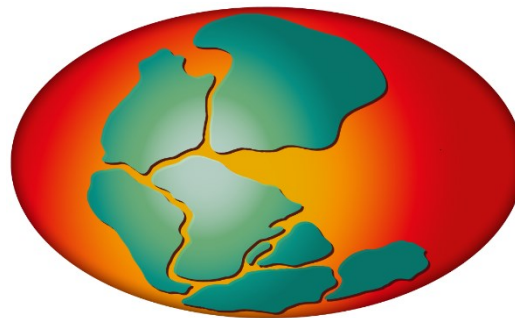




WORLD DATA SYSTEM

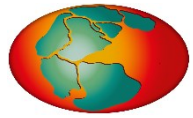
# PANGAEA

Data Publisher  
for Earth & Environmental Sciences



Michael Diepenbroek

# What is PANGAEA?



- Information system for long-term archiving and publication of data from earth & environmental sciences  
*(since 1993)*
- Accredited by the „World Meteorological Organisation“ (WMO) as „World Radiation Monitoring Center“ (WRMC)  
*(since 2007)*
- Accredited by the „International Council for Scientific Data Centers“ (ICDC) as „World Data Center  
*„Publisher for Earth & Environmental Science“ (since 2001)*



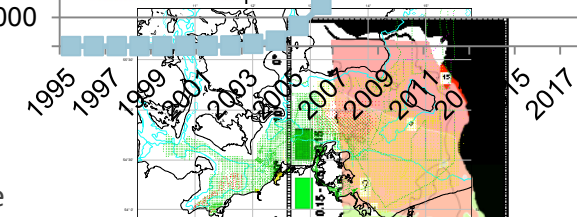
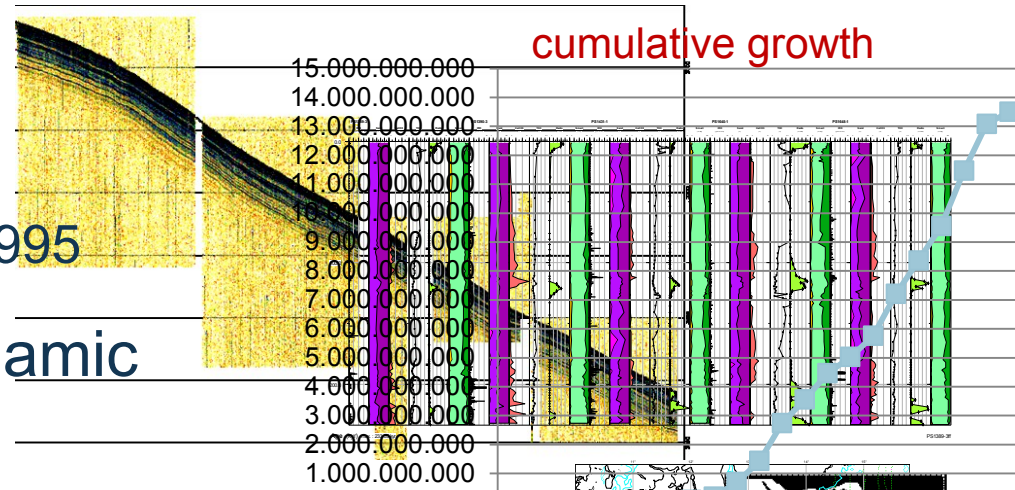
**World  
Meteorological  
Organization** **SU**

Weather • Climate • Water  
**WORLD DATA SYSTEM**

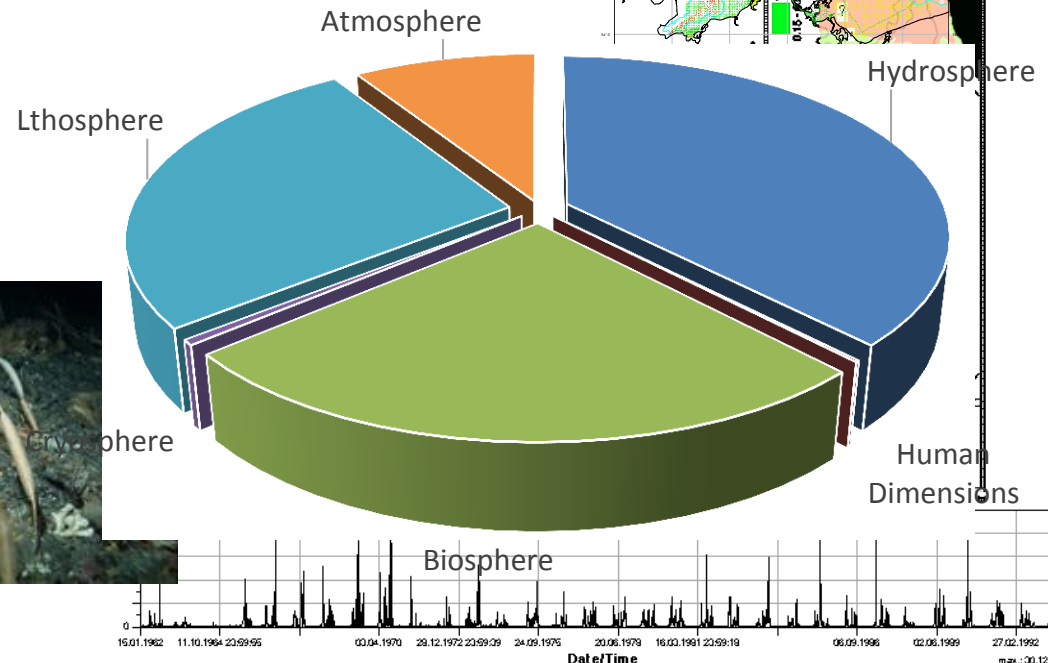
# PANGAEA - contents



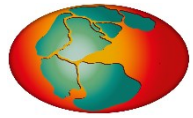
- Integral part of science
  - More than 160 European to international projects since 1995  
(<https://www.pangaea.de/projects>)
- highly heterogenous & dynamic
- multidisciplinary



Number of data sets ~360.000  
 Number of data items ~14 Billion  
 Data volume <3 PB  
 Increase ~5% per year



# PANGAEA – interoperability



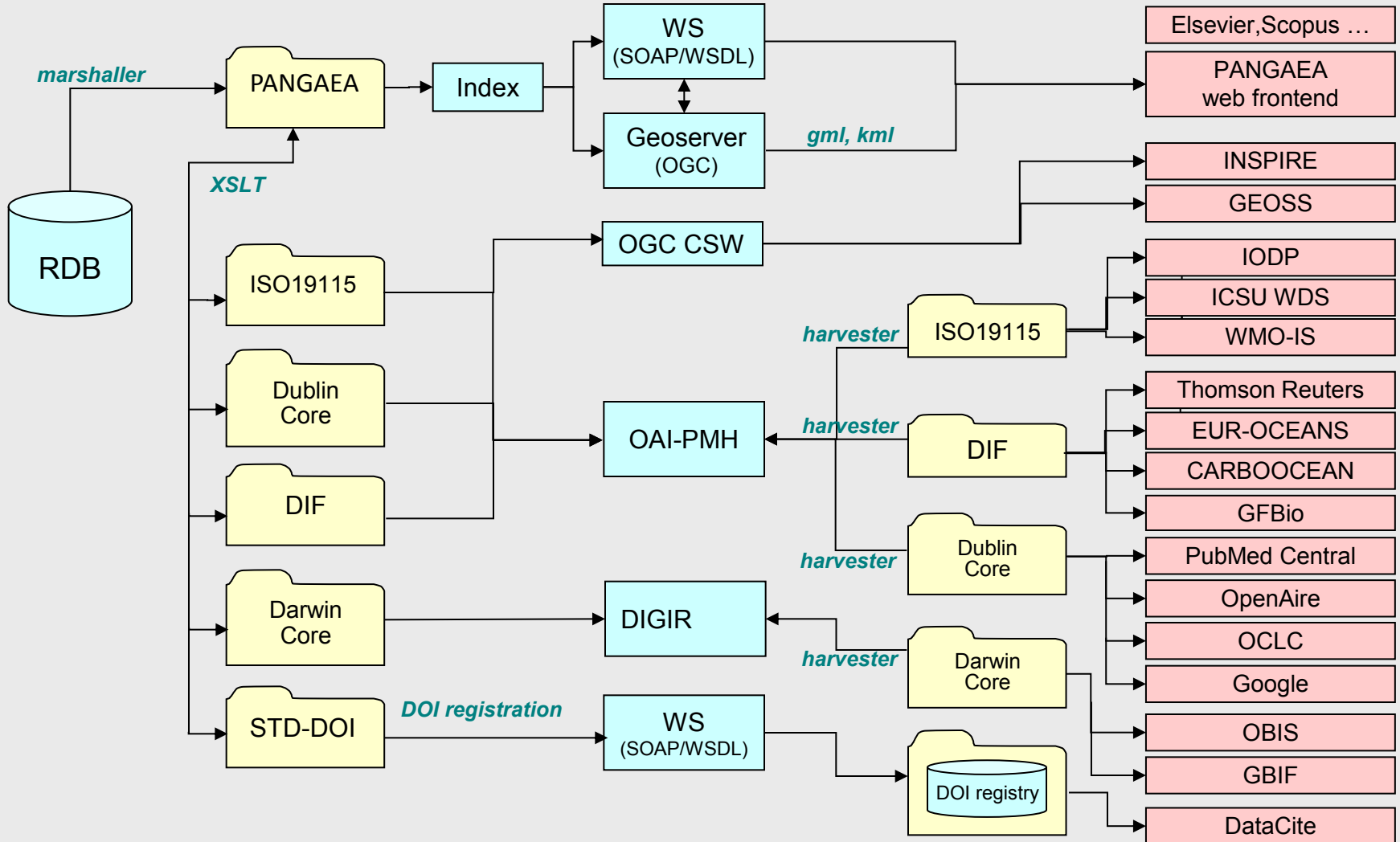
data management &  
longterm archiving

catalogues

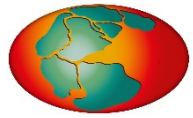
protocols

catalogues

Frontends /  
portals



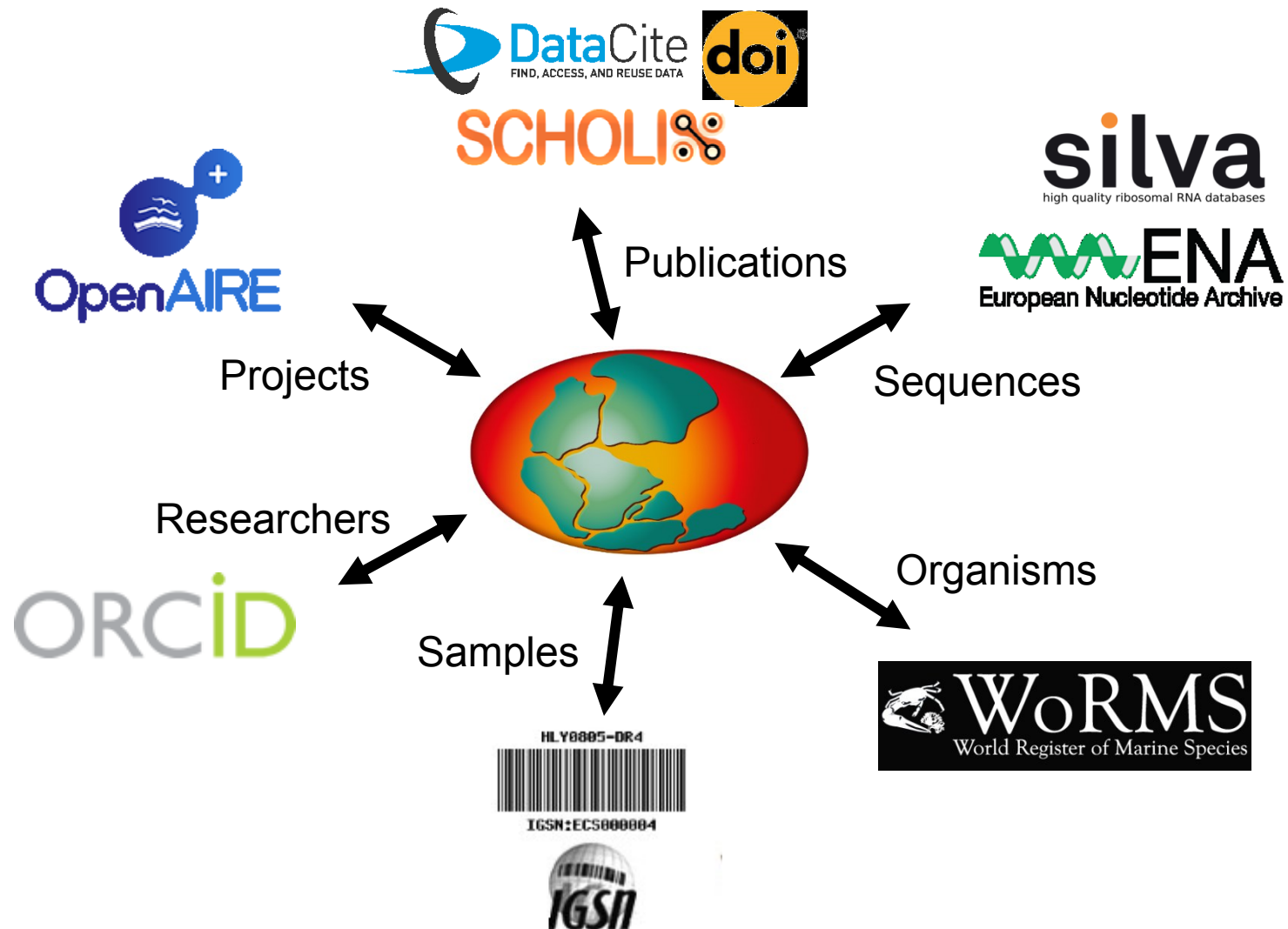
# PANGAEA – Dissemination of Data & Metadata







# Cross-referencing, linking



# Data Publishing – Cross-referencing



ScienceDirect - Marine Microbiology | Mohtadi, M et al. (2010): Su

doi.pangaea.de/10.1594/PANGAEA.733340



**PANGAEA®**

Data Publisher for Earth & Environmental Science

Logged in as uschindler (log out, profile)

Always quote citation when using data!

## Data Description

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**Citation:** Mohtadi, M et al. (2010): Surface sediment samples from several fore-arc basins west and southwest of the Indonesian Archipelago, analyzed by planktonic foraminifera, stable oxygen and carbon isotopic signals and opal and CaCO<sub>3</sub> contents in bulk sediment.

doi:10.1594/PANGAEA.733340,

**Supplement to: Mohtadi, Mahyar; Max, Lars; Hebbeln, Dierk; Baumgart, Anne; Krück, Nils; Jennerjahn, Tim C (2007): Modern environmental conditions recorded in surface sediment samples off W and SW Indonesia: Planktonic foraminifera and biogenic compounds analyses. *Marine Micropaleontology*, 65(1-2), 96-112, doi:10.1016/j.marmicro.2007.06.004**

