

# Trying to track the re-use of research data – open licensing, DOI usage and the Data Citation Index

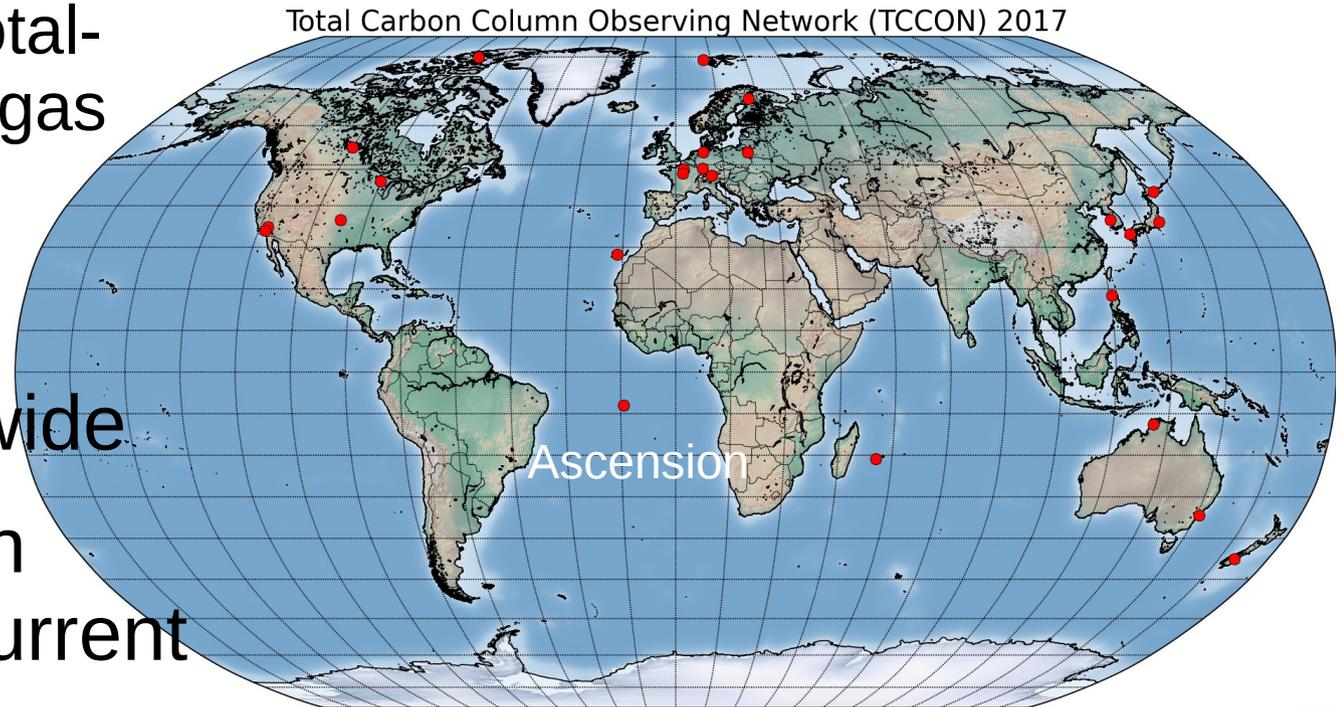
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Max Planck Institute for Biogeochemistry  
Jena, Germany

Max-Planck-Institut  
für Biogeochemie



# Total Carbon Column Observing Network (TCCON)

- Global network for total-column greenhouse gas (GHG) observations
- Established 2005
- 25 stations worldwide
- Primary calibration reference for all current and future GHG satellite observations



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# Ascension Island TCCON station



- Established 2012
- Only equatorial station and only station sampling air from Africa and South America
- Operating in extremely harsh environment
- Data used in ~14 publications in 2016 and 2017.

# TCCON data policy and licence

- TCCON uses self-defined open data license (no acceptable standard licence).
- Data may be freely downloaded and examined without registration.
- Use in scientific publications requires contacting PIs before submission. Proper acknowledgement required, co-authorship might be requested.
- Data hosted by CaltechDATA since Oct 2017.

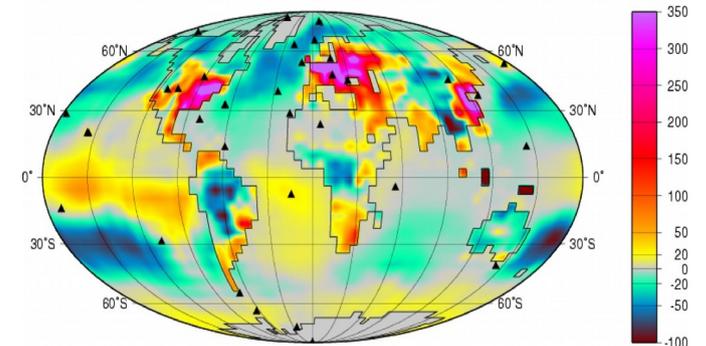


# TCCON data users

- Providers of GHG satellite observations: NASA, JAXA, ESA, ...
- Users of GHG satellite observations
- Carbon cycle inverse modelling community
- Other similar networks



A Posteriori Fluxes + Fossil Emissions, Average July 1995 - June 2000 [gC/m



*Rödenbeck et al., Atmos. Chem. Phys., 9, 5331–5342, 2009*

# Introduction to DOIs

- A DOI provides a reference to an online document, dataset or other resource through a landing page.
- URLs may change but DOIs should live much longer.
- A DOI like `10.14291/tccon.archive/1348407` contains a prefix (`10.14291`) and a suffix (rest).
- DOIs should have metadata about the resource attached.
- DOIs do not prescribe any data format for the resource itself.

# TCCON DOI usage

- TCCON switched from URLs to DOIs in 2014 after the data archive was moved to a new hosting institution.
- Main goals:
  - Provide an exact reference to the dataset that was used in a publication (reproducibility).
  - Allow tracking of TCCON data use in scientific publications (traceability).

# Advantages of DOIs vs URLs

- URLs change often for a variety of reasons. Therefore, URLs cited in the scientific literature may become invalid very quickly.
- TCCON has already had to move its archive twice in 10 years, rendering all dataset URLs invalid. Due to the DOIs, the forced move in 2017 was accomplished without major disruptions for the data users or the existing citations.

# DOI granularity

- Granularity describes how specific a DOI is for the linked data resource.
- There might be just one DOI for the whole archive or individual DOIs for subsets of data.
- TCCON dataset DOIs uniquely identify the processing software revision, the station and the data release but not the subset of data that was used, e.g.:  
`10.14291/tcccon.ggg2014.ascension01.R0/1149285`

# DOI metadata

- DOIs have metadata about the resource attached.
- The type of metadata and the format is not fixed. Several accepted standards exist: e.g. Dublin Core, DataCite Metadata Schemata, ...
- DOI metadata is provided in XML format.
- XML metadata file format definition is also provided in XML.

# XML metadata for DOIs: Datacite Metadata Schema 4.0

- Describes a set of required and optional metadata elements for a resource:
  - Creators & contributors
  - Description
  - Data Versions
  - Data formats information
  - Time information
  - Geographic information
  - Funding information
  - ...



DataCite  
DataCite - International Data Citation

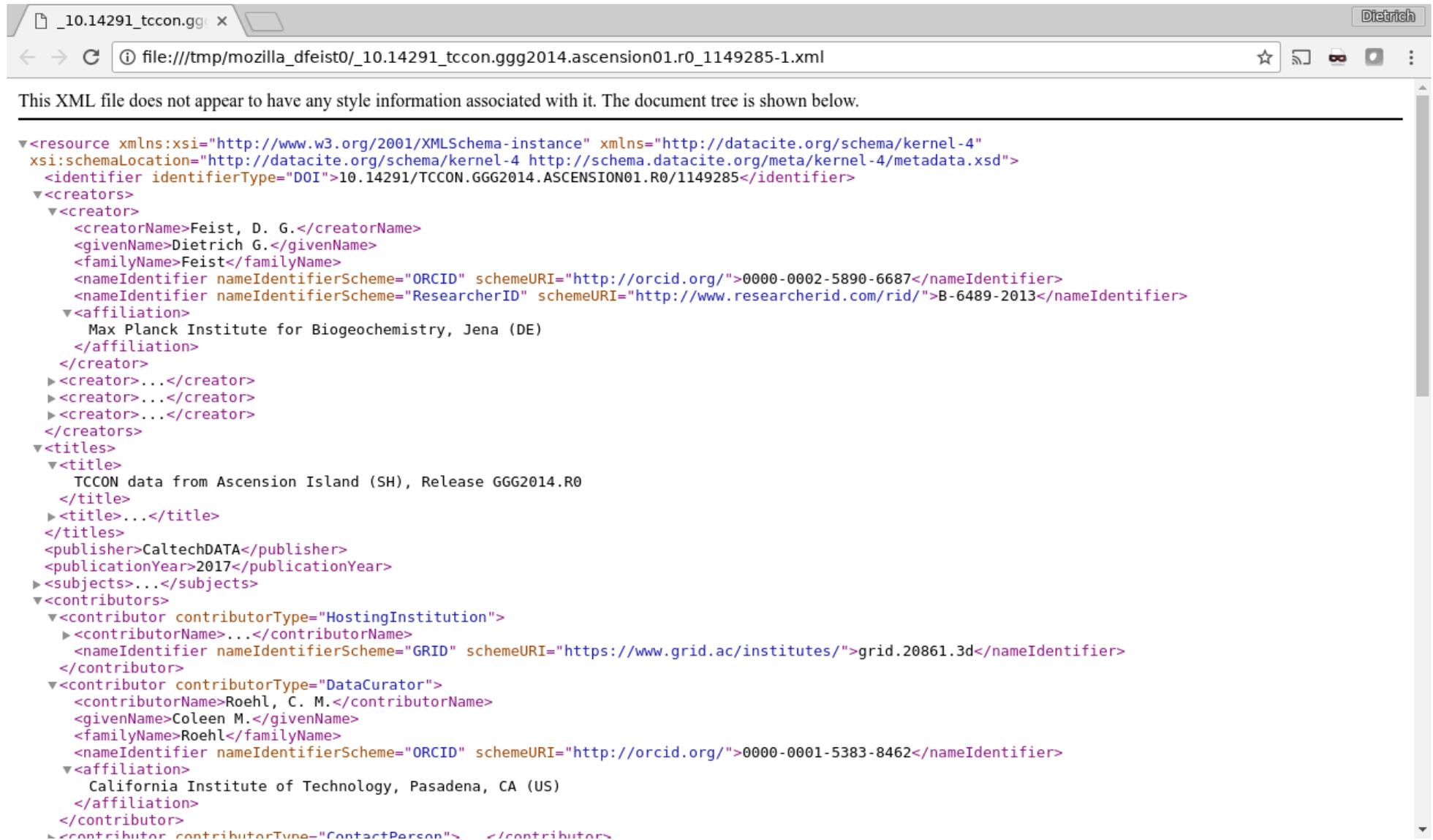
Note that this version of the schema is not backward compatible with previous schema versions. DataCite will provide ongoing support for the use of previous schema versions for a minimum of one year after the release of this version.

## DataCite Metadata Schema Documentation for the Publication and Citation of Research Data

Citation:  
DataCite Metadata Working Group. (2016). DataCite Metadata Schema Documentation for the Publication and Citation of Research Data. Version 4.0. DataCite e.V.  
<http://doi.org/10.5438/0012>.

Members of the Metadata Working Group  
Madelaine de Smaele, TU Delft (co-chair of working group)  
Joan Starr, California Digital Library (co-chair of working group)  
Jan Ashton, British Library  
Amy Barton, Purdue University Library  
Tina Bradford, NRC/CISTI (New)  
Anne Golek-Figiel, Inist-CNRS  
Stefanie Dietiker, ETH Zurich (New)  
Janean Elliott, DOE/DSTI  
Berit Genat, TIB  
Karoline Harzenetter, GESIS  
Barbara Hirschmann, ETH Zurich (Departing)  
Stefan Jakobsson, SND (New)  
Jean-Yves Mailloux, NRC/CISTI (Departing)  
Lars Holm Nielsen, CERN (Departing)  
Mohamed Yahia, Inist-CNRS  
Frauke Ziedorn, TIB (On leave, Metadata Supervisor)

# XML metadata file example



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      <nameIdentifier nameIdentifierScheme="ORCID" schemeURI="http://orcid.org/">0000-0002-5890-6687</nameIdentifier>
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# XML metadata file example

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# XML metadata file example

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# Metadata view @datacite.org

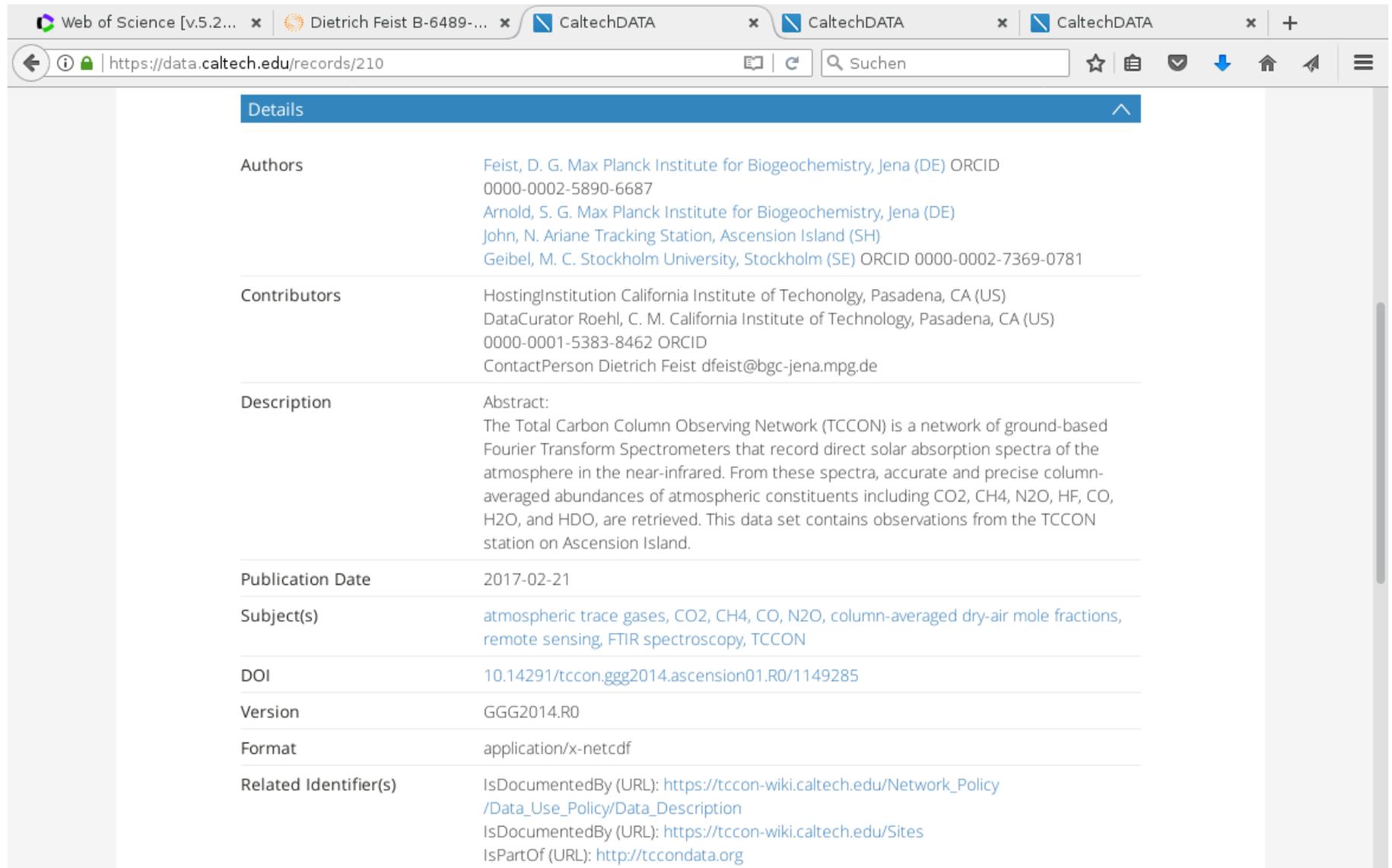
The screenshot shows a web browser window with multiple tabs. The active tab is 'DataCite Search' with the URL <https://search.datacite.org/works/10.14291/tccon.ggg2014.ascension01.ro/1149285>. The page header includes 'DataCite Search' and navigation links for 'Works', 'People', 'Data Centers', 'Members', 'Support', and a 'Sign in' button. The main content area features a title 'TCCON data from Ascension Island (SH), Release GGG2014.R0' by 'D. G. Feist, S. G. Arnold, N. John & M. C. Geibel', published in 2017 via CaltechDATA. A detailed description follows, explaining the TCCON network and the data retrieved. A 'Cite' button and a DOI link are provided. On the right, a sidebar lists the 'Data Center' (California Institute of Technology), 'Member' (California Digital Library), and 'Download' options (DataCite XML, RDF/XML, Schema.org JSON-LD, Citeproc JSON). Below this, 'Share on' links for Twitter and Facebook are shown. At the bottom, a 'Resource Types' section lists 'Dataset' and 'Text', both with a count of 1. A '2 Related Works' section is partially visible at the bottom left, showing a link to '2014 TCCON Data Release'.

# Metadata view @CaltechDATA

The screenshot shows a web browser window with three tabs open, all titled 'CaltechDATA'. The address bar shows the URL 'https://data.caltech.edu/records/210'. The page features a dark blue header with a search bar on the left and 'Home' and 'Login' links on the right. The main content area is white and displays the following information:

- Dataset Icon:** A blue circle containing a white bar chart with an upward-trending line graph, labeled 'Dataset'.
- Title:** 'TCCON data from Ascension Island (SH), Release GGG2014.R0'
- Metadata:**
  - Dataset icon
  - 2017-02-21
  - CaltechDATA
- Download:** A large grey button with a blue downward arrow icon and the text 'Download'.
- Details:** A blue bar with the text 'Details' and an upward arrow icon.
- Authors:**
  - Feist, D. G. Max Planck Institute for Biogeochemistry, Jena (DE) ORCID 0000-0002-5890-6687
  - Arnold, S. G. Max Planck Institute for Biogeochemistry, Jena (DE)
  - John, N. Ariane Tracking Station, Ascension Island (SH)
  - Geibel, M. C. Stockholm University, Stockholm (SE) ORCID 0000-0002-7369-0781
- Contributors:**
  - HostingInstitution California Institute of Technology, Pasadena, CA (US)
  - DataCurator Roehl, C. M. California Institute of Technology, Pasadena, CA (US) ORCID 0000-0001-5383-8462

# Metadata view @CaltechDATA



Details	
Authors	Feist, D. G. Max Planck Institute for Biogeochemistry, Jena (DE) ORCID 0000-0002-5890-6687 Arnold, S. G. Max Planck Institute for Biogeochemistry, Jena (DE) John, N. Ariane Tracking Station, Ascension Island (SH) Geibel, M. C. Stockholm University, Stockholm (SE) ORCID 0000-0002-7369-0781
Contributors	HostingInstitution California Institute of Techonolgy, Pasadena, CA (US) DataCurator Roehl, C. M. California Institute of Technology, Pasadena, CA (US) 0000-0001-5383-8462 ORCID ContactPerson Dietrich Feist dfeist@bgc-jena.mpg.de
Description	Abstract: The Total Carbon Column Observing Network (TCCON) is a network of ground-based Fourier Transform Spectrometers that record direct solar absorption spectra of the atmosphere in the near-infrared. From these spectra, accurate and precise column-averaged abundances of atmospheric constituents including CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HF, CO, H <sub>2</sub> O, and HDO, are retrieved. This data set contains observations from the TCCON station on Ascension Island.
Publication Date	2017-02-21
Subject(s)	atmospheric trace gases, CO <sub>2</sub> , CH <sub>4</sub> , CO, N <sub>2</sub> O, column-averaged dry-air mole fractions, remote sensing, FTIR spectroscopy, TCCON
DOI	10.14291/tccon.ggg2014.ascension01.R0/1149285
Version	GGG2014.R0
Format	application/x-netcdf
Related Identifier(s)	IsDocumentedBy (URL): <a href="https://tccon-wiki.caltech.edu/Network_Policy/Data_Use_Policy/Data_Description">https://tccon-wiki.caltech.edu/Network_Policy/Data_Use_Policy/Data_Description</a> IsDocumentedBy (URL): <a href="https://tccon-wiki.caltech.edu/Sites">https://tccon-wiki.caltech.edu/Sites</a> IsPartOf (URL): <a href="http://tccondata.org">http://tccondata.org</a>

