



# Using BEXIS 2 as efficient research data management system for the ATTO research project

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& Susan Trumbore

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The Amazon Tall Tower Observatory (**ATTO**) is a joint German-Brazilian project launched in 2009 and funded by MCTI, BMBF and the Max-Planck Society.

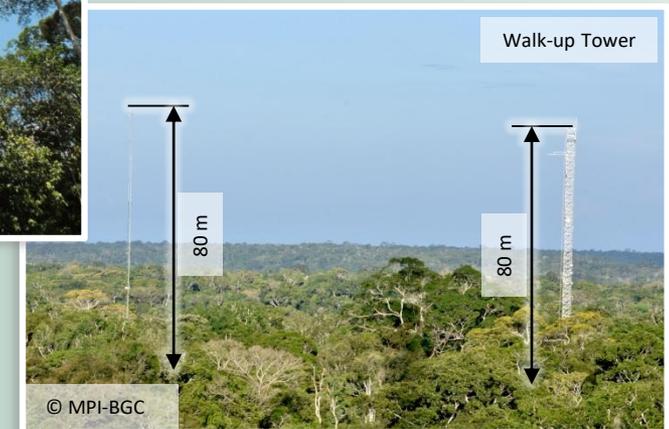


© Claire Andreae



© Susanne Benner / MPI-C

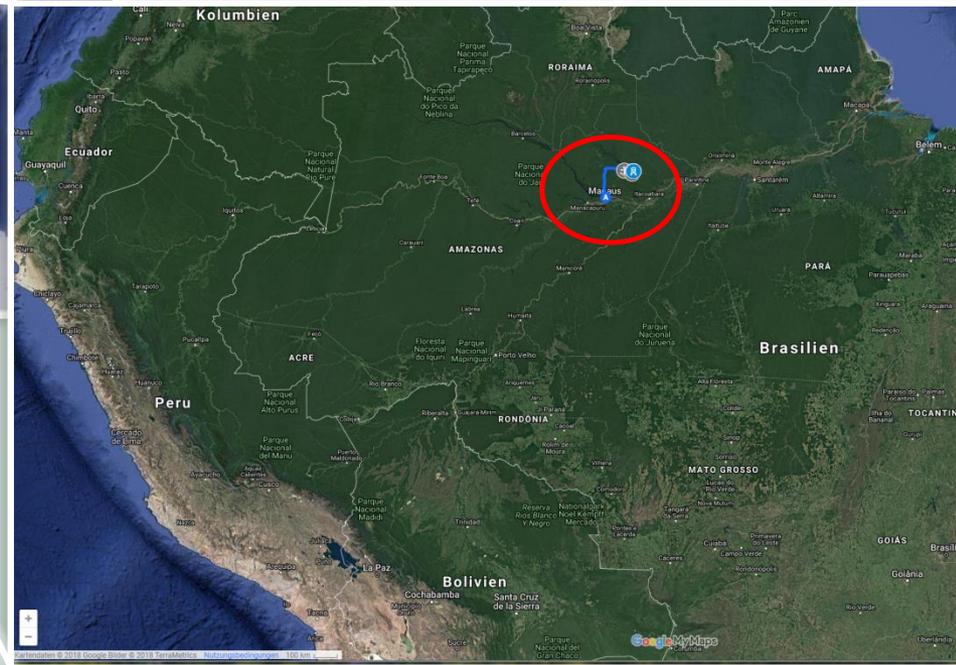
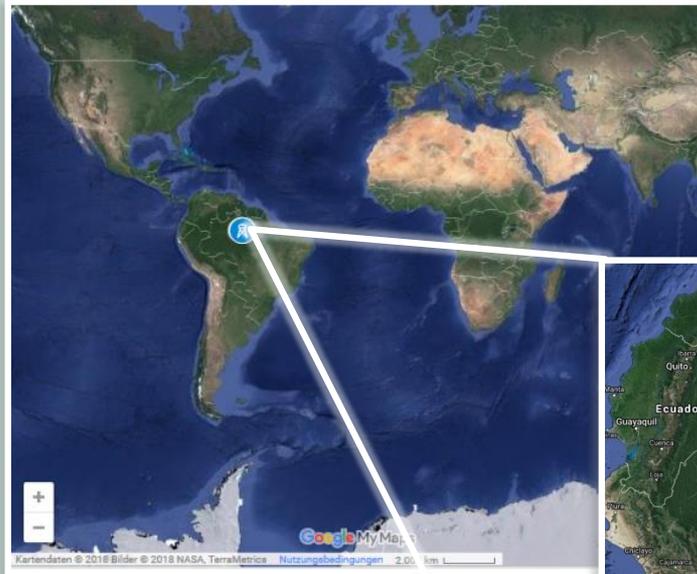
- add. 6 container-labs
- base camp
- field site with several plots