**Abstract:** A total of 69 surface sediment samples from several fore-arc basins located west and southwest of the Indonesian Archipelago was analyzed with respect to the faunal composition of planktonic foraminifera, the stable oxygen and carbon isotopic signal of a surface-dwelling (*Globigerinoides ruber*) and a thermocline-dwelling (*Neogloboquadrina dutertrei*) species, and the opal and CaCO<sub>3</sub> contents in bulk sediment. Our results show that the distribution pattern of opal in surface sediments corresponds well to the upwelling-induced chlorophyll concentration in the upper water column and thus, represents a reliable proxy for marine productivity in the coastal upwelling area off S and SW Indonesia. Present-day oceanography and marine productivity are also reflected in the tropical to subtropical and upwelling assemblages of planktonic foraminifera in the surface sediments, which in part differ from previous studies in this region probably due to different coring methods and dissolution effects. The average stable oxygen isotopic values (δ<sup>18</sup>O) of *G. ruber* in surface sediments vary between 2.9 per mill and 3.2 per mill from basin to basin and correspond to the oceanographic settings during the SE monsoon (July-October) off west Sumatra, whereas off southern Indonesia, they reflect the NW monsoon (December-March) or annual average conditions. The δ<sup>18</sup>O values of *N. dutertrei* show a stronger interbasinal variation between 1.6 per mill and 2.2 per mill and correspond to the upper thermocline hydrology in July-October. In addition, the difference between the shell carbon isotopic values (δ<sup>13</sup>C) of *G. ruber* and *N. dutertrei* (Delta δ<sup>13</sup>C) appears to be an appropriate productivity recorder only in the non-upwelling areas off west Sumatra. Consequently, joint interpretation of the isotopic values of these species is distinctive for different fore-arc basins W and SW of Indonesia and should be considered in paleoceanographic studies.



**Project(s):** [Center for Marine Environmental Sciences \(MARUM\)](#)

**Coverage:** *Median Latitude:* -2.448691 \* *Median Longitude:* 102.924024 \* *South-bound Latitude:* -9.012150 \* *West-bound Longitude:* 95.331100 \* *North-bound Latitude:* 3.874500 \* *East-bound Longitude:* 121.002536

**Event(s):** **GeoB10008-4** \* *Latitude:* -0.015914 \* *Longitude:* 98.004331 \* *Date/Time:* 2005-08-06T04:29:00 \* *Elevation:* -934.0 m \* *Campaign:* SO184/1 (PABESIA) \* *Basis:* Sonne \* *Device:* MultiCorer \* *Comment:* 6/6 4/4

**GeoB10010-1** \* *Latitude:* -1.002969 \* *Longitude:* 97.016358 \* *Date/Time:* 2005-08-06T11:14:00 \* *Elevation:* -2937.0 m \* *Campaign:* SO184/1 (PABESIA) \* *Basis:* Sonne \* *Device:* MultiCorer \* *Comment:* 6/6 4/4

**GeoB10014-1** \* *Latitude:* 1.011308 \* *Longitude:* 96.016350 \* *Date/Time:* 2005-08-08T01:30:00 \* *Elevation:* -1158.0 m \* *Campaign:* SO184/1 (PABESIA) \* *Basis:* Sonne \* *Device:* MultiCorer \* *Comment:* 6/6 4/4

# Data Publishing – Cross-referencing



Modern environmental con x

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Abstract

Keywords

1. Introduction

2. Regional setting

3. Materials and methods

Table 1.

Table 2.

4. Results

Table 3.

5. Discussion

5.1. Effect of dissolution

**Marine Micropaleontology**

Volume 65, Issues 1–2, 29 October 2007, Pages 96–112

**Modern environmental conditions recorded in surface sediment samples off W and SW Indonesia: Planktonic foraminifera and biogenic compounds analyses**

Mahyar Mohtadi<sup>a, b</sup>, Lars Max<sup>b</sup>, Dierk Hebbeln<sup>a, b</sup>, Anne Baumgart<sup>c</sup>, Nils Krüick<sup>c</sup>, Tim Jennerjahn<sup>c</sup>

<sup>a</sup> Center for Marine Environmental Sciences (MARUM), University of Bremen, 28359 Bremen, Germany

<sup>b</sup> Geosciences Department, University of Bremen, 28359 Bremen, Germany

<sup>c</sup> Center for Tropical Marine Ecology (ZMT), Fahrenheitstr. 6, 28359 Bremen, Germany

Received 23 April 2007. Revised 19 June 2007. Accepted 20 June 2007. Available online 6 July 2007.

<http://dx.doi.org/10.1016/j.marmicro.2007.06.004>, How to Cite or Link Using DOI

Permissions & Reprints

**Abstract**

A total of 69 surface sediment samples from several fore-arc basins located west and southwest of the Indonesian Archipelago was analyzed with respect to the faunal composition of planktonic foraminifera, the stable oxygen and carbon isotopic signal of a surface-dwelling (*Globigerinoides ruber*) and a thermocline-dwelling (*Neogloboquadrina dutertrei*) species, and the opal and CaCO<sub>3</sub> contents in bulk sediment. Our results show that the distribution pattern of opal in surface sediments corresponds well to the upwelling-induced chlorophyll concentration in the upper water column and thus, represents a reliable proxy for marine productivity in the coastal upwelling area off S and SW Indonesia. Present-day oceanography and marine productivity are also reflected in the tropical to subtropical and upwelling assemblages of planktonic

**PANGAEA® – Related Data**

Surface sediment samples from several fore-arc basins located west and southwest of the Indonesian Archipelago were analyzed for CaCO<sub>3</sub> contents in bulk sediment.

Thailand Vietnam Philippines

Andaman Sea Gulf of Thailand Malaysia Indonesia Java Sea Banda Sea

Hybrid

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**Related articles**

- Direct evidence for nitrogen isotope discrimination in planktonic foraminifera from the North Atlantic Ocean. *Organic Geochemistry*
- Stable isotopes of planktonic foraminifera from the North Atlantic Ocean. *Marine Micropaleontology*
- Comparison of the Compositional, Microbiological and Geochemical Characteristics of Planktonic Foraminifera from the North Atlantic Ocean. *Journal of Dairy Science*
- A quadra-directional decomposition heuristic for the analysis of planktonic foraminifera. *Computers & Operations Research*
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**Nature**  
 Volume 431, Issue 7005, 9 September 2004, Pages 147-151

ISSN: 00280836  
 CODEN: NATUA  
 DOI: 10.1038/nature02805  
 Document Type: Article  
 Source Type: Journal

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## High-resolution record of Northern Hemisphere interglacial period

[No author name available]

**Abstract**

Two deep ice cores from central Greenland, drilled in the Northern Hemisphere, but the oldest sections of the cores were present an undisturbed climate record from a North Greenland ice core within the last interglacial period. The oxygen isotopes with temperatures 5 °C warmer than today. We find undisturbed ice cores from northern Greenland and the undisturbed sections of the Northern Hemisphere modulated the latitudinal temperature temperatures that marked the initiation of the last glacial period by an abrupt climate warming about 115,000 years ago appear to have an immediate Antarctic counterpart, suggesting that the climate see-saw between the hemispheres (which dominated the last glacial period) was not operating at this time.

**Language of original document**  
English

**Index Keywords**

**Engineering controlled terms:** Geochronology; Glacial geology; Ice; Isotopes; Oxygen; Rocks  
**Engineering uncontrolled terms:** Bedrock; Greenland; Northern hemisphere  
**Engineering main heading:** Climate change  
**GEOBASE Subject Index:** ice core; Last Interglacial; Northern Hemisphere; paleoclimate; Quaternary  
**EMTREE medical terms:** Antarctica; article; chronology; climate change; cold climate; document examination; geographic elevation; glacial mass balance; information retrieval; last glacial maximum; latitude; low temperature; priority journal

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**PANGAEA<sup>®</sup> – Supplementary Data**  
 50 year means of oxygen isotope data from ice core NGRIP

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1  Johnsen, S.J., Clausen, H.B., Dansgaard, W., Fuhrer, K., Gundestrup, N., Hammer, C.U., Iversen, P., (...), Steffensen, J.P. **Irregular glacial interstadial recorded in a new Greenland ice core** (1992) *Nature*, 359 (6202), pp. 241-243. Cited 684 times

