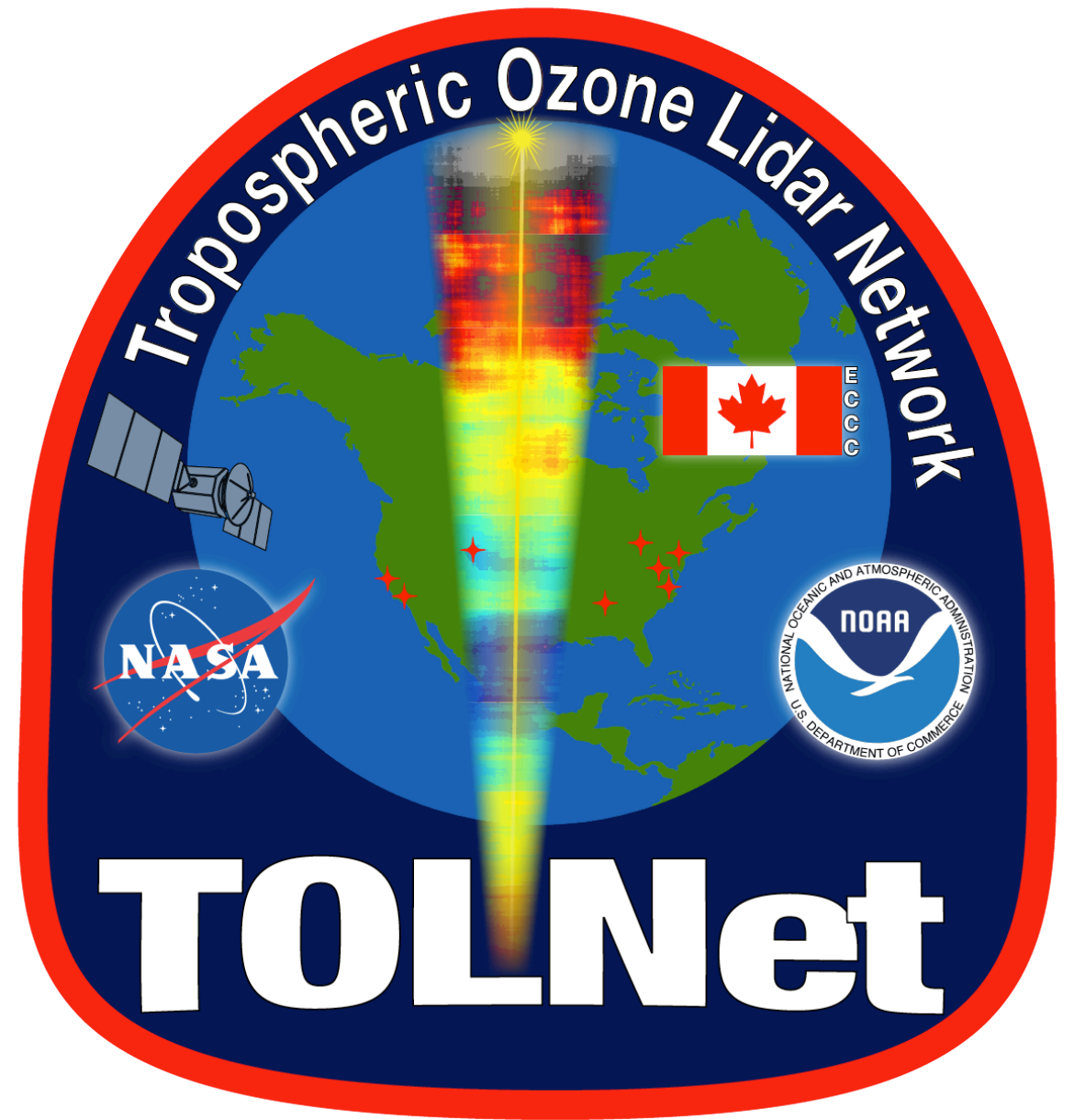


The Last Mile Matters

IN12A-06 The TOLNet 2.0 website:
How an API can promote Open
Science and FAIR Principles



Authors: Crystal Gummo, John Sullivan, Michael Shook, Gao Chen



It starts with a vision.



Ozone?
↙

Scientists Assemble!!!

(Data Collection begins)





But it's not enough to collect the data.
It must be stored in a standard format too.





And even then, you aren't done.

None of what came before matters if the data never ends up in the hands of the people who need it.



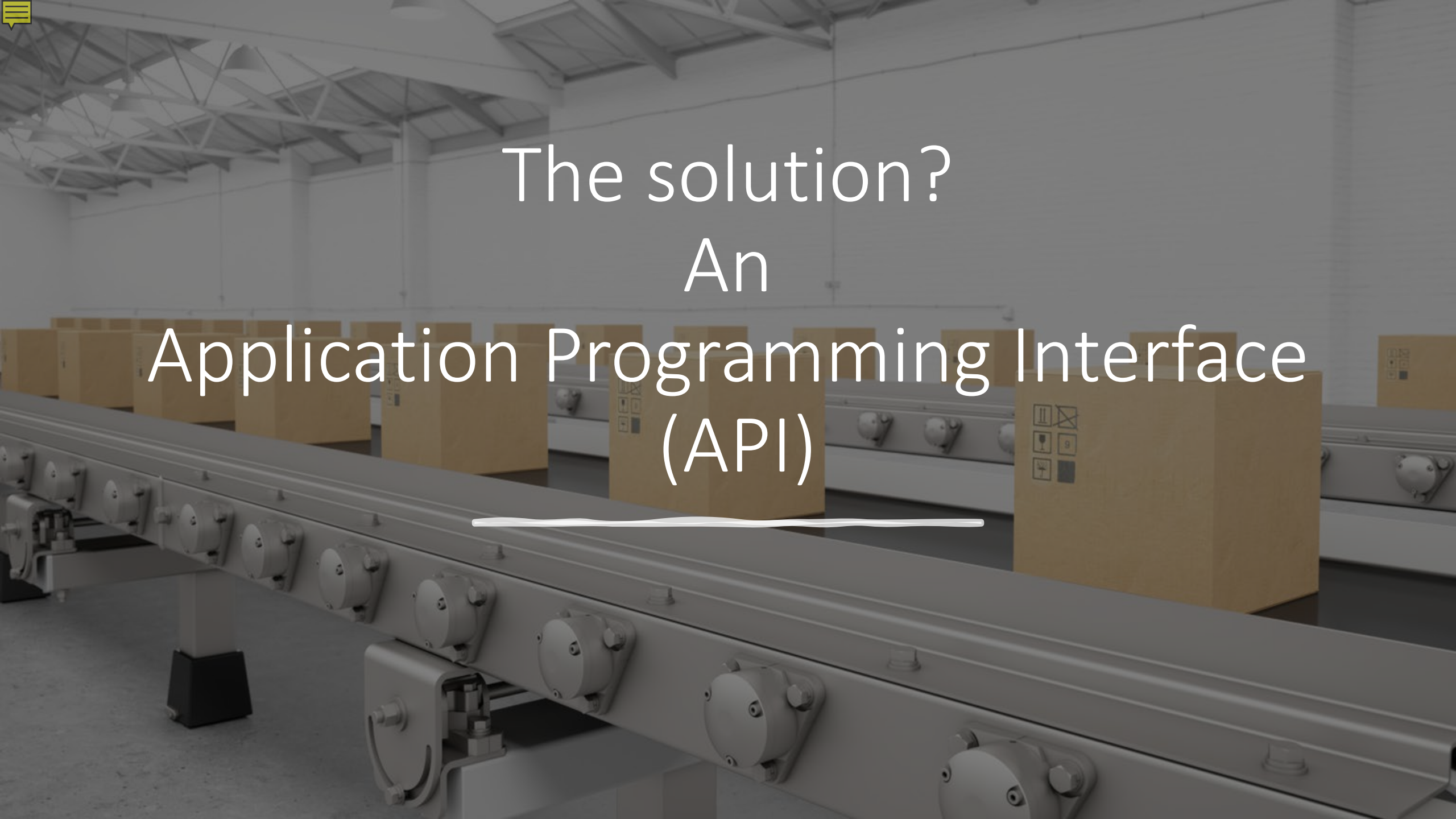
The last mile matters!

If the price of admission is too high, users will give up before getting to the good stuff.





The solution?
An
Application Programming Interface
(API)





Data
Validation:
enforcing
the GEOMS
standard

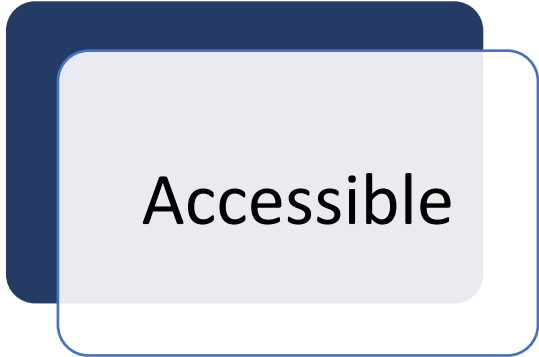





FAIR Principles




Findable



Accessible



Interoperable



Reusable



FAIR Principles



Users



Advanced Users



Computers

Findable

Accessible

Interoperable

Reusable



Download Selected Files

Filter by:

Clear Filters

Date Range (UTC)

Data Date is after

No date selected

Data Date is before

No date selected

Instrument Group

- NASA GSFC
- NASA LaRC
- NASA JPL SMOL-1
- NASA JPL SMOL-2
- NASA JPL TMTOL
- ECCC
- NOAA ESRL/CSL
- UAH

Product Type

- O3Lidar
 - HIRES
 - CALVAL
 - CLIM
 - Gridded
 - Legacy
- Surface
- Other

File Types

- HDF GEOMS (Standard)
- ASCII
- Image

Select Data

Total files available: 4692

<input type="checkbox"/>	Instrument Group	Data Date (UTC)	Upload Date	Product Type	File Type	Info
<input checked="" type="checkbox"/>	NASA JPL TMTOL	2023-11-15	2023-11-16	CLIM	HDF GEOMS (Standard)	
<input checked="" type="checkbox"/>	NASA JPL TMTOL	2023-11-14	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA GSFC	2023-11-14	2023-11-14	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-11-13	2023-11-13	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-11-12	2023-11-13	Surface	ASCII	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-11	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-10	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA GSFC	2023-11-10	2023-11-10	Surface	ASCII	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-09	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA GSFC	2023-11-09	2023-11-09	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-11-08	2023-11-08	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-11-07	2023-11-07	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-11-06	2023-11-07	Surface	ASCII	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-03	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-02	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA JPL TMTOL	2023-11-01	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA JPL TMTOL	2023-10-31	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA GSFC	2023-10-31	2023-10-31	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-10-31	2023-10-31	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-10-30	2023-10-30	Surface	ASCII	
<input type="checkbox"/>	NASA GSFC	2023-10-29	2023-10-29	Surface	ASCII	
<input type="checkbox"/>	NASA JPL TMTOL	2023-10-28	2023-11-15	CLIM	HDF GEOMS (Standard)	
<input type="checkbox"/>	NASA GSFC	2023-10-28	2023-10-29	Surface	ASCII	

DISPLAYING 80 DATA FILES

Get All

Download Selected Files

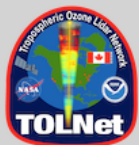


Graph



Graph of groundbased_lidar.o3_nasa.gsfc003_hires_oldfield.ny_20230712t000000z_20230713t000000z_001.hdf

Download data



Group NASA GSFC
Location OLDFIELD.NY
Lat 40.964
Lon -73.14
PI Sullivan;John
Date/Time (UTC) 2023-07-12 00:00:00 - 2023-07-13 00:00:00

Colorbar: Rainbow

Y max

15

Re-graph

Y min

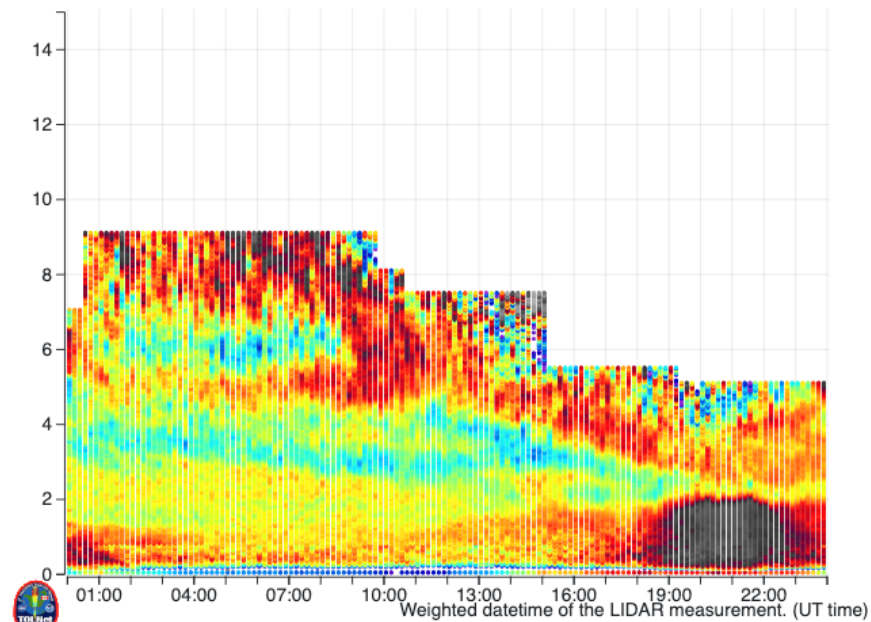
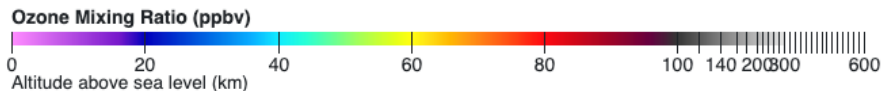
0

X min

07/12/2023 00:00

X max

07/13/2023 00:00



Filter by:

Instrument Group

- NASA GSFC
- NASA LaRC
- NASA JPL SMOL-1
- NASA JPL SMOL-2
- NASA JPL TMTOL
- ECCC
- NOAA ESRL/CSL
- UAH

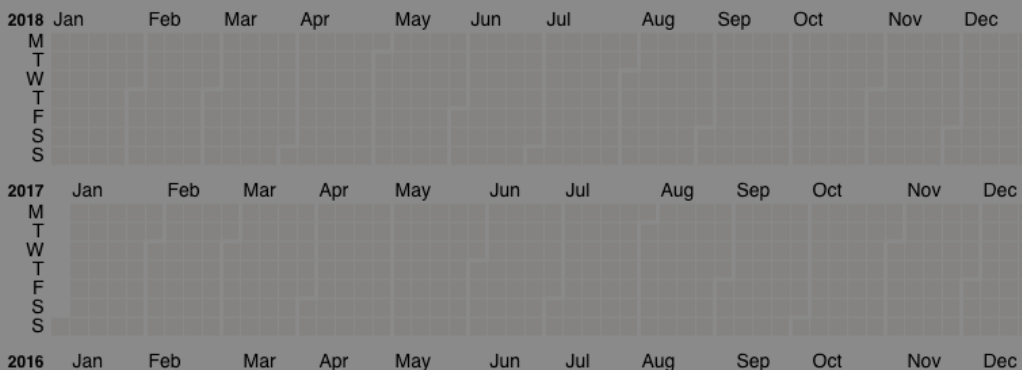
Product Type

- HIRES
- CALVAL
- CLIM
- Gridded

Processing Type

- Centrally Processed (GLASS)
- In-House Processed

Note: Only HDF4-GEOMS files are shown here. Other surface and profile data is available on the Downloads page.





FAIR Principles



Users



Advanced Users



Computers

Findable

✓ Website

✓ Website
✓ API

✓ API

Accessible

Interoperable

Reusable



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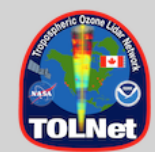


Graph



Graph of groundbased_lidar.o3_nasa.gsfc003_hires_oldfield.ny_20230712t000000z_20230713t000000z_001.hdf

[Download data.](#)



Group NASA GSFC
Location OLDFIELD.NY
Lat 40.964
Lon -73.14
PI Sullivan;John
Date/Time (UTC) 2023-07-12 00:00:00 - 2023-07-13 00:00:00

Colorbar: Rainbow

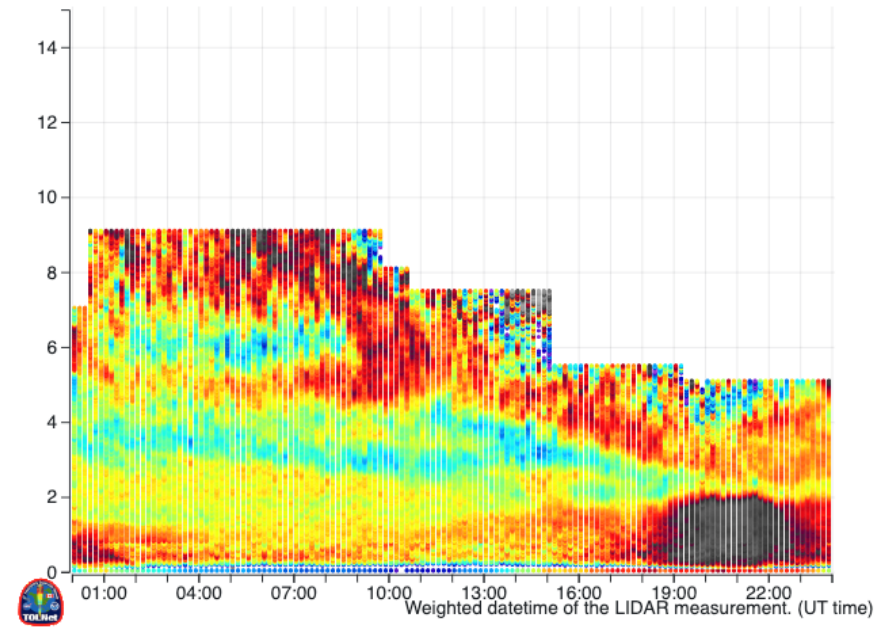
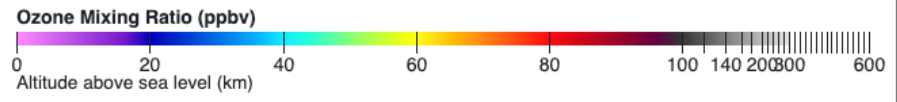
Y max: 15

Re-graph

Y min: 0

X min: 07/12/2023 00:00

X max: 07/13/2023 00:00



Filter by:

Instrument Group

- NASA GSFC
- NASA LaRC
- NASA JPL SMOL-1
- NASA JPL SMOL-2
- NASA JPL TMTOL
- ECCC
- NOAA ESRL/CSL
- UAH

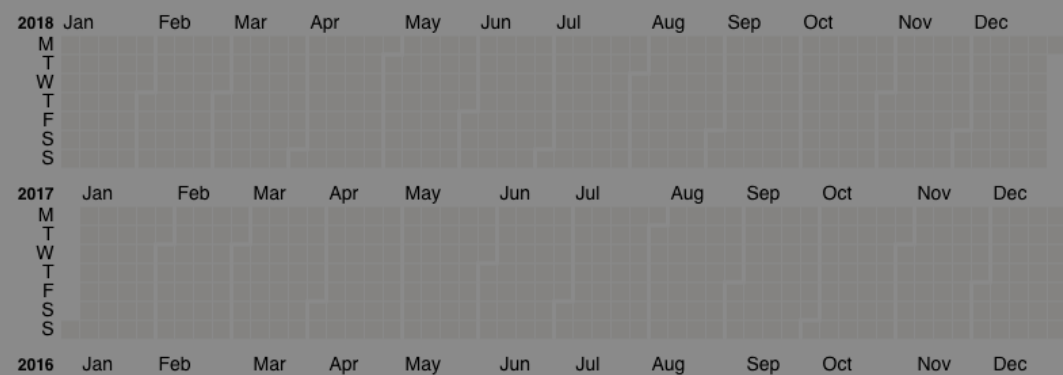
Product Type

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Processing Type

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- In-House Processed

Note: Only HDF4-GEOMS files are shown here. Other surface and profile data is available on the Downloads page.



TOLNet API 0.3 OAS3

</api/openapi.yml>

This is the NASA TOLNet self-documenting JSON REST API. Engage the API interactively here or directly on the API endpoints.

Authorize

Server

/api/ ▾

Data TOLNet data and details

GET /data/{page} Get information about all TOLNet data

GET /data/product_types Get information on all data product_types

GET /data/processing_types Get information on all data processing_types

GET /data/file_types Get information on all data file_types

GET /data/download/{ids} Download TOLNet data

GET /data/calendar Get a date driven list of all available TOLNet data

GET /data/json/{id} Json versions of the TOLNet data

Instruments Instrument names and details

GET /instruments/groups Get information on all instrument groups



FAIR Principles



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Are the contents
GEOMS
compliant?





FAIR Principles



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✓ Website
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✓ API

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✓ GEOMS

✓ GEOMS
✓ JSON

✓ GEOMS
✓ JSON

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✓ Website

✓ Website
✓ API

✓ API

Interoperable

✓ GEOMS

✓ GEOMS
✓ JSON

✓ GEOMS
✓ JSON

Reusable



Is the data usable?

Is the data reusable?



Metadata in the file:

```
"DO_AFFILIATION": "NASA Goddard Space Flight Center;NASA.GSFC",
```

GEOMS Standards
Documentation:

4.1.6. DO_AFFILIATION

The global attribute DO_AFFILIATION contains the Data Originator's **official** affiliation and acronym. The DO_AFFILIATION may differ from the PI_AFFILIATION (cf. Table 7.1).

Type: STRING

Format: Affiliation name;Affiliation acronym

Entry: Two semicolon-separated fields

Example 1: DO_AFFILIATION = Norwegian Institute for Air Research;NILU

Example 2: DO_AFFILIATION = National Oceanic and
Atmospheric Administration;NOAA

Are the contents
GEOMS
compliant?





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✓ GEOMS
✓ JSON

✓ GEOMS
✓ JSON

Reusable

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✓ GEOMS

✓ API
✓ GEOMS
✓ JSON

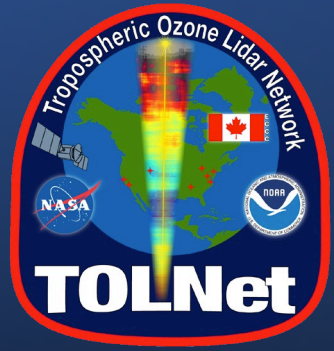
✓ API
✓ GEOMS
✓ JSON



Future steps



- Centrally Processed files
 - Using a new GLASS (Global Lidar Analysis Software Suite) system that can take the raw data from the various teams, process it, and then upload files directly to the API.
- Near Real Time
 - The ability to provide up-to-date graphs of data while the data is still being collected.
- FAIR Journey
 - How can we be more FAIR tomorrow than we are today?



Want to see more?



TOLNet website:
<https://tolnet.larc.nasa.gov>



TOLNet DOI:
10.5067/LIDAR/OZONE/TOLNET



GEOMS data format:
<https://evdc.esa.int/documentation/geoms/>



Authors:
Crystal Gummo, John Sullivan,
Michael Shook, Gao Chen