temporal and Spatial Coverage (The ED/T-symbol to the left provides vi

Latitude		Longitude	
Min	Max	Min	Max
44.045486...	55.842428...	2.8710901...	43.124996...

Select Region (click left mouse and drag)

Paleosol-derived data used for the reconstruction of environmental conditions during the Holocene in the upper part of the Kali Gandaki valley, Central Nepal
(<http://doi.org/10.5880/GFZ.4.6.2019.001>)

Johanna Menges¹, Niels Hovius¹, Christoff Andermann¹, Michael Dietze¹, Charlie Swoboda¹, Kristen Cook², Basanta Adhikari², Andrea Vieth-Hillebrand¹, Stephane Bonnet³, Tony Reimann⁴, Andreas Koutsodendris⁵, Dirk Sachse¹

1. GFZ German Research Centre For Geosciences, Telegrafenberg, 14473 Potsdam, Germany
2. Department of Civil Engineering, Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal
3. GET CNRS Univ Toulouse, UMR 5563, Toulouse, France
4. Soil Geography and Landscape group & Netherlands Centre for Luminescence dating, Wageningen University, The Netherlands
5. Heidelberg University Institute of Earth Sciences, Heidelberg, Germany

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2. Citation

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When using the data please cite:

Menges, J.; Hovius, N.; Andermann, C.; Dietze, M.; Swoboda, C.; Cook, K.; Adhikari, B.; Vieth-Hillebrand, A.; Bonnet, S.; Reimann, T.; K., Andreas; Sachse, D. (2019): Paleosol-derived data used for the reconstruction of Holocene environmental conditions during in the upper Kali Gandaki valley, Central Nepal. GFZ Data Services. <http://doi.org/10.5880/GFZ.4.6.2019.001>

The data are supplementary to:

Menges, J., Hovius, N., Andermann, C., Dietze, M., Swoboda, C., Cook, K. L., ... Sachse, D. (2019). Late

The generation of our rich metadata is supported by an online Metadata Editor and additional data description templates.

Online Metadata Editor

Data description template





Metadata Editor

GFZ Metadata Editor (Java Script „translator“)

„Special“ Features:

- Interactive map
- ORCID and Fundref
- Controlled vocabularies
- Multiple affiliations for authors

The screenshot displays the GFZ Metadata Editor interface with the following sections:

- Resource Information:** Fields for DOI (10.5880/GFZ.1.4.2016.001), Publisher (GFZ Data Services), Year (2016), Resource Type (Dataset), Title (Supplement to: The New World Atlas of Artificial Night Sky Brightness), and Language of dataset (eng).
- Licenses and Rights:** A field for Licence with a note: "Please contact the authors for a licence agreement".
- Authors (Persons and/or Institutions):** A table with columns: Author (Lastname, Firstname), Role, Author ID Type, Author Identifier (ID), and Affiliation. Authors listed include Cinzano, Pierantonio; Duriscoe, Dan; Kyba, Christopher C. M.; Elvidge, Christopher D.; Baugh, Kimberly; Portnov, Boris; Rybnikova, Nataliya A.; and Furgoni, Riccardo.
- Contact Person(s) / Point of Contact:** Fields for name, email, and phone number.
- Temporal and Spatial Coverage:** A table for coordinates (Latitude/Longitude) with Min and Max values.
- Interactive Map:** A map of Europe with a red bounding box over Germany and Poland, labeled "Select Region (click left mouse and drag)".

Output:

Standardised XML

files (Datacite, ISO 19115, Dublin Core)

via **standardised API**



GFZ Data Services
Metadata Catalogue
and **Landing pages**

EPOS, B2FIND,
ENVRiplus,
etc.

Metadata Editor

Online Metadata Editor

Metadata Dataset Publication About/Help

DataCite Metadata

Resource Information

DOI (will be generated in the publishing process) Year
10.5880/GFZ.4.1.2019.005 2019

Resource Type Title Version Language of dataset
Dataset Supplement to "Synchronization of great subduction megathrust earthquakes: Insights from scale model analysis" eng

Licenses and Rights

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CC BY 4.0

Authors (Persons and/or Institutions)

Lastname	Firstname	Role	Author ID Type	Author Identifier (ID)	Affiliation
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Oncken	Onno		ORCID	0000-0002-2894-480X	GFZ German Research Centre for Geosciences

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Author (Lastname, Firstname)	Position	Email	Website	Affiliation
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Contributors (Persons and/or Institutions)

Lastname	Firstname	Role	Contributor ID ...	Contributor Identifier (ID)	Affiliation
HelTec - Helmholtz Laboratory for Tectonics		Hosting Institution			GFZ German Research Centre for Geosciences

XML

Landing page

GFZ Data Services

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Cite as:
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Files

Explanation_Reiter-et-al-2016.pdf 0.5 Mb
 List of files_Reiter-et al 2016.pdf 232.6 Mb
 Experimenting.avi 78.9 Mb
 g70 pictures.pdf 497.1 Kb
 g240-320-ev-30-34.avi 2.9 Mb
 g250-320-ev-30-33.avi 5.1 Mb
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 g270-320-ev-30-30.avi 6.5 Mb
 g280-320-ev-30-31.avi 5.9 Mb
 g460-320-ev-30-38.avi 5.7 Mb

Abstract

This data publication includes animations and Figures of eight scaled analogue models that are used to investigate the evolution of a curved mountain belt along the inner and Hindu Kush orogenic system and adjacent Tethys basin. Crustal deformation is simulated by means of indentation of two submergent blocks into a sedimentary sequence and the formation of a curved fold-and-thrust belt. The experimental setup has two adjacent rigid indenters representing the basement blocks moving in parallel with a velocity difference (Figure 1). The slow indenter moves with a relative velocity ranging from 40 to 80% of that of the fast one. A layer of quartz sand in front of the indenters, 2 by 1 meter in size and 1.5 cm thick, represents the sedimentary basin infill. A basal detachment layer is made up of low-friction glass beads or viscous silicone oil representing weak shale or evaporite layers, respectively. The surface evolution by means of topography and strain distribution is derived from 3-D particle image velocimetry (PIV). This allows visualizing and analysing the development of the model surface during the complete model run at high spatial-temporal resolution. All details about the model setup, modeling results and interpretation can be found in Reiter et al. (2011).

Dataset Description

Supplement to:
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Related Work

References
 Adam, J., Urai, J. L., Wernicke, B., Ordian, O., Pfeffer, K., Kukowski, N., Schmalz, J. (2007). Shear localization and strain distribution during tectonic belt-forming: new insights from granular-flow experiments and high-resolution optical image correlation techniques. Journal of Structural Geology, 27(2), 283-301. doi:10.1016/j.jsg.2004.08.009

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<http://bit.ly/efenruew> <http://doi.org/10.5880/GFZ.4.1.2016.007>

Keywords

two indenter tectonics, particle image velocimetry, fold-and-thrust belts, fold basin, Penit, 4D analogue experiments, mountain building, continental collision, sandbox model, digital elevation model, analogue model, EPSC, multi-scale laboratories, analogue models of geologic processes, analogue modeling results, Microsphere > Glassy, Particle Image Velocimetry (PIV), Sand > Quartz Sand, Sandbox > Sandbox (on scale), Sectioning, Tectonics, Tectonic Processes, Tectonic Settings > Upper continental crust setting, detachment fault, mountain, oblique dip fault, reverse fault, tectonic and structure features, tectonic process in continental collision, tectonically defined setting > collisional setting, tectonically defined setting > foreland setting, thrust fault, wrench fault