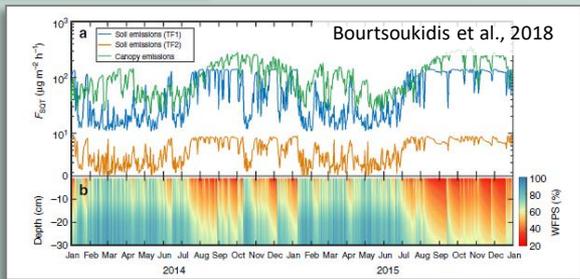
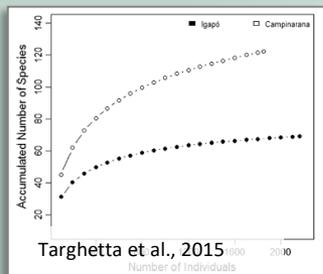
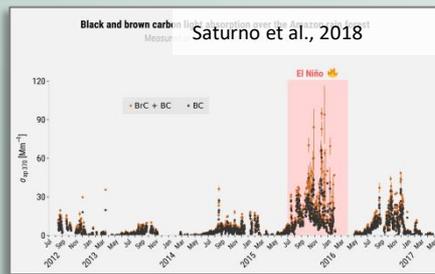
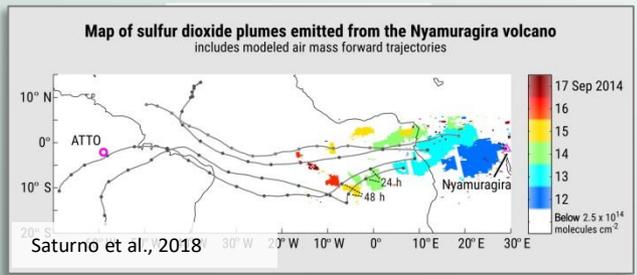
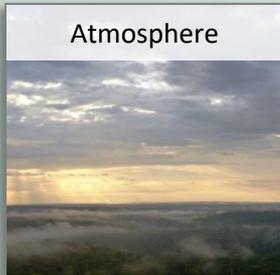
© MPI-BGC



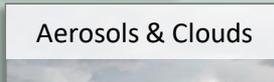
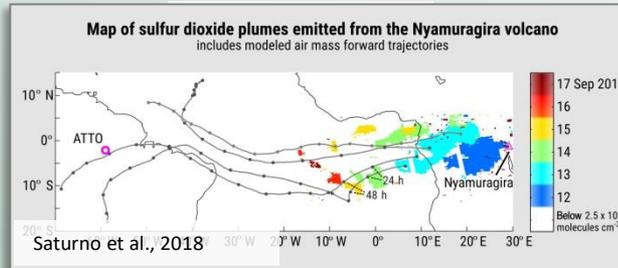
The ATTO site is located at the center of the world's largest continuous tropical forest in Brazil, 150 km north of Manaus.



ATTO allows the observation of geo-/bio-/atmosphere interactions and their impact on climate, atmospheric chemistry, aerosols and clouds, and greenhouse gases in near-pristine conditions.