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Landais, A., Waelbroeck, C., Masson-Delmotte, V. **On the limits of Antarctic and marine climate records synchronization: Lag estimates during marine isotopic stages 5d and 5c** (2006) *Paleoceanography*

Lhomme, N., Clarke, G.K.C., Marshall, S.J. **Tracer transport in the Greenland Ice Sheet: Constraints on ice cores and glacial history** (2005) *Quaternary Science Reviews*

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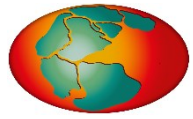
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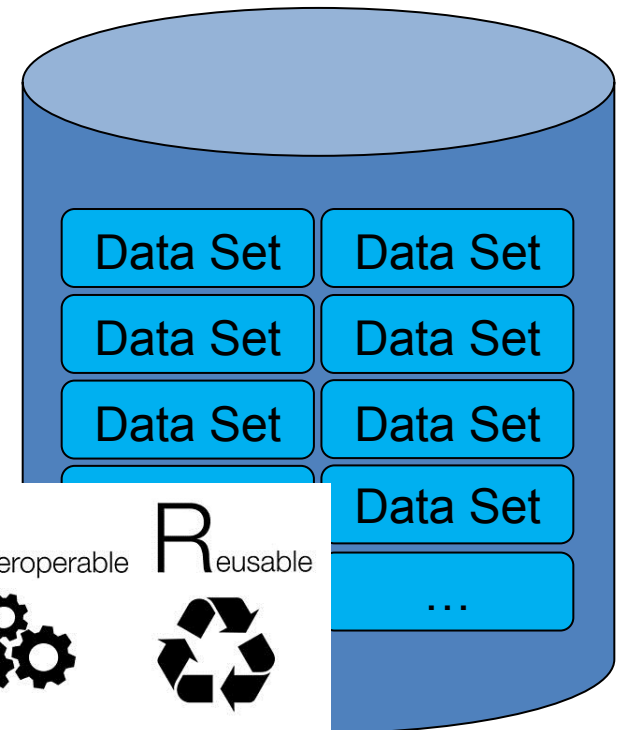


# Data publication - prerequisites

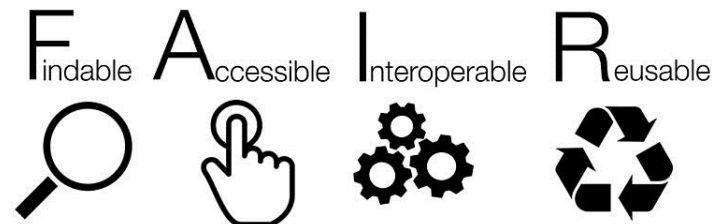


OECD principles and guidelines for access to research data (2007)

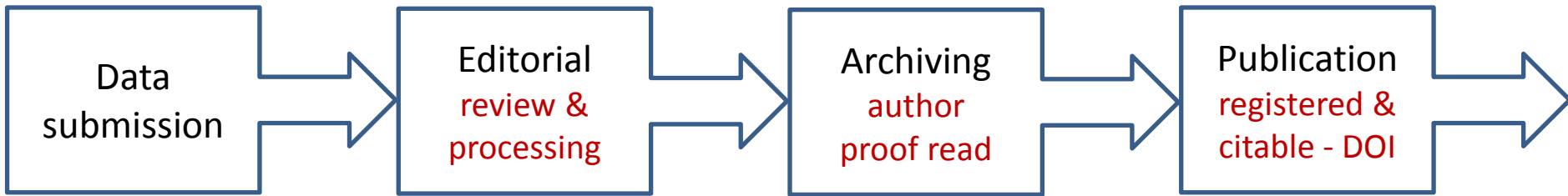
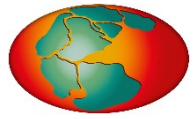
- Licenses & persistent identification (DOI)
- Quality
  - ✓ QA/QC -> review procedures
  - ✓ Harmonization of data -> ontologies
- Efficiency
  - ✓ (Meta)data & interoperability standards (machine readable)