GFZ Data Services

Location

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Metadata editor

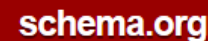
Machine readable metadata standards



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iso19115: close inline view / download xml
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  ■ fileIdentifier
    ■ CharacterString: doi:10.5880/igets.po.11.001
  ■ language
    ■ LanguageCode (codeList=http://www.loc.gov/standards/iso639-2/ codeListValue=eng): eng
  ■ characterSet
    ■ MD_CharacterSetCode (codeList=http://www.isotc211.org/2005/resources/codeList.xml#MD_CharacterSetCode codeListValue=utf8):
  ■ hierarchyLevel
    ■ MD_ScopeCode (codeList=http://www.isotc211.org/2005/resources/CodeList/gmx-CodeLists.xml#MD_ScopeCode codeListValue=):
  ■ hierarchyLevelName
    ■ CharacterString:
  ■ contact
    ■ CI_ResponsibleParty
      ■ organisationName
        ■ CharacterString: GFZ German Research Center for Geosciences
      ■ contactInfo
        ■ CI_Contact
          ■ address
            ■ CI_Address
              ■ electronicMailAddress
                ■ CharacterString:
          ■ onlineResource
            ■ CI_OnlineResource
              ■ linkage
                ■ URL: http://www.gfz-potsdam.de/
              ■ function
                ■ CI_OnlineFunctionCode (codeList=http://www.isotc211.org/2005/resources/CodeList/gmxCodeLists.xml#CI_OnlineFunctionCode codeListValue=):
          ■ role
            ■ CI_RoleCode (codeList=http://www.isotc211.org/2005/resources/CodeList/gmxCodeLists.xml#CI_RoleCode codeListValue=pointOfContact): pointOfContact
        ■ dateStamp
          ■ Date: 2017-01-06
        ■ referenceSystemInfo
          ■ MD_ReferenceSystemSystem
            ■ referenceSystemIdentifier
              ■ RS_Identifier
                ■ code
                  ■ CharacterString: urn:ogc:def:crs:EPSG:4326
  ■ identificationInfo
```

- XML metadata in DataCite, ISO19115 standards
- Exchange via OAI-PMH interface

- Machine-readable websites
- JSON LD
- Google Dataset Search





PIDs & Vocabularies

Persistent Identifier used in metadata of data publications



for data, software,
cross-references to
related work



Crossref
Funder Registry

List of funders
with DOIs

ORCID

Connecting Research
and Researchers

uniquely identifying
persons

ROR

New PID for
Institutions



PID for physical samples,
cross references to
samples underlying
measurements



PIDs & Vocabularies

PIDs and the provenance of research outcomes



Data

Table S3. Sierra Nevada analyses of plant samples

sample ID	IGSN	brief sample description	Element concentrations (µg/g)				
			Al	Fe	Mn	Mg	Ca

Table SN1. Sierra Nevada analyses of soil, saprolite, rock, bedload sediment and

sample ID	IGSN	sample type	XRF lab	depth (cm)	Major element oxides (wt%) (calculated)			
					SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃

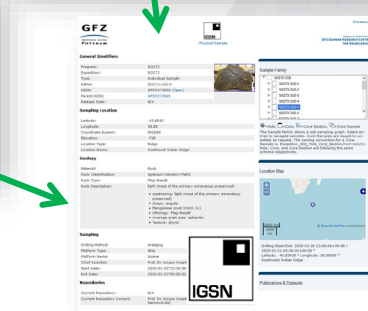
fresh MW1
MW2
MW3
mean (2SE)

Table SN1. Sierra Nevada analyses of soil, saprolite, rock, bedload sediment and

sample ID	IGSN	sample type	XRF lab	depth (cm)	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃
P301 regolith depth profile								
SN01	GFFB1002T	bulk soil	GFZ	7	36.2	0.55	11.4	3.88
SN02	GFFB1002U	bulk soil	GFZ	20	49.3	0.71	14.9	4.84
SN02e	GFFB1002U	exchangeable soil	-	20	n.a.	<lod	0.00	0.00
SN02r	GFFB1002U	residuum soil	-	20	n.a.	0.84	14.3	5.68
SN03	GFFB1002V	bulk soil	GFZ	30	57.5	0.88	17.6	6.44
SN04	GFFB1002R	bulk soil	GFZ	39	56.6	0.93	17.7	6.85
SN04e	GFFB1002R	exchangeable soil	-	39	n.a.	<lod	0.00	0.00
SN04r	GFFB1002R	residuum soil	-	39	n.a.	0.91	15.3	6.95



Sample



Sample Description



Data Publication



Papers

Report





PIDs & Vocabularies

Use of controlled vocabularies in the Metadata Editor



**NASA Global Change Master
Directory (GCMD) Keywords**

*Example: EARTH SCIENCE > SOLID EARTH > TECTONICS
> VOLCANIC ACTIVITY > ERUPTION DYNAMICS*



INSPIRE
Infrastructure for Spatial Information
in Europe

INSPIRE ISO 19115 Keywords

RDF-Version



**GeoSciML: Geoscience Vocabularies
for Linked Data**



IGSN International GeoSample Number

A globally unique and persistent identifier for physical objects in the Earth Sciences

- guaranteed to be unique via a centralized control mechanism (unique name spaces)
- resolves to virtual sample representations (sample metadata profiles) managed at federated IGSN Allocating Agents.



IGSN: GRO000188	
	IGSN: GRO000188 Sample Name: 12PTX04 Other Name(s): Rhodes at Pawtuxet Sample Type: Individual Sample Parent IGSN: Not Provided
Description	
Material:	Liquid>aqueous
Classification:	Not Provided
Field Name:	Not Provided
Description:	Not Provided

IGSN: GMY00007W	
	IGSN: GMY00007W Sample Name: TN182_47_002 Other Name(s): Sample Type: Individual Sample Parent IGSN: GMY00001B
Description	
Material:	Rock
Classification:	Igneous>Plutonic>Mafic
Field Name:	gabbro, hornblende gabbro
Description:	mafic plutonic rock

Benefits of IGSN

- unambiguously cite and track physical samples on a global scale:
 - allows previously impossible **linking of samples to data and publications**
 - allows previously impossible linking and integration of sample-based observations across data systems, and
 - paves the road towards advanced data mining of sample-based data.
- persistently link to online digital representations of samples (landing pages)
 - builds a federated global sample catalog.
 - are citable in scholarly literature

**IGSNs close the last gap of the full
provenance of research results**

IGSN Landing Page

General Identifiers

Program:	SO273
Expedition:	SO273
Type:	Individual Sample
Name:	SO273-31D-10
IGSN:	GFSO273N31
Parent IGSN:	GFSO273N21
Release Date:	N/A

Sampling Location

Latitude:	-43.8543
Longitude:	38.86
Coordinate System:	WGS84
Elevation:	-738
Location Type:	Ridge
Location Name:	Southeast Indian Ridge

Geology

Material:	Rock
Rock Classification:	Igneous/Volcanic-Mafic
Rock Type:	Basalt
Rock Description:	light (most of the primary mineralogy preserved)
• weathering:	light (most of the primary mineralogy preserved)
• shape:	subangular
• manganese crust (mm):	0.1
• Lithology:	Basalt
• Average grain size:	aphanitic
• Texture:	highly phytic

Sampling

Drilling Method:	dredging
Platform Type:	Ship
Platform Name:	
Chief Scientist:	
Start Date:	
End Date:	

Repository

Current Repository:	N/A
Current Repository Contact:	Prof. Dr. Jürgen Koepeke (koepeke@mineralogie.uni-hannover.de)

Sample Family

- SO273-31D
- SO273-31D-1
- SO273-31D-2
- SO273-31D-3
- SO273-31D-4
- SO273-31D-5
- SO273-31D-6
- SO273-31D-7

Location Map

Drilling Start/End: 2020-03-20 23:06:56+00:00 / 2020-03-21 00:55:04+00:00
Latitude: -43.8543 Longitude: 38.86000

Credit: K. Lehnert (IEDA)

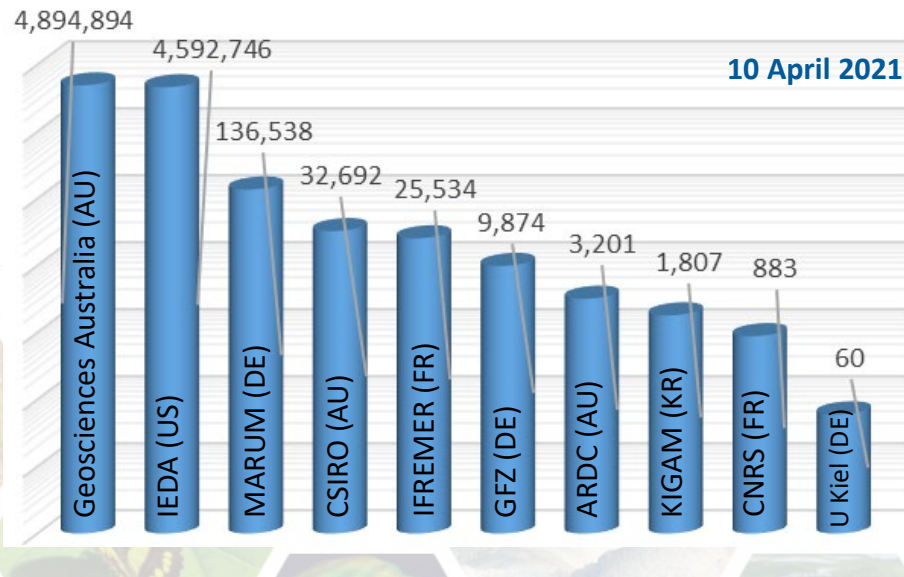


IGSN governance

<https://www.igsn.org/>

- established in 2011, registered as non-profit organization in Germany (IGSN e.V.)
- Members are organizations that want to provide registration and catalogue services (Allocating Agents)
 - currently 15 members,
 - 6 affiliate members and
 - 10 active Allocating Agents

Number of IGSN by Allocating Agent



Total = 9,698,229 registered IGSNs

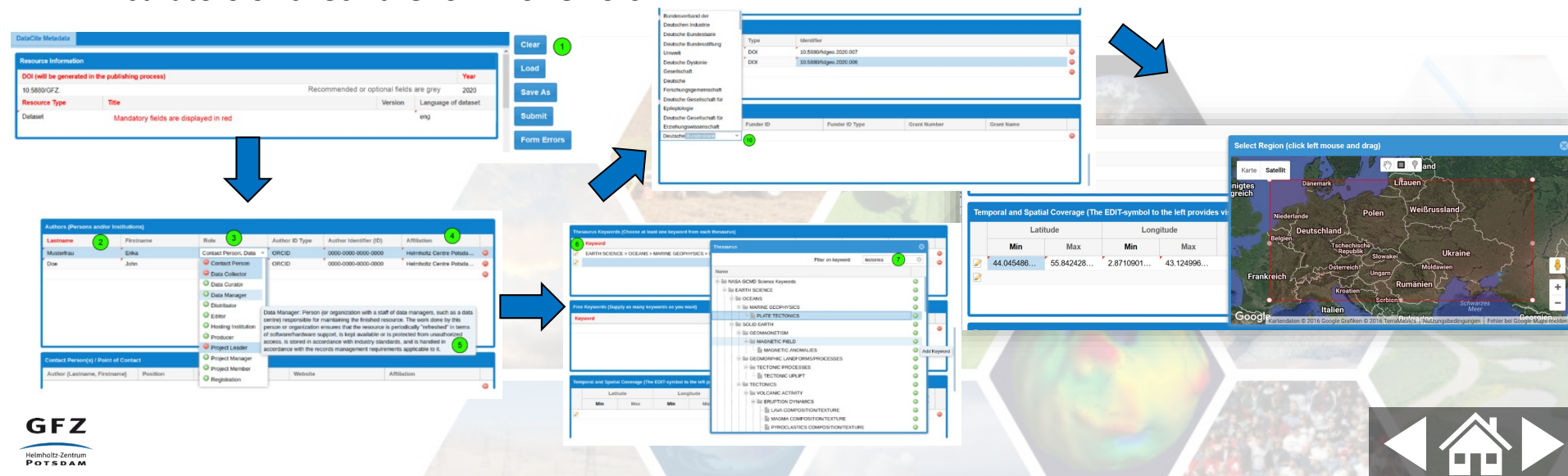
Credit: K. Lehnert (IEDA)



Metadata Editor: How to

How to navigate the form

- This form is used to create metadata according to different standard schema (DataCite 4.0, ISO19115, NASA DIF). It relies on cookies to automatically save your entries and retrieve them when you return to the site. Using the buttons on the right of the form (1), you can clear the form, **save and load** the metadata in XML format on your hard drive, submit the metadata to our curators or check the form for errors.



The screenshot displays the Metadata Editor form, which is used to create metadata according to different standard schema (DataCite 4.0, ISO19115, NASA DIF). The form is divided into several sections, each with a blue header and a white body. The sections include:

- Resource Information:** Contains fields for DOI (will be generated in the publishing process), Year (2020), Resource Type (10.5880/GFZ), Title, Version, and Language of dataset (eng). Mandatory fields are displayed in red.
- Authors (Persons and/or Institutions):** A table with columns for Lastname, Firstname, Role, Author ID Type, Author Identifier (ID), and Affiliation. It lists two authors: Erika Musterbau and John Doe.
- Temporal and Spatial Coverage:** A table with columns for Latitude (Min, Max) and Longitude (Min, Max). It shows values: 44.045488... 55.842428... 2.8710901... 43.124996...
- Keywords:** A section for selecting keywords from a list of terms, including EARTH SCIENCE, OCEANS & MARINE, GEOPHYSICS, and others.
- Form Errors:** A section for checking the form for errors.

Navigation buttons are located on the right side of the form, including Clear, Load, Save As, Submit, and Form Errors. A large blue arrow points from the Resource Information section to the Authors section, and another blue arrow points from the Keywords section to the Temporal and Spatial Coverage section. A third blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A fourth blue arrow points from the Keywords section to the Form Errors section. A fifth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A sixth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A seventh blue arrow points from the Keywords section to the Form Errors section. A eighth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A ninth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A tenth blue arrow points from the Keywords section to the Form Errors section. A eleventh blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A twelfth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A thirteenth blue arrow points from the Keywords section to the Form Errors section. A fourteenth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A fifteenth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A sixteenth blue arrow points from the Keywords section to the Form Errors section. A seventeenth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. An eighteenth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A nineteenth blue arrow points from the Keywords section to the Form Errors section. A twentieth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A twenty-first blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A twenty-second blue arrow points from the Keywords section to the Form Errors section. A twenty-third blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A twenty-fourth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A twenty-fifth blue arrow points from the Keywords section to the Form Errors section. A twenty-sixth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A twenty-seventh blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A twenty-eighth blue arrow points from the Keywords section to the Form Errors section. A twenty-ninth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A thirtieth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A thirty-first blue arrow points from the Keywords section to the Form Errors section. A thirty-second blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A thirty-third blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A thirty-fourth blue arrow points from the Keywords section to the Form Errors section. A thirty-fifth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A thirty-sixth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A thirty-seventh blue arrow points from the Keywords section to the Form Errors section. 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A ninety-fifth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A ninety-sixth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A ninety-seventh blue arrow points from the Keywords section to the Form Errors section. A ninety-eighth blue arrow points from the Form Errors section to the Temporal and Spatial Coverage section. A ninety-ninth blue arrow points from the Temporal and Spatial Coverage section to the Keywords section. A hundredth blue arrow points from the Keywords section to the Form Errors section.



Frequently Asked Questions

What is the goal of data management?

What are research data?

Why should I publish research data?

How do I publish data with GFZ Data Services?

What is a data publication?

Can I set an embargo on the publishing of my data?

Why shouldn't I publish my data as a supplement with the scientific journal in which my article is published?

What are domain repositories and what are they preferred to general repositories?

How do I cite a dataset?

What are metadata?

What is a Digital Object Identifier (DOI)?

What is an ORCID ID?

What is Fundref?

What type of format is needed to submit my data?

What are controlled vocabularies? Which ones does GFZ Data Services use?

What is resdata?

FAQs below are not ready yet

Will the data be versioned?

What type of format is needed to submit my data?

What is an IGSN?

What are persistent identifiers (PIDs)?

What is FAIR Data?

How do I publish data with GFZ Data Services?

In brief, you need to describe your data via the [GFZ Metadata Editor](#) and additional data description or README file if required and prepare your data files according to our [guidelines](#). Please refer to the [publication instructions](#). Our staff is also happy to help.

GFZ Data Services increases the interoperability of research data by (1) the provision of comprehensive domain-specific data description via standardised and machine-readable metadata complemented with controlled "linked-data" domain vocabularies; (2) complementing the metadata with technical data descriptions or reports; and (3) embedding the research data in wider context by providing cross-references through Persistent Identifiers (DOI, IGSN, ORCID, Fundref) to related research products and people or institutions involved.

A key tool for metadata generation is the GFZ Metadata Editor which assists scientists in creating metadata in different metadata schemas that are popular in the Earth sciences (ISO19115, NASA GCMD DIF, DataCite). Emphasis is placed on removing barriers, in particular the editor is publicly available on the internet without registration, a copy of the metadata can be saved to and loaded from the local hard disk and scientists are not requested to provide information that may be generated automatically. To improve usability, form fields are translated into the scientific language and we offer a facility to search structured vocabulary lists. In addition, multiple geospatial references can be entered via an interactive mapping tool, which helps to minimize problems with different conventions to provide latitudes and longitudes.

Visibility of the data is established through registration of the metadata at DataCite and the dissemination of metadata in standard protocols. The DOI Landing Pages embed metadata in Schema.org to facilitate discovery through internet search engines like the Google Dataset Search. In addition, we feed links of data and related research products into Scholix, which allows to link data publications and scholarly literature, even when the data are published years after the article.

What type of format is needed to submit my data?

GFZ Data Services has no special data format requirements for submissions. Wherever possible, community data standards and open data formats are preferred. Nevertheless, files submitted for publication may be converted by the editors (e.g. tab separated text files for tables). The UK Data Service provides some [recommendations](#) for other types of data. We will be happy to advise you.

In general, the following applies: data should be exchangeable without barriers and readable by others. Ideal formats are non-proprietary, unencrypted and commonly known across your research community and are based on open, documented standards. If the problem of proprietary formats occurs, in particular in the case of commercial software, you may be able to convert the data into open, standardised formats. Open and common formats are always preferable to proprietary formats if they achieve the same results or can be used accordingly without much effort. However, some data loss may occur when converting to an open format. In this case, you could provide the data in both open and proprietary formats.





Download section

Content for download

- Data description template
 - commented version
 - uncommented version
 - data type specific templates when available (e.g. for lithospheric models, EnMAP reports)
- Data file instructions
- Data publication instructions
- Quick Start Guide

Data Files Instructions

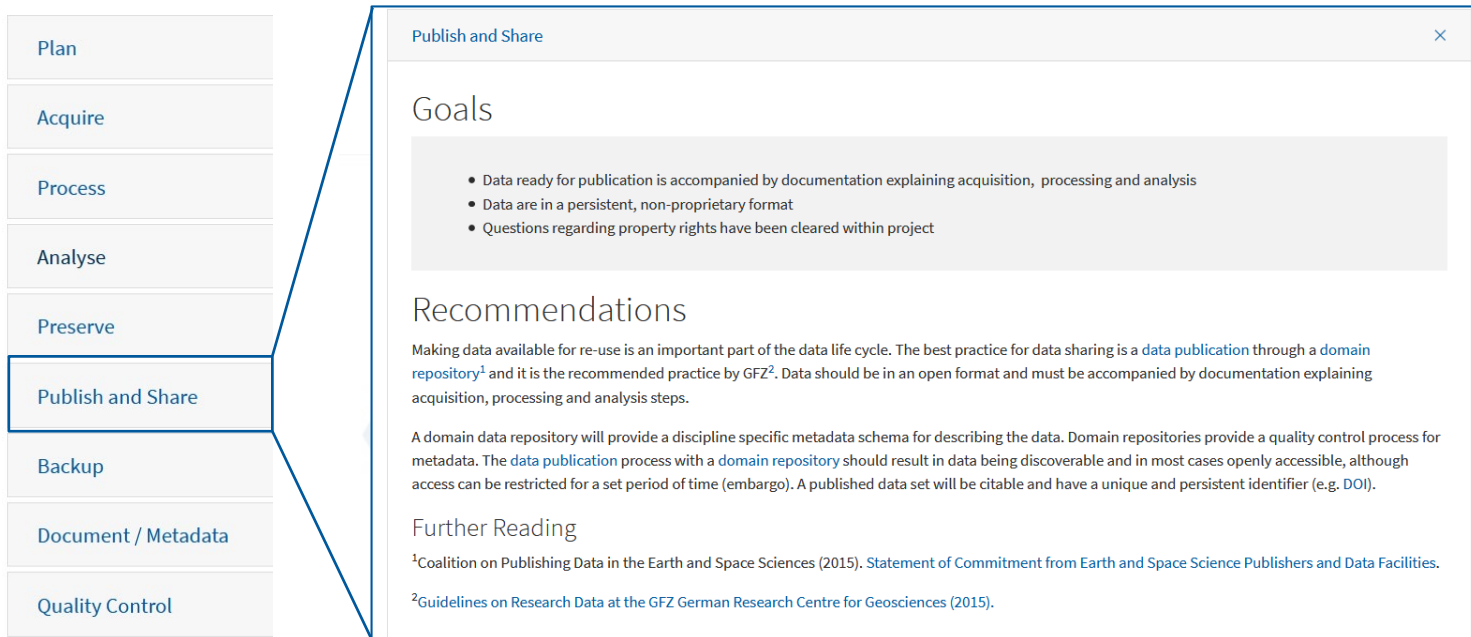
GFZ Data Services has no special data format requirements for submissions. Wherever possible, community data standards are preferred. Nevertheless, files submitted for publication may be converted by the editors. In order to minimize the publication processing time, data authors should consider the following recommendations:

- Geographic coordinates
 - Please use decimal degrees (DD.dddd) where southern latitudes and western longitudes have negative values
- Persistent identifiers for samples
 - If you used samples with an [IGSN](#), please list them in your data table (e.g. [GFHHA001A](#))
- Date and time
 - Please always define the date and time formats and their notation in the data headers and/or description.
 - Whenever possible we recommend the [ISO- 8601](#) format for date and time (e.g. 1981-07-16T13:34:11 [yyyy-mm-ddThh:mm:ss]), and [yyyy-mm-dd] if only dates were recorded.)
- Units
 - Please use [SI units](#) for your measurement variables
 - Define units in data description
 - Include units in table column labels
- Data formats
 - Please use non-proprietary and persistent file formats (e.g. txt, csv, geoTIFF, netCDF) whenever possible. Internationally recommended file formats for data publications can also be found here:
 - Please submit tabular data as [TAB delimited text files](#) (ASCII). In addition to ASCII files, you may submit tabular data in Excel-format or PDF/A if these formats provide for special formatting or functionality that would otherwise be lost.
- Metaheader
 - Whenever possible, data files published with GFZ Data Services will contain a [metaheader](#) at the beginning of the file marked by "#". It will contain the title and author information, license and citation.



Data Readiness Roadmap

The Data Readiness Roadmap is a tool to help researchers cope with the challenges of data management and **helps you navigate the RDM process by outlining RDM practices and recommendations** along the data life cycle



The interface displays a vertical sidebar on the left with the following stages: Plan, Acquire, Process, Analyse, Preserve, **Publish and Share** (highlighted), Backup, Document / Metadata, and Quality Control. A large window on the right provides details for the 'Publish and Share' stage.

Publish and Share

Goals

- Data ready for publication is accompanied by documentation explaining acquisition, processing and analysis
- Data are in a persistent, non-proprietary format
- Questions regarding property rights have been cleared within project