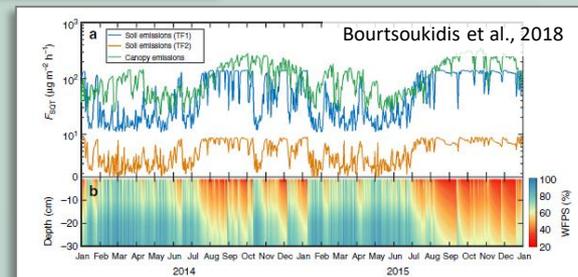
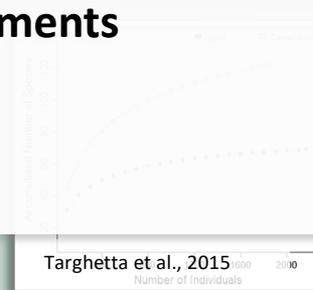


ATTO allows the observation of **geo-/bio-/atmosphere** interactions and their impact on **climate, atmospheric chemistry, aerosols and clouds,** and **greenhouse gases** in near-pristine conditions.



**1. Challenge: Highly diverse data over several scales e.g.:**

- micrometeorological data
- greenhouse gas measurements
- remote sensing data
- soil & water samples ...



The ATTO research consortium consists of 9 research institutes from Brasil, 9 research institutes from Germany & is financed by 6 funding agencies, ESPR, DLR & Max Planck Society.



**2. Challenge:** To respond to the interests of a wide range of institutions and funders and to take into account a wide variety of mentalities.

DO ESTADO DO AMAZONAS





# BEXIS 2: Efficient research data management system for the ATTO project.



Free & open source software

Modularity

Flexibility of Metadata

Close collaboration with developer

### End User Features

<b>Search Data</b> Find datasets by keyword (incl. autocomplete) or use facets, filtering, sorting to quickly retrieve the dataset you need.	<b>Upload Data</b> Upload your tabular data or any other type of data to BEXIS 2 and describe it with metadata.	<b>Web API Access</b> Beside downloading a dataset from the portal, you may also retrieve data stored in BEXIS directly with a script or from your application (e.g. R) using API calls.
<b>Dataset Permissions</b> Specify fine grained data permissions on who can view, access, or update your dataset	<b>Re-use Data Structures</b> Design your dataset by specifying its data structures, variables, or units only once in BEXIS 2 and re-use them for any dataset.	<b>Dataset Versioning</b> Keep track of the evolution of your dataset (i.e. who did what and when) and return to any previous version if needed.
<b>Data Publication</b> Publish your dataset with a renown data repository or data journal (e.g. GFBio, Biodiversity Data Journal) and make it a citeable data publication identified by a DOI.	<b>Single Sign-on</b> Use your existing credentials of your organisation to log on to BEXIS. No need to remember another username and password.	

<http://bexis2.uni-jena.de/bexis2-software/features/>

Accessible for all project members

Advanced end user features

# Flexibility of metadata

## Requirements for the **ATTO Metadata**:

- Should follow **FAIR** Guiding Principles for scientific data management and stewardship. (Wilkinson et al., <https://www.nature.com/articles/sdata201618>)

- ✓ ...**F**indable – good metadata, data are indexed
- ✓ ...**A**ccessible – data are retrievable & metadata are always accesible
- ✓ ...**I**nteroperable – have common metadata standards
- ✓ ...**R**e-usable – richly described, follows community standards & with data usage license

- Should be able to **describe data sets** of all “**scientific ATTO niches**” in a meaningful way.



- Should meet the mandatory metadata requirements of DataCite/Max Planck Digital Library (MPDL). -> **easy publishing process**

Table 1: DataCite Mandatory Properties

<i>ID</i>	<i>Property</i>	<i>Obligation</i>
1	Identifier (with mandatory type sub-property)	M
2	Creator (with optional name identifier and affiliation sub-properties)	M
3	Title (with optional type sub-properties)	M
4	Publisher	M
5	PublicationYear	M
10	ResourceType (with mandatory general type description sub-property)	M

# XSD schema of metadata allows an easy definition of an project-related metadata structure.



ATTO data portal Dashboard Search Collect Plan Information

ATTO - Create Dataset

Import

Dataset Level Metadata

Dataset

Title

Abstract

Data Of Phd Thesis

Keywords

Identifier Type

Identifier Value

Publisher

Contributor

Contributor Type

Contributor Name

Publication Year

Data Classification

Resource Type

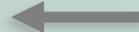
Format

Table 1: DataCite Mandatory Properties

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4	Publisher	M
5	PublicationYear	M
10	ResourceType (with mandatory general type description sub-property)	M

City

Country



```

1 <?xml version="1.0" encoding="utf-8"?>
2 <xs:schema targetNamespace="http://tempuri.org/XMLSchema.xsd"
3   elementFormDefault="qualified"
4   xmlns="http://tempuri.org/XMLSchema.xsd"
5   xmlns:metcs="http://tempuri.org/XMLSchema.xsd"
6   xmlns:xs="http://www.w3.org/2001/XMLSchema"
7   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
8 >
9   <xs:element name="Metadata">
10     <xs:complexType>
11       <xs:sequence>
12         <xs:element name="DatasetLevelMetadata">
13           <xs:complexType>
14             <xs:sequence>
15               <xs:element name="Dataset">
16                 <xs:complexType>
17                   <xs:sequence>
18                     <xs:element name="Title" type="xs:string" minOccurs="1">
19                       <xs:annotation>
20                         <xs:documentation>Title of the dataset to be uploaded to the ATTO data portal.</xs:documentation>
21                       </xs:annotation>
22                     </xs:element>
23                     <xs:element name="Abstract" type="xs:string" minOccurs="1">
24                       <xs:annotation>
25                         <xs:documentation>A brief overview of the resource to be uploaded to the ATTO data portal.</xs:documentation>
26                       </xs:annotation>
27                     </xs:element>
28                     <xs:element name="DataOfPhdThesis" type="xs:boolean" minOccurs="1">
29                       <xs:annotation>
30                         <xs:documentation>Was the dataset collected as part of a doctoral thesis? If so, do not check this box.</xs:documentation>
31                       </xs:annotation>
32                     </xs:element>
33                     <xs:element name="Keywords" type="xs:string" minOccurs="0">
34                       <xs:annotation>
35                         <xs:documentation>Provide a set of related keywords describing the content of the dataset.</xs:documentation>
36                       </xs:annotation>
37                     </xs:element>
38                     <xs:element name="IdentifierType" type="relatedIdentifierType" minOccurs="0">
39                       <xs:annotation>
40                         <xs:documentation>Applies only for data sets, which will be published via MPDL. A list of possible values is available at: http://www.mpdll.org/IdentifierType/</xs:documentation>
41                       </xs:annotation>
42                     </xs:element>
43                     <xs:element name="IdentifierValue" type="xs:string" minOccurs="0">
44                       <xs:annotation>
45                         <xs:documentation>Applies only for data sets, which will be published via MPDL. A list of possible values is available at: http://www.mpdll.org/IdentifierValue/</xs:documentation>
46                       </xs:annotation>
47                     </xs:element>
48                     <xs:element name="DataCreators">
49                       <xs:annotation>
50                         <xs:documentation>The main researchers involved working on the data, or the author of the dataset. Name format: Given Family</xs:documentation>
51                       </xs:annotation>
52                       <xs:complexType>
53                         <xs:sequence>
54                           <xs:element name="DataCreator" type="contact" minOccurs="1" maxOccurs="unbounded"/>
55                         </xs:sequence>
56                       </xs:complexType>
57                     </xs:element>
58                   </xs:sequence>
59                 </xs:complexType>
60               </xs:element>
61             </xs:sequence>
62           </xs:complexType>
63         </xs:element>
64       </xs:sequence>
65     </xs:complexType>
66   </xs:element>

```



Approx. **80 metadata variables** are requested as **predefined form** with **autocomplete function, dropdown menus** and **free-text fields**.