# Metadata view @CaltechDATA

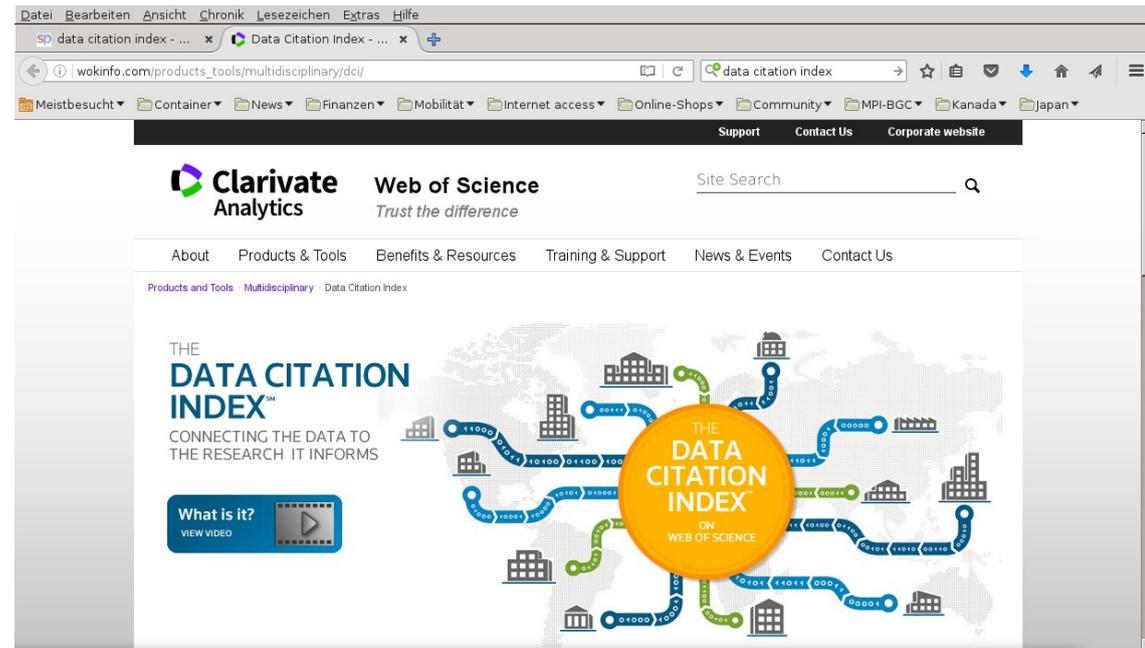
DOI	<a href="https://doi.org/10.14291/tccon.ggg2014.ascension01.R0/1149285">10.14291/tccon.ggg2014.ascension01.R0/1149285</a>
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Relevant Dates	Created: 2014-10-01 Updated: 2017-10-02 Collected: 2012-05-22/2016-12-21
License	other-license
Funding	Max Planck Society Max Planck Institute for Biogeochemistry
Language	eng
Geographic coverage	Ariane Tracking Station (AC) -7.9165 -14.3325

# Getting your data cited and its usage tracked

- In theory, only two steps are needed:
  - Get your data users to cite your data set references with the DOI.
  - Get index providers (e.g. Web of Science) to count these references.
- In practice, this turns out to be more complicated.

# Data Citation Index (DCI) in the Web of Science (WoS)

- Dedicated database for indexing scientific datasets in WoS
- Not part of WoS Core Collection: requires separate subscription!



# Getting your DOIs and metadata registered in the DCI

- Contact WoS/DCI representative directly.
- Prepare your metadata (largest part of the work!)
- DCI creates a parent repository in the DCI.
- Send your meta data for all datasets.
- Set up a way to update your entries.
- Wait for WoS to start counting ...

# Metadata view @DCI

The screenshot shows the Web of Science interface for a record titled "TCCON Data Archive". The browser address bar shows the URL: [https://apps.webofknowledge.com/full\\_record.do?product=DRCI&search\\_mode=](https://apps.webofknowledge.com/full_record.do?product=DRCI&search_mode=). The page header includes navigation links for "Web of Science", "InCites", "Journal Citation Reports", "Essential Science Indicators", "EndNote", and "Publons", along with "Sign In", "Help", and "English" options. The "Web of Science" logo and "Clarivate Analytics" branding are also present. The main content area is divided into two columns. The left column contains the following information: **TCCON Data Archive** (highlighted in yellow), **Edited by:** Total Carbon Column Observing Network (TCCON) team, **TCCON Data Archive**, **Source URL:** <http://dx.doi.org/10.14291/tcon.archive/1348407>, **Viewed Date:** 20 Jun 2016, **Published:** 2014, **Abstract:** The Total Carbon Column Observing Network (TCCON) is a network of ground-based Fourier Transform Spectrometers that record direct solar absorption spectra of the atmosphere in the near-infrared. From these spectra, accurate and precise column-averaged abundances of atmospheric constituents including CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HF, CO, H<sub>2</sub>O, and HDO, are retrieved. This is the TCCON Data Archive which contains the datasets from the individual TCCON stations., **Keywords:** **Author Keywords:** atmospheric trace gases; CO<sub>2</sub>; Co; CH<sub>4</sub>; column-averaged dry-air mole fractions; TCCON; FTIR spectroscopy; Remote Sensing; N<sub>2</sub>O, and **Author Information** with **Addresses:** listed below. The right column contains a **Citation Network** section showing **0 Times Cited** and **0 Cited References**, with a **Create Citation Alert** button and a note "(data from Web of Science Core Collection)". Below this is an **All Times Cited Counts** section listing zero citations across various databases: All Databases, Web of Science Core Collection, BIOSIS Citation Index, Chinese Science Citation Database, Data Citation Index, Russian Science Citation Index, and SciELO Citation Index.

# Metadata view @DCI

The screenshot shows a browser window with the URL [https://apps.webofknowledge.com/full\\_record.do?product=DCI&search\\_mode=](https://apps.webofknowledge.com/full_record.do?product=DCI&search_mode=). The page displays metadata for a record in the Data Citation Index. The main content is organized into several sections: Author Information, Categories / Classification, Document Information, and Other Information. A table lists associated data sets with links to external sources. A right-hand sidebar contains sections for Usage Count, citation information, and a suggestion to correct the record.

**Author Information**  
**Addresses:**  
1. USA

**Categories / Classification**  
**Research Areas:** Geology; Meteorology & Atmospheric Sciences  
**Web of Science Category:** Geosciences, Multidisciplinary; Meteorology & Atmospheric Sciences

**Document Information**  
**Document Type:** Repository  
**Language:** English  
**Accession Number:** DRCI:DATA2017048011072810

**Other Information**  
**Cited References in Data Citation Index:** 0  
**Associated Data:** 38 (from Data Citation Index)

TCCON data from Indianapolis (US), Release GGG2014.R1 TCCON data from Indianapolis, Indiana, USA, Release GGG2014.R1	Data set	<a href="#">Link to External Source</a>
TCCON data from Edwards (US), Release GGG2014.R1 TCCON data from Armstrong Flight Research Center, Edwards, CA, USA, Release GGG2014.R1	Data set	<a href="#">Link to External Source</a>
TCCON data from Rikubetsu (JP), Release GGG2014.R1 TCCON data from Rikubetsu, Hokkaido, Japan, Release GGG2014.R1	Data set	<a href="#">Link to External Source</a>
TCCON data from Tsukuba (JP), 125HR, Release GGG2014.R1 TCCON data from Tsukuba, Ibaraki, Japan, 125HR, Release GGG2014.R1	Data set	<a href="#">Link to External Source</a>

[View All Associated Data](#)

**Usage Count**  
Last 180 Days: 0  
Since 2013: 0  
[Learn more](#)

**This record is from:**  
**Data Citation Index**

[How to cite this Resource](#)

**Suggest a correction**  
If you would like to improve the quality of the data in this record, please [suggest a correction](#).

# Metadata view @DCI

The screenshot displays the Web of Science interface. At the top, the browser address bar shows the URL: <https://apps.webofknowledge.com/summary.do?product=DRCI&parentProduct=C>. The navigation bar includes links for Web of Science, InCites, Journal Citation Reports, Essential Science Indicators, EndNote, and Publons. The main header features the Web of Science logo and the Clarivate Analytics logo. Below the header, there are tabs for Search, Search Results, My Tools, Search History, and Marked List. The search results page shows a list of records sorted by 'Times Cited -- highest to lowest'. The first record is 'TCCON data from Saga (JP), Release GGG2014.R0 TCCON data from Saga, Japan, Release GGG2014.R0' with 8 citations. The second record is 'TCCON data from Park Falls (US), Release GGG2014.R0 TCCON data from Park Falls, Wisconsin, USA, Release GGG2014.R0' with 8 citations. The third record is 'TCCON data from Karlsruhe (DE), Release GGG2014.R1 TCCON data from Karlsruhe, Germany, Release GGG2014.R1' with 7 citations. The left sidebar contains 'Associated Records: 38', 'Refine Results' section with a search box, and filters for 'Years Published' (2014, 2016, 2015) and 'Document Types' (DATA SET).

Web of Science [v.5.2... x +]  
https://apps.webofknowledge.com/summary.do?product=DRCI&parentProduct=C Suchen

Web of Science InCites Journal Citation Reports Essential Science Indicators EndNote Publons Sign In Help English

Web of Science Clarivate Analytics

Search Search Results My Tools Search History Marked List

Associated Records: 38  
(from Data Citation Index)

You searched for: Total Carbon Column Observing Network (TCCON) team. TCCON Data Archive ...More

Refine Results

Search within results for...

Years Published

- 2014 (28)
- 2016 (7)
- 2015 (3)

more options / values...

Refine

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By: Kawakami, Shuji; Ohyama, Hirofumi; Arai, Kohei; et al.  
TCCON Data Archive  
DOI: <http://dx.doi.org/10.14291/tcccon.ggg2014.saga01.R0/1149283> Version: GGG2014.R0  
Document Type: Data set  
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Times Cited: 8 (from All Databases)  
Usage Count
2. **TCCON data from Park Falls (US), Release GGG2014.R0 TCCON data from Park Falls, Wisconsin, USA, Release GGG2014.R0**  
By: Wennberg, Paul O; Roehl, Coleen M; Wunch, Debra; et al.  
TCCON Data Archive  
DOI: <http://dx.doi.org/10.14291/tcccon.ggg2014.parkfalls01.R0/1149161> Version: GGG2014.R0  
Document Type: Data set  
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3. **TCCON data from Karlsruhe (DE), Release GGG2014.R1 TCCON data from Karlsruhe, Germany, Release GGG2014.R1**  
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### TCCON data from Ascension Island (SH), Release GGG2014.R0 TCCON data from Ascension Island, Saint Helena, Ascension and Tristan da Cunha, Release GGG2014.R0