Recommendations

Making data available for re-use is an important part of the data life cycle. The best practice for data sharing is a [data publication](#) through a [domain repository](#)¹ and it is the recommended practice by GFZ². Data should be in an open format and must be accompanied by documentation explaining acquisition, processing and analysis steps.

A domain data repository will provide a discipline specific metadata schema for describing the data. Domain repositories provide a quality control process for metadata. The [data publication](#) process with a [domain repository](#) should result in data being discoverable and in most cases openly accessible, although access can be restricted for a set period of time (embargo). A published data set will be citable and have a unique and persistent identifier (e.g. DOI).

Further Reading

¹Coalition on Publishing Data in the Earth and Space Sciences (2015). [Statement of Commitment from Earth and Space Science Publishers and Data Facilities](#).

²Guidelines on Research Data at the GFZ German Research Centre for Geosciences (2015).



RDM Recommendations for students

My_PhD_Project Project Folder Example

[Show me online](#)

Step 1: Create an overview document. It should contain the following:



- short summary of work
 - include title, ID number (if available), funding agency, keywords describing subject and content
 - include dates, location, intellectual property rights, file formats, methodology, and data sources
 - overview of folder structure, explain relationships
- This document should evolve alongside your project.

Step 2: Create a sensible folder structure



01_data

This folder will contain all data you use in your project organized in subfolders.



01_initial_data

Store original data as it came out of a sensor, lab experiment or analysis, satellite source, field book copies etc. here. Create separate folders for data according to source. If the data is too large, create a where_to_find_initial_data.txt and explain where the raw data can be found.



This folder should reflect the structure of 01_initial_data. Store data at



Back to start

Curating geosciences data in the Earth, Space and
Environmental Sciences – new developments of GFZ

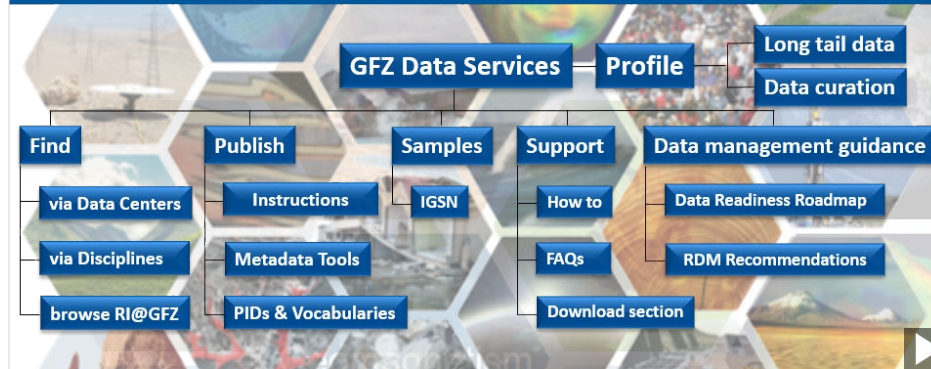
Data Services

Florian Ott, Kirsten Elger, Damian Ulbricht
GFZ German Research Centre for Geosciences, Potsdam, Germany

GFZ DATA SERVICES

GFZ
Helmholtz Centre
POTSDAM

EGU General
Assembly 2021



DOI Data



RI @ GFZ



IGSN



Publish Data



Metadata Editor



Search for datacenters, science keywords



Geomagnetism

Back



Data Publications...

...best practice for FAIR sharing data

Publication of datasets as individual publications (with assigned persistent Identifier; DOI) **through data repositories**



Data Repositories:

- permanent archives and access points to research data
- Open Access
- disciplinary, institutional, general
- persistent identifier (ideally DOI)

- **Findable:** integration of standardised metadata in external data portals (e.g. DataCite, EUDAT B2Find)
- **Accessible:** persistent data storage and access guaranteed by the publisher (= data repository)
- **Documented:** with metadata for discovery and reuse
- **Citable:** DOI-referenced datasets are citable just as journal articles (→ credit for the researcher)

[Back](#)



“Data in Review” links

- Link: <http://pmd.gfz-potsdam.de/panmetaworks/review/d5e90191aeefd0632ed35813dd442e186ad1187ad892f3d3ff968bd4716eb472/>
- Allows access to still unregistered data (for paper review purposes)
- DOI is reserved and citable
- Data can still be changed
- DOI registration when paper is accepted
- Please inform GFZ Data Services when a paper is accepted
- Please send the DOI of the paper to GFZ Data Services

The screenshot shows the GFZ Data Services interface for a dataset in review. The title is "Geochemical Data Used to Trace Variations of Organic Carbon Sourcing Along a Trans-Himalayan River, Central Nepal". The status is "IN REVIEW". The dataset is labeled "Released". The abstract states: "This data publication contains the data sets of a study aiming to trace variations in organic carbon sourcing along the Kali Gandaki River in Central Nepal. The data are on samples from different materials in the landscape (litter, soil, bedrock) and river sediments. On these samples we measured total organic carbon content, stable carbon and nitrogen isotopes, radiocarbon content and surface area. The data was generated between 2015-05 and 2017-12. Please consult the data description file for more details." The methods section describes the sampling process: "River sediment (n=58) and end-member samples (n=70) were taken in the KG catchment during two consecutive Monsoon seasons (July 2015 and June 2016). Suspended sediment