Dataset Level Metadata	Environmental Level Metadata
<p><b>Dataset</b></p> <p>General infos on dataset incl. For publication</p>	<p><b>Spatial Coverage</b></p>
<p><b>Data Creators</b></p> <p>Owner &amp; contributors</p>	<p><b>Geo Locations</b></p> <p>Lat, long, Coordinate reference system, ...</p>
<p><b>Data</b></p> <p>Methods, location, resolution, ...</p>	<p><b>Special Remarks</b></p>
<p><b>Data Quality</b></p>	<p><b>Published In</b></p>
<p><b>Plot Info</b></p>	<p><b>Project</b></p>
<p><b>Software</b></p>	<p><b>Project Title</b></p>
	<p><b>Funders</b></p>



Approx. **80 metadata variables** are requested as **predefined form with autocomplete function, dropdown menus and free-text fields.**

ATTO data portal Dashboard Search Collect Plan Information mguderle Help

ATTO - Create Dataset

Data

- \* Dataset Method Specification: Data have been averaged over 30 minute intervals. The time of measurement by the Picarro instrument has been taken. Due to the buffer system and the length of the inlets, there is some time delay between the arrival of the air mass at the inlet and the time of
- \* Dataset Sampling Specification: The data have been measured by CRDS instrument 'Picarro G1302 CKADS-18'. The instrument is connected to inlets, which are set up at the 80 m Walk-up tower at altitudes 79 m, 53 m, 38 m, 24 m, 04 m above ground level. The inlets are probed
- \* Dataset Sampling Equipment Info: The data have been measured by CRDS instrument 'Picarro G1302 CKADS-18'.
- \* Data Processing Level: Level 1
- \* Data Processing Level Standards: AmeriFlux
- \* Data Collection Layer: Above ground
  - Layer Start: 400
  - Layer End: 7900
- \* Start Date: 2012-01-01
- End Date: 2017-11-23
- Temporal Resolution: 30 min
- Number Of Parameters: 6
- \* Location: Select, please
  - Location Other: Select, please
  - Tall Tower (S 02 08.756 W 059 00.335)
  - Walk-Up Tower (S 02 08.637 W 058 59.992)
  - Triangular Mast (S 02 08.603 W 059 00.030)
- Abbreviations
  - Abbreviation (1): River
  - Description: Tree(s)
  - Soil
  - Other
- Data Quality
  - \* Check Performed
  - \* Issues
  - Curation Info

Plot Info

## Further adaptations of BEXIS 2



The ATTO Data Portal is accessible via [www.attodata.org](http://www.attodata.org).



**ATTO data portal** Dashboard Search Collect- Plan- **Information-** Register Login Help- ⚙

**ATTO**  
AMAZONIAN TALL  
TOWER OBSERVATORY

Register Login **Continue without Login**

**On ATTO**

The Amazon Tall Tower Observatory (ATTO) is a joint German-Brazilian project launched in 2009. ATTO is with its tall tower, the associated research infrastructure and scientific plots a unique interdisciplinary scientific platform in a region of global significance. Its core objective is to obtain a detailed understanding of the biogeochemical cycles and energy fluxes at the geo-, bio-, atmosphere interface in the Amazon, and to integrate this knowledge into diverse climate and Earth system models to improve our prognostic abilities regarding climatic and ecological processes as well as our understanding of the various effects of global climate change.

The ATTO Data Portal is a data management platform, built for storing, sharing, exchanging and publishing data of the ATTO research consortium scientists.

**Data accessibility**

The metadata of the datasets stored in this portal are freely accessible to everyone and can be explored by clicking on the button "Continue without Login". Datasets which are published and do have a persistent identifier (DOI or similar) are publically available as well. To access datasets which are not public available, you need to be a registered user and request the datasets.

**Registration**

For registration:

1. Click on the "Register" button above and follow the indicated procedure.
2. Send an e-mail to [attodbm\[at\]bgc-jena.mpg.de](mailto:attodbm[at]bgc-jena.mpg.de) briefly indicating your intended use of the datasets

Please note that the validation and approval of a registration may require up to several working days.

The registration does not make you a member of ATTO – it is intended to ensure that the ATTO Data Policy is known to and accepted by all ATTO data users. Registered users will receive notifications about updates and corrections of the datasets they have downloaded.

Details regarding the use and functions of the ATTO Data Portal can be found under the link "Help" above. If you have any further questions and suggestion, please contact us.

Powered by

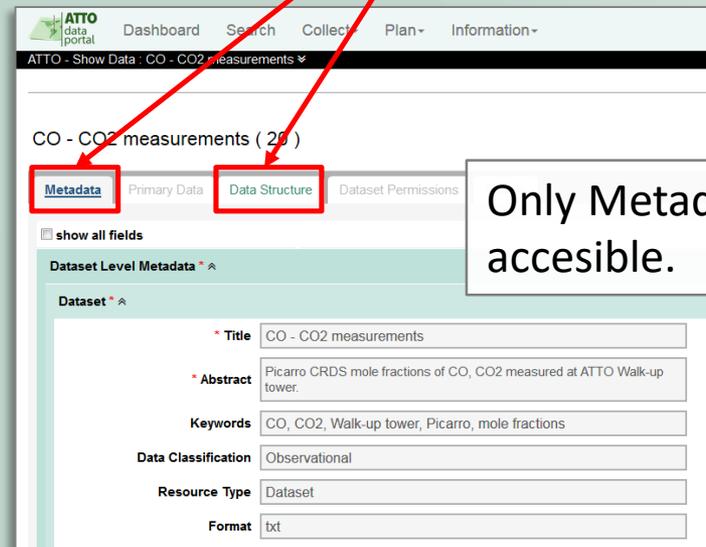
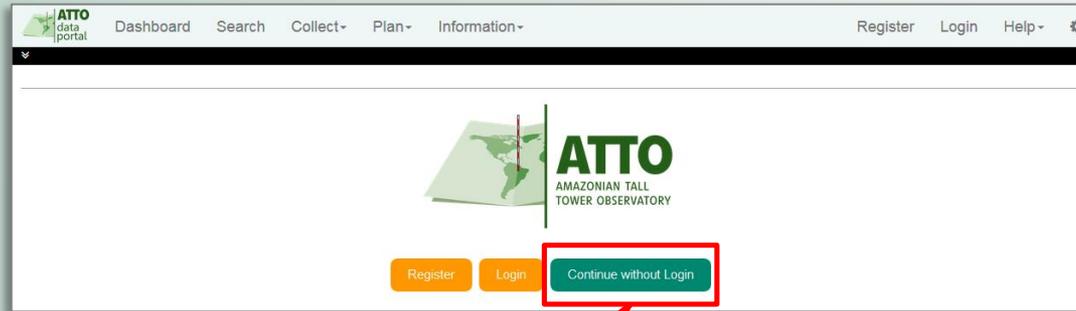
**BEXIS**  
BIOGEOCHEMISTRY EXCHANGE INFRASTRUCTURE

Privacy Policy Contact Us Imprint

Max Planck Institute for Biogeochemistry  
MAX-PLANCK-GESELLSCHAFT  
INPA  
UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE  
UEA  
UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE  
FINEP  
FUNDAÇÃO DE APOIO À PESQUISA EM CIÊNCIAS  
FAPEAM  
FUNDAÇÃO ELSA ARAÚJO