**FITNESS OF USE!**



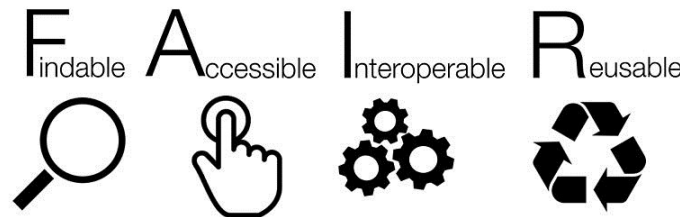
# Data Publishing – simplified workflow





# Fitness for Use - Initiatives

- RDA/WDS Data Publishing Workflows WG
- Certification of data centers/repositories
- FAIR principles
- GEO label facets
- ESIP Information Quality Cluster
- Literature!



25/08/2015



DSA-WDS Partner Working Group

Collaboration

Information

DMP label			
	Discoverable	1	D
	Accessible	2	A
	Standard encoding using	3	Usability
	Well documented metadata	4	
	Traceable	5	
	Quality documented	6	
	Preserved	7	Preservation
	Periodically verified	8	
	Reviewed and refreshed	9	Curation
	Tagged with permanent ID	10	

Repositories are increasingly likely to mandate open data and data management storage and accessibility of data.

Therefore, we need to store them in a trustworthy digital repository. Data created, managed, curated, and archived in such a way to preserve the initial investment in collecting them. Researchers must be certain that data held in archives remain useful and meaningful into the future. Funding authorities increasingly require continued access to data produced by the projects they fund, and have made this an important element in Data Management Plans. Indeed, some funders now stipulate that the data they fund must be deposited in a trustworthy repository.

Sustainability of repositories raises a number of challenging issues in different areas: organizational, technical, financial, legal, etc. Certification can be an important contribution to ensuring the reliability and



# Fitness for Use - Assessment & Roles



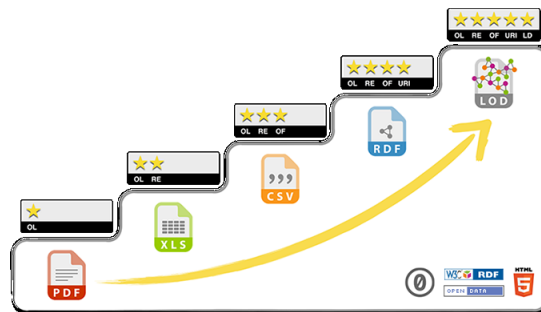
- Certification authority
  - Reviewers
- Data center / repository
  - Data editors / reviewers
- User
  - Downloads, social tagging





TrustSeal Repository  
TrustSeal Software  
TrustSeal Data

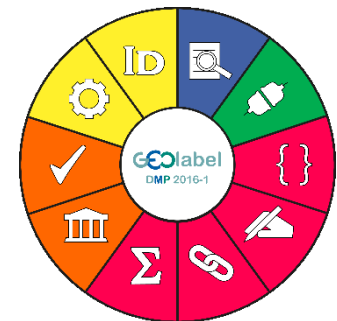
## Current approaches



**5 ★ OPEN DATA**



2 User Reviews  
1 Archivist Assessment  
24 Downloads





WDS/RDA Publishing Data IG  
WDS/RDA Certification of Digital Repositories IG

# Assessment of Data Fitness for Use

Helena Cousijn  
Claire Austin  
Jon Petters  
Michael Diepenbroek



# Lessons learnt

- Multidisciplinarity
- Generic & flexible technical infrastructure
- Flexible business model
- Linkage to international developments
  
- Moving target!



# Costs

- Overall annual budget -> ~1 Mio Euro
- Staff -> ~24, >2/3 for curation
- Open access
- Basic operation -> host institutions (AWI, marum ~15%)
- Further development -> third party funds
- Curational costs -> third party funds
  - Open science policy -> EU, DFG, BMBF