load (n= 36) was sampled from bridges with a metal bucket, targeting the upper meter of the fast flowing part of the river and filtered on the same day using a using custom made filtration system equipped with PES filters (pore size: 0.2 µm, Sartorius). Filters were wrapped in combusted aluminium foil and stored in plastic bags. River bank samples (n=22) were taken, when possible, the morning following suspended load sampling, when the water level dropped slightly and river bank sediment was exposed. Bank samples were wrapped in combusted aluminium foil and plastic bags. In the Tibetan part of the catchment, bedrock from the Tethyan Sedimentary Sequence (Lupra, Bagung and Jomsom Formation) was sampled within the main river valley (n=11). Paleosol samples (n=21) were collected in the central valley from visibly organic rich". The license is Creative Commons Attribution 4.0 International Licence (CC BY 4.0). The dataset description is a supplement to the paper, and the DOI link is provided: <http://dx.doi.org/DOI of paper when available>.

Geomagnetism

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Data description templates

- Many users are unaware of what a data publication represents and what to include in description
 - Increase the quality of metadata
 - Reduces curation workload
 - Uniform format aids comprehension
- Template Soon available via <https://dataservices.gfz-potsdam.de> (until then: via Email)

Paleosol-derived data used for the reconstruction of environmental conditions during the Holocene in the upper part of the Kali Gandaki valley, Central Nepal
(<http://doi.org/10.5880/GFZ.4.6.2019.001>)

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2. Citation

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When using the data please cite:

Menges, J.; Hovius, N.; Andermann, C.; Dietze, M.; Swoboda, C.; Cook, K.; Adhikari, B.; Vieth-Hillebrand, A.; Bonnet, S.; Reimann, T.; K., Andreas; Sachse, D. (2019): Paleosol-derived data used for the reconstruction of Holocene environmental conditions during in the upper Kali Gandaki valley, Central Nepal. GFZ Data Services. <http://doi.org/10.5880/GFZ.4.6.2019.001>

The data are supplementary to:

Menges, J., Hovius, N., Andermann, C., Dietze, M., Swoboda, C., Cook, K. L., ... Sachse, D. (2019). Late

1. Licence
2. Citation
3. Data Description
 - Sampling method
 - Analytical procedure
 - Data processing
4. File description
 - File inventory
 - File naming convention
 - Description of data tables
5. References

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Data description templates

Example Data Description (before use of template):

Stimulation data for each of the analyzed EGS projects.

The are provided in tabular form (CSV). The file names indate the project.

Definition of columns in the data tables (also in the header of the data):

- V = Cumulative injected volume (m^3) - Ehyd = Applied hydraulic energy (J) -
MaxM0 = Maximum observed seismic moment (Nm) - CumM0 = Cumulative
seismic moment (Nm) - IE = Injection efficiency (-)

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Data description templates

Example Data Description ([after use of template](#)):

The here provided data are part of a broader analysis of past and present stimulation projects, revealing that the temporal evolution and growth of maximum observed moment magnitudes may be linked directly to the injected fluid volume and hydraulic energy. Analyzed projects include the most prominent European Enhanced Geothermal System (EGS) projects in Basel, Switzerland (BAS) and Soultz-sous-Forêts (STZ), France. In Soultz, three different stimulations over the course of 10 years were performed in different wells and different depths. Therefore, we differentiate between the injections in 1993 (STZ93), 2000 (STZ00), and in 2003 (STZ03). We also included the deepest EGS Project to date (St1), located in Helsinki, Finland. Furthermore, we included the fluid-injection experiment from the German super deep scientific drilling hole (KTB), two Australian EGS projects, located at Paralana (Para) and the 2003 Cooper Basin (CBN) injection, as well as the EGS project near Pohang, South Korea. Finally, we also considered a single well injection period at the Berlín geothermal field (BGF), El Salvador, representing the only hydrothermal site considered here.

For each project the cumulative volume injected is provided along with the applied hydraulic energy, maximum observed seismic moment, cumulative seismic moment, and injection efficiency as tab separated ASCII files with the .csv extension. All stimulation files are combined into a single .zip archive. More details on processing steps and references herein can be found in the accompanying data description.

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