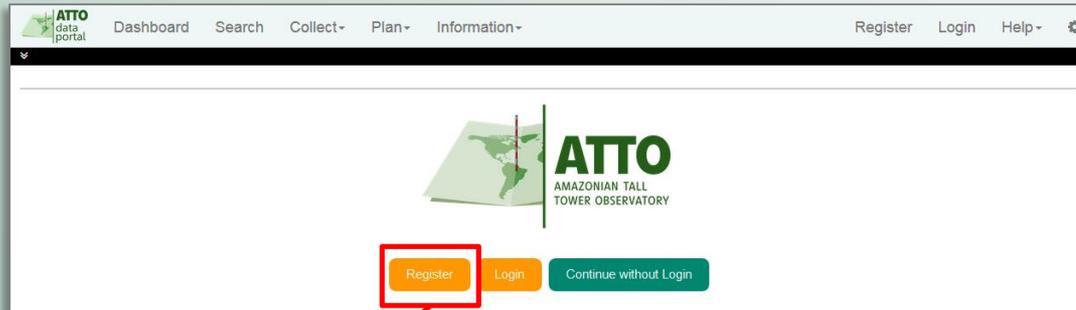
# Free access to metadata for external researchers without registration.



Only Metadata and data structure are accessible.



# Registration is recommended for all ATTO consortium members & Data Policy has to be accepted by each registered user.



ATTO data portal Dashboard Search Collect- Plan- Information- Register Login Help- ⚙

Register

Create a new account

User Name: TestUser

Email: testuser@bgc-jena.mpg.de

Password: \*\*\*\*\*

Confirm password: \*\*\*\*\*

I accept the Terms and Conditions.  
 I agree to the ATTO data Policy.

Specifically as A DATA CONTRIBUTOR, I agree to:

- Provide metadata for each set of data collected and derived, including appropriate acknowledgments.
- Provide verification of data quality according to the adopted standard method or recommended protocol.
- Make the data available to ATTO collaborators as fast as possible; laws indicate data should be made publicly available within 6 months. The only exceptions are for data needed for student theses - these should be made public within 6 months after the thesis defense.

As a DATA USER, I agree to:

- Inform the researcher who contributed the data about how I intend to use data before I start using it; if the data are not public, I agree to communicate with the data provider so that they can contribute scientifically to any research product.
- Recognize the data by citing the relevant DOI or article(s), and acknowledging ATTO support.
- To not forward downloaded data to third parties.
- That data which were collected as part of a dissertation are granted specific protection and might not be freely available in special cases.

Register

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Max Planck Institute for Biogeochemistry, INPA, UEA, FAPEAM, Fundação Ezequiel Dias, Finep

ATTO data portal Dashboard Search Collect- Plan- Information- Register Login Help- ⚙

Registration

Account type: Person

FirstName: Test

LastName: User

Phone: +49 3641 576164

Mobile:

Fax:

Street: Hans-Knoll-Straße 10

ZipCode: 07745

City: Jena

Country: Germany

Website: www.attodata.org

ORCID:

Atto Member:  True  False

E-Mail: testuser@bgc-jena.mpg.de

Institute: Max Planck Institute for Biogeochemistry, Instituto Nacional de Pesquisas Espaciais, Universidade Federal de Sao Paulo, Brazil, Brazilian Agricultural Research Corporation (Embrapa), Institute of Environmental Physics, University of Bremen, Karlsruhe-Institute of Technology - KIT

Save

BEXIS

Privacy Policy Contact Us Imprint

Max Planck Institute for Biogeochemistry, INPA, UEA, FAPEAM, Fundação Ezequiel Dias, Finep

“Information”: general information about the data portal and the field site as download and access to the **ATTO Calendar**.



A screenshot of the ATTO data portal website. The top navigation bar includes "ATTO data portal", "Dashboard", "Search", "Collect-", "Plan-", and "Information-". The "Information-" dropdown menu is open, showing "General Information" (highlighted with a red box and a red arrow) and "Calendar". On the left, a blue box highlights the "Portal", "Logistics", and "Science" menu items, with a blue arrow pointing to the "General Information" page content. The main content area, titled "General Information", contains a list of links: "Data Policy", "How To's for using the portal", "Assign Rights", "Data Publication", "Open Access", and "....". Below this list are three green buttons: "How To Explore Data", "How To Upload Data", and "How To Assign Rights". The "Upload Data" section includes the text "How to upload data and fill in metadata information." and the "Assigning Rights" section includes "How to assign rights on your data to other users." The "Data Publication" section is partially visible at the bottom.



“Information”: general information about the data portal and the field site as download and access to the **ATTO Calendar**.



A screenshot of the ATTO data portal website. The top navigation bar includes "Dashboard", "Search", "Collect", "Plan", and "Information". The "Information" dropdown menu is open, showing "General Information" and "Calendar", with a red arrow pointing to "General Information". On the left side, a blue box highlights the "Portal", "Logistics", and "Science" menu items, with a blue arrow pointing to the "Maps" link in the main content area. The main content area is titled "General Information" and contains a list of links: "Maps", "Travel infos", "Camp rules", "Safety Regulations", and "....". Below this list are sections for "How to find datasets via metadata information and request datasets.", "Upload Data", "Assigning Rights", and "Data Publication", each with a corresponding "How To" button.



“Information”: general information about the data portal and the field site as download and access to the **ATTO Calendar**.



A screenshot of the ATTO data portal website. The top navigation bar includes "Dashboard", "Search", "Collect", "Plan", and "Information". The "Information" dropdown menu is open, showing "General Information" and "Calendar", with a red arrow pointing to "General Information". On the left, a blue box highlights the "Portal", "Logistics", and "Science" menu items, with a blue arrow pointing to the "Contact list" section. The "Contact list" section is highlighted with a blue border and contains a bullet point for "Portal" and a description: "The ATTO data portal is the main tool for data sharing within the ATTO consortium and for external researchers. Step by step tutorials on how to use the ATTO data portal are provided. Please review the following documents carefully before uploading or sharing any data to the portal. The data management will help with sharing and publication of data." Below this are sections for "Data Policy", "Explore Data", "Upload Data", "Assigning Rights", and "Data Publication", each with a corresponding "How To" button.



# “Information”: general information about the data portal and the field site as download and access to the ATTO Calendar.



ATTO data portal Dashboard Search Collect- Plan- Information-  
General Information

General Information

Portal  
Logistics  
Science

## General Information

### Portal

The ATTO data portal is the main tool for data sharing within the ATTO consortium and for external researchers. Step by step tutorials on how to use the ATTO data portal are provided. Please review the following documents carefully before uploading and sharing any data to the portal. The data management will help with sharing and publication of data.

### Data Policy

All data sharing has to be done via the ATTO data portal. Please read the Data Policy carefully - it is intended to ensure that the ATTO Data policy is known to and accepted by all ATTO Data users.

[Data Policy](#)

### Explore Data

How to find datasets via metadata information and request datasets.

[How To Explore Data](#)

### Upload Data

How to upload data and fill in metadata information.

[How To Upload Data](#)

### Assigning Rights

How to assign rights on your data to other users.

[How To Assign Rights](#)

### Data Publication

ATTO data portal Dashboard Search Collect- Plan- Information-  
Calendar

Use this calendar for planning and scheduling your field trips, events and meetings.

## ATTO CALENDAR

< June 2018 > << >> < Today > 11 - 17 Jun 2018 Scheduler Day 5 Days

M	T	W	T	F	S	S	W24	11 Jun 2018	Tue 12	Wed 13	Thu 14
28	29	30	31	1	2	3					
4	5	6	7	8	9	10					
11	12	13	14	15	16	17					
18	19	20	21	22	23	24					
25	26	27	28	29	30	1					
2	3	4	5	6	7	8					

All Calendars ^

- Events/Public holiday
- Media&PR
- Meetings
- Science
- Tech&Support
- Transport
- Travel

Filter v

Contact ^

Need help?  
Contact us at: jost.lavric@bgc-jena.mpg.de





Data: [www.attodata.org](http://www.attodata.org)  
News: [www.attoproject.org](http://www.attoproject.org)  
Contact: [attodbm@bgc-jena.mpg.de](mailto:attodbm@bgc-jena.mpg.de)  
Twitter: [@ATTOresearch](https://twitter.com/ATTOresearch)  
Instagram: [attoresearch](https://www.instagram.com/attoresearch)