**From Repository:** [TCCON Data Archive](#)

**By:** Feist, Dietrich G; Arnold, Sabrina G; John, Nicholas; Geibel, Marc C

**TCCON Data Archive**  
**DOI:** <http://dx.doi.org/10.14291/tccon.ggg2014.ascension01.R0/1149285>  
**Viewed Date:** 18 Apr 2017  
**Published:** 2014  
**Version:** GGG2014.R0

#### Abstract

The Total Carbon Column Observing Network (TCCON) is a network of ground-based Fourier Transform Spectrometers that record direct solar absorption spectra of the atmosphere in the near-infrared. From these spectra, accurate and precise column-averaged abundances of atmospheric constituents including CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HF, CO, H<sub>2</sub>O, and HDO, are retrieved. This data set contains observations from the TCCON station on Ascension Island.

#### Keywords

**Author Keywords:** atmospheric trace gases; CO<sub>2</sub>; CH<sub>4</sub>; CO; N<sub>2</sub>O; column-averaged dry-air mole fractions; Remote Sensing; FTIR spectroscopy; TCCON

#### Citation Network

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### TCCON data from Ascension Island (SH), Release GGG2014.R0 TCCON data from Ascension Island, Saint Helena, Ascension and Tristan da Cunha, Release GGG2014.R0

From Repository: [TCCON Data Archive](#)  
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#### Citation Network

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**Keywords**  
**Author Keywords:** atmospheric trace gases; CO<sub>2</sub>; CH<sub>4</sub>; Co; N<sub>2</sub>O; column-averaged dry-air mole fractions; Remote Sensing; FTIR spectroscopy; TCCON

**Author Information**  
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1. Max Planck Institute for Biogeochemistry, Jena , Germany  
2. Max Planck Institute for Biogeochemistry, Jena , Germany  
3. Ariane Tracking Station, Ascension Island , Saint Helena

**Funding**

Funding Agency	Grant Number
Max Planck Society	
Max Planck Institute for Biogeochemistry	

**Categories / Classification**  
**Research Areas:** Geology; Meteorology & Atmospheric Sciences  
**Web of Science Category:** Geosciences, Multidisciplinary; Meteorology & Atmospheric Sciences

**Document Information**  
**Document Type:** Data set  
**Language:** English  
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Max Planck Institute for Biogeochemistry

**Categories / Classification**  
**Research Areas:** Geology; Meteorology & Atmospheric Sciences  
**Web of Science Category:** Geosciences, Multidisciplinary; Meteorology & Atmospheric Sciences

**Document Information**  
**Document Type:** Data set  
**Language:** English  
**Accession Number:** DRCI:DATA2017049011072812

**Other Information**  
**Geospatial:**

Descriptor Term
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Latitude: -7.9165
Longitude: -14.3325

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**1. Title:** TCCON data from Ascension Island (SH), Release GGG2014.R0 TCCON data from Ascension Island, Saint Helena, Ascension and Tristan da Cunha, Release GGG2014.R0  
**Author(s):** Feist, Dietrich G.; Arnold, Sabrina G.; John, Nicholas; et al.  
**DOI:** <http://dx.doi.org/10.14291/tcon.ggg2014.ascension01.R0/1149285> added 15-Oct-17

**2. Title:** Comparisons of the Orbiting Carbon Observatory-2 (OCO-2) X-CO2 measurements with TCCON  
**Author(s):** Wunch, Debra; Wennberg, Paul O.; Osterman, Gregory; et al.  
**Source:** Atmospheric Measurement Techniques **Volume:** 10 **Issue:** 6 **Pages:** 2209-2238 **Published:** JUN 13 2017  
**Times Cited:** 6  
**DOI:** [10.5194/amt-10-2209-2017](https://doi.org/10.5194/amt-10-2209-2017) added 15-Oct-17

# Things we had to learn the hard way

- URLs don't work for citations!
- Make sure you have full control over your own DOIs and metadata!
- Think about metadata from the beginning!
- Set up a reasonable level of granularity that works for
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  - index providers
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- Not everybody will follow your data licence or use your data in the way you want.