Dynamic tiling with Zarr

ESIP cloud computing cluster session
"Cutting Edge in the Cloud"

Nov 2022

Vincent Sarago - Developmentseed

Vincent sarago

Software Engineer @ Developmentseed

COG Tzar

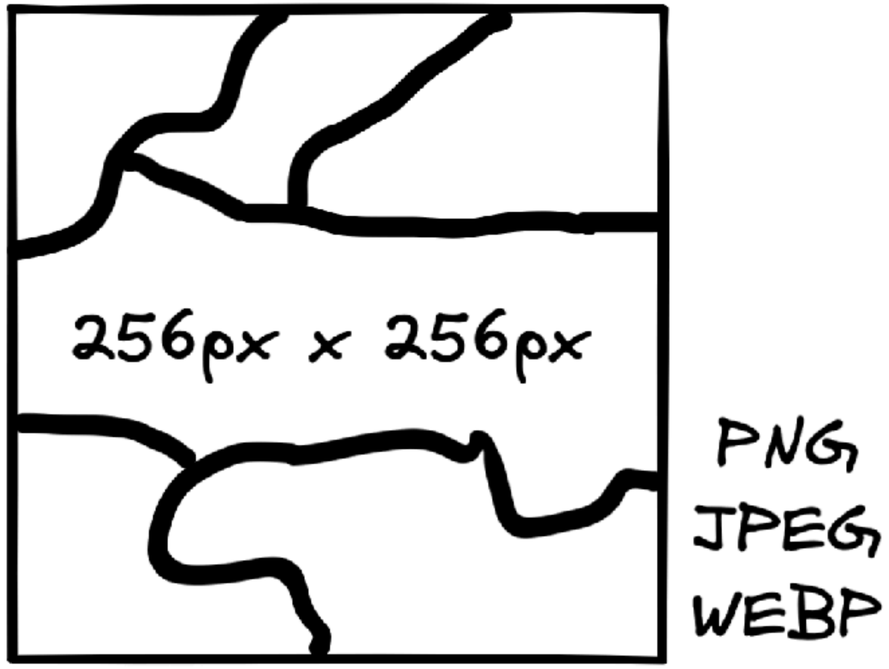
Self-Taught Python dev

Creator of @RemotePixel

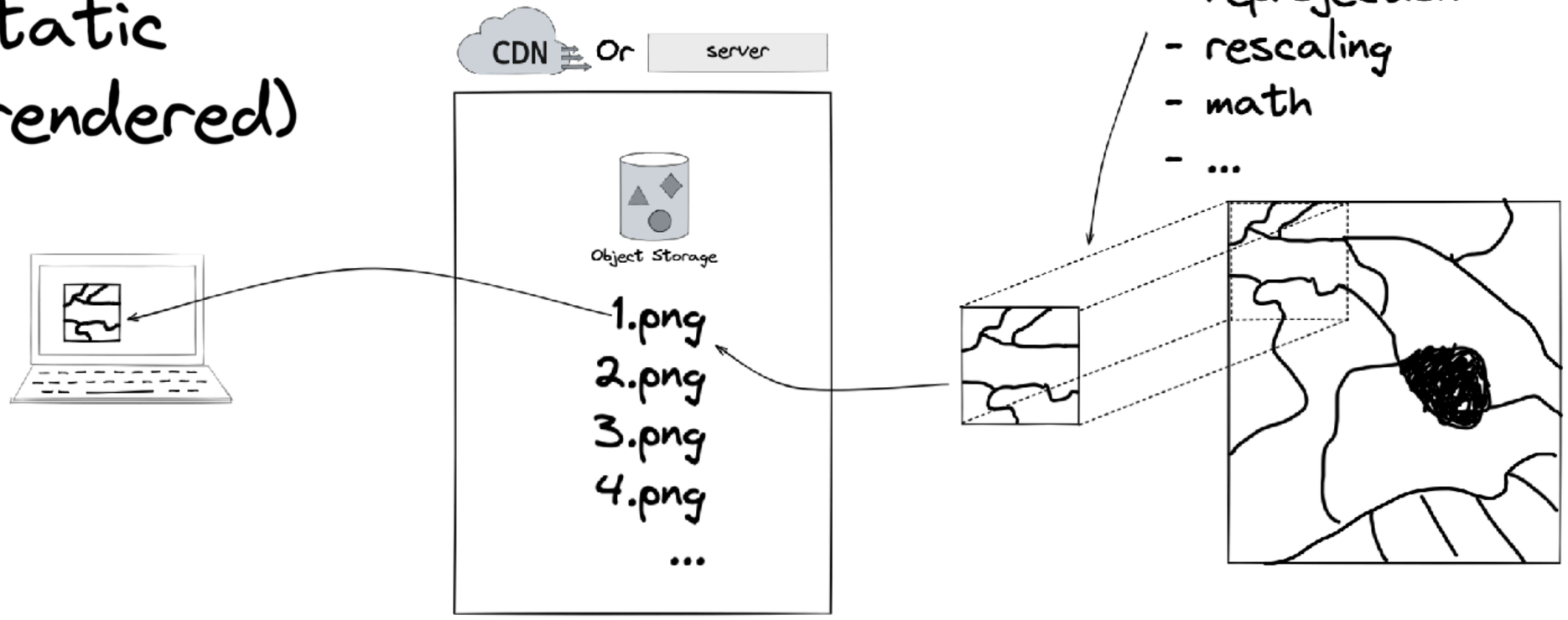
MSc in Earth Sciences

Bike & Coffee

Map Tile (raster)

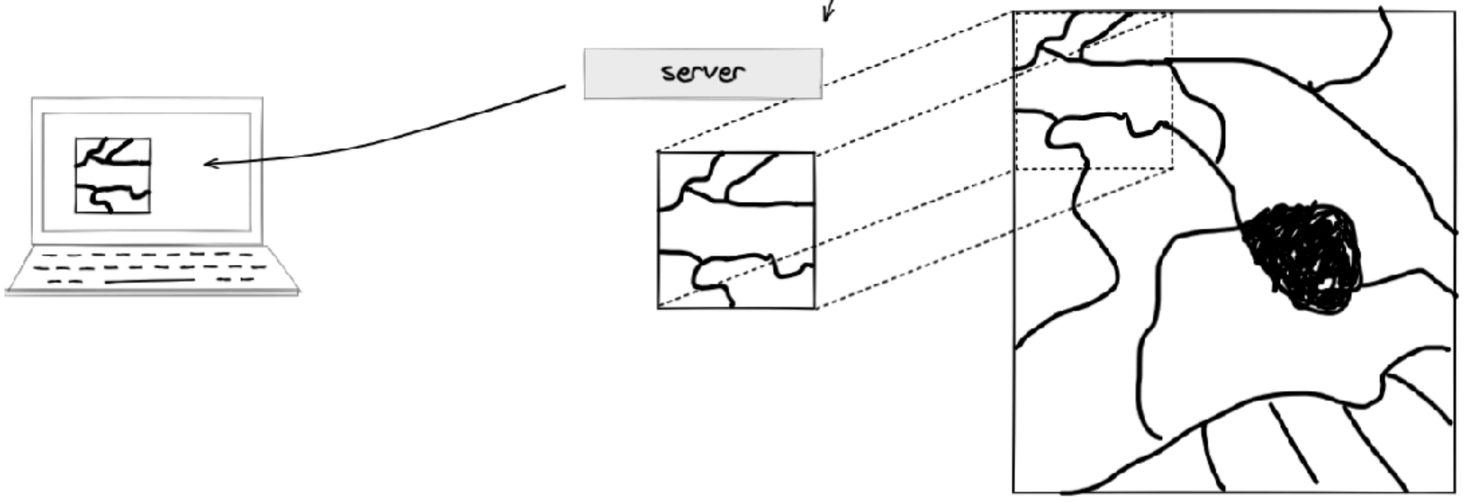


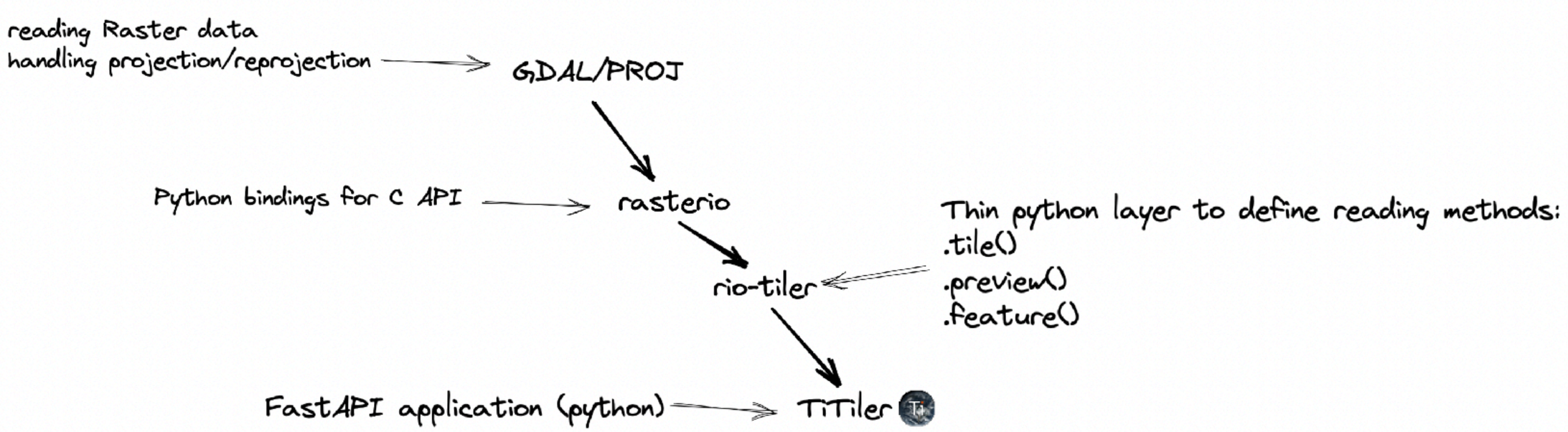
Static (pre-rendered)



Dynamic
(rendering on-demand)

Processing:
- reprojection
- rescaling
- math
- ...




reading Raster data
handling projection/reprojection
GDAL/PROJ
Python bindings for C API
rasterio
Thin python layer to define reading methods:
.tile()
.preview()
.feature()
rio-tiler
FastAPI application (python)
TiTiler

cogeotiff / rio-tiler Public

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How to read zarr? #511

Edit

Answered by vincentsarago Break00 asked this question in Q&A

rasterio / rasterio Public

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Multi-dimensional support #1759

Edit | New issue

Closed normanb opened this issue on Aug 22, 2019 · 12 comments

cogeotiff / rio-tiler Public

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Zarr custom Reader? #453

Status: Closed

Edit | New issue

Closed vincentsarago opened this issue on Nov 9, 2021 · 6 comments

rasterio / rasterio Public

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Code | Issues 140 | Pull requests 13 | Discussions | Actions | Projects | Wiki | Security

PROPOSAL: Might dataset.read() support zarr in the future? #2383

Edit | New issue

Closed lukasValentin opened this issue on Jan 26 · 4 comments

developmentseed / titiler Public

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Code | Issues 17 | Pull requests 3 | Discussions | Actions | Projects 1 | Security | Insights

Loading Zarr dataset ? #461

Edit

Answered by jsuwala steph-ben asked this question in Q&A

Vincent Sarago
@_VincentS_

Here is what happens when you spent to much time around so many smart peoples!
github.com/cogeotiff/rio-...
🙌 @geospatialjeff @TomAugspurger @rabernat @kylebarron2
@sat_summit

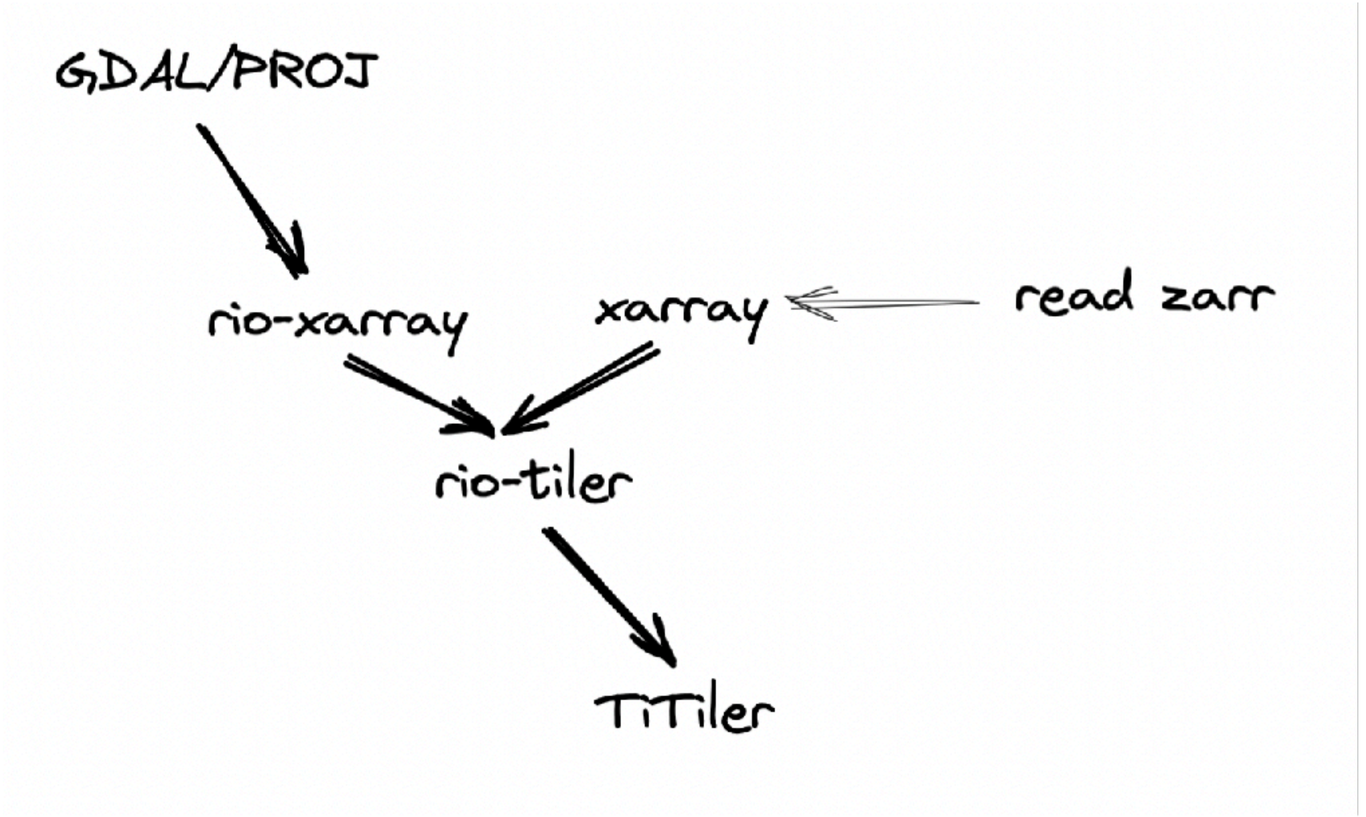
cogeotiff/rio-tiler

#530 **Xarray reader**

20 comments 8 reviews 7 files +1510 −13

vincentsarago • September 28, 2022 23 commits

github.com
Xarray reader by vincentsarago · Pull Request #530 · cogeotiff/rio-tiler
ping @geospatial-jeff @kylebarron @TomAugspurger @rabernat


GDAL/PROJ
rio-xarray
xarray
read zarr
rio-tiler
TiTiler

Open the dataset with Xarray

Select a variable

Use rio-tiler's custom reader to read a Tile

```python
import xarray
from rio_tiler.io.xarray import XarrayReader

ds = xarray.open_dataset(
    "https://pangeo.blob.core.windows.net/pangeo-public/daymet-rio-tiler/na-wgs84.zarr/",
    engine="zarr",
    decode_coords="all",
    consolidated=True,
)
da = ds["tmax"]

with XarrayReader(da) as dst:
    img = dst.tile(1, 1, 2)
```

demo

https://gist.github.com/vincentsarago/7085801ecf403a45421802d8642aa0d3

http://127.0.0.1:8000/info?url=https://pangeo.blob.core.windows.net/pangeo-public/daymet-rio-tiler/na-wgs84.zarr&variable=tmax


```
{
  "bounds": [
    -179.99998449579846,
    6.073484821356791,
    179.98170598363066,
    83.79467217916716
  ],
  "minzoom": 1,
  "maxzoom": 6,
  "band_metadata": [
    [
      "b1",
      {
        "long_name": "24-hour day based on local time",
        "standard_name": "time"
      }
    ]
  ],
  "band_descriptions": [
    [
      "b1",
      "1980-07-01T12:00:00.000000000"
    ]
  ],
  "dtype": "float32",
  "nodata_type": "Nodata",
  "colorinterp": null,
  "scale": null,
  "offset": null,
  "colormap": null,
  "count": 1,
  "attrs": {
    "cell_methods": "area: mean time: maximum within days time: mean over days",
    "coordinates": "lon lat",
    "long_name": "annual average of daily maximum temperature",
    "units": "degrees C"
  },
  "name": "tmax",
  "width": 17268,
  "height": 3728
}
```


http://127.0.0.1:8000/info?url=https://ncsa.osn.xsede.org/Pangeo/pangeo-forge/noaa-coastwatch-geopolar-sst-feedstock/noaa-coastwatch-geopolar-sst.zarr&variable=analysed_sst


```
{
  "bounds": [
    -180.00000610436345,
    -89.99999847369712,
    180.00000610436345,
    89.99999847369712
  ],
  "minzoom": 0,
  "maxzoom": 2,
  "band_metadata": [
    [
      "b1",
      {
        "axis": "T",
        "comment": "Nominal time of Level 4 analysis",
        "long_name": "reference time of sst field",
        "standard_name": "time"
      }
    ]
  ],
  "band_descriptions": [
    [
      "b1",
      "2002-09-01T12:00:00.000000000"
    ]
  ],
  "dtype": "float32",
  "nodata_type": "Nodata",
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  "scale": null,
  "offset": null,
  "colormap": null,
  "count": 1,
  "attrs": {
    "comment": "Analysed SST for each ocean grid point",
    "long_name": "analysed sea surface temperature",
    "reference": "Fieguth,P.W. et al. "Mapping Mediterranean altimeter data with a multiresolution optimal interpolation algorithm", J. Atmos. Ocean Tech, 15 (2): 535-546, 1998.  Fieguth, P. Multiply-Rooted Multiscale Models for Large-Scale Estimation, IEEE Image Processing, 10(11), 1676-1686, 2001.  Khellah, F., P.W. Fieguth, M.J. Murray and M.R. Allen, "Statistical Processing of Large Image Sequences", IEEE Transactions on Geoscience and Remote Sensing, 12 (1), 80-93, 2005.  Maturi, E., A. Harris, J. Mittaz, J. Sapper, G. Wick, X. Zhu, P. Dash, P. Koner, "A New High-Resolution Sea Surface Temperature Blended Analysis", Bulleting of the American Meteorological Society, 98 (5), 1015-1026, 2017.",
    "source": "STAR-ACSPO_GAC, STAR-ACSPO_H-8, STAR-Geo_SST, UKMO-OSTIA",
    "standard_name": "sea_surface_foundation_temperature",
    "units": "kelvin",
    "valid_max": 4000,
    "valid_min": -200
  },
  "name": "analysed_sst",
  "width": 7200,
  "height": 3600
}
```
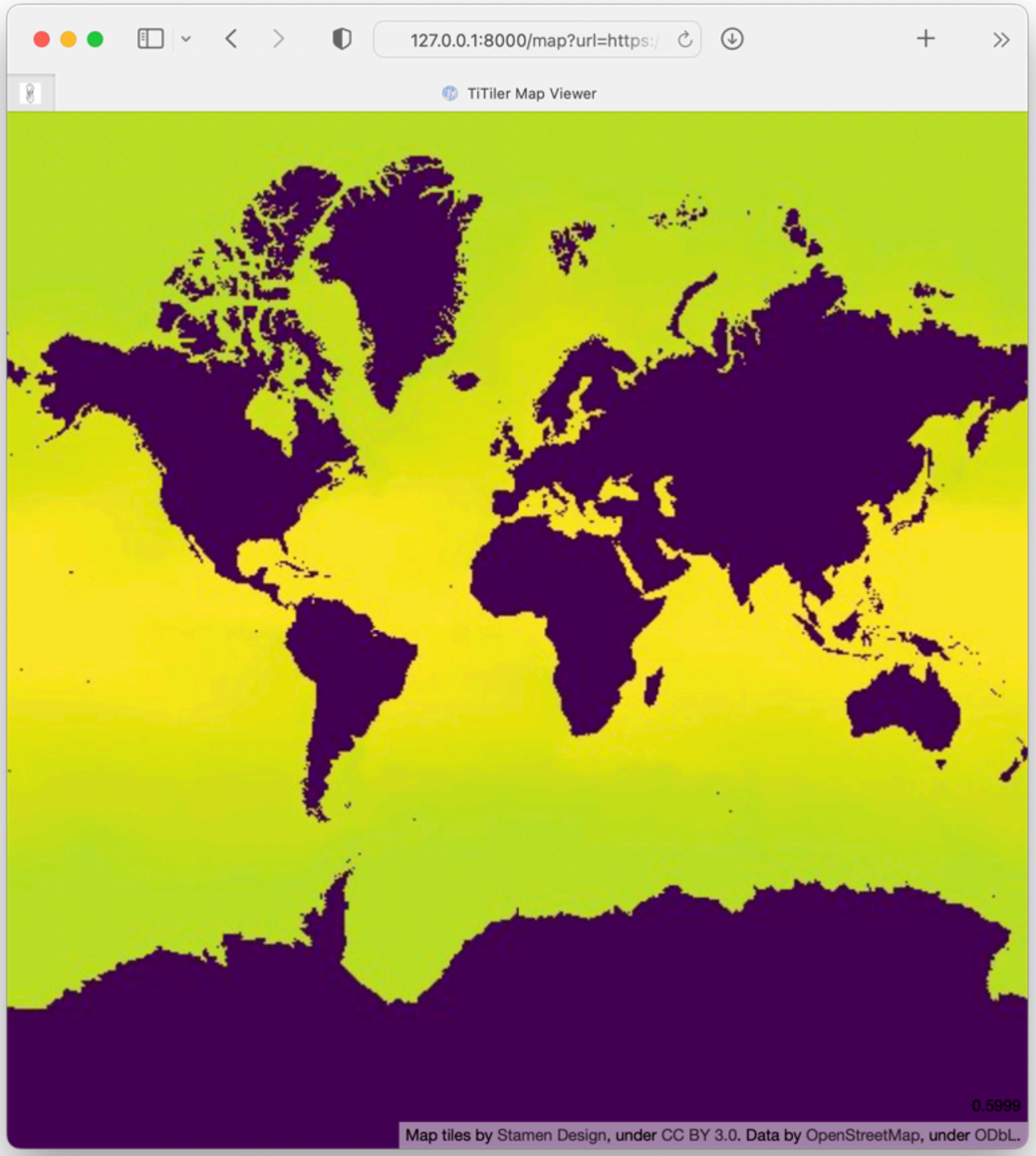

http://127.0.0.1:8000/map?url=https://ncsa.osn.xsede.org/Pangeo/pangeo-forge/noaa-coastwatch-geopolar-sst-feedstock/noaa-coastwatch-geopolar-sst.zarr&variable=analysed_sst&rescale=0,300&colormap_name=viridis



http://127.0.0.1:8000/map?url=https://pangeo.blob.core.windows.net/pangeo-public/daymet-rio-tiler/na-wgs84.zarr&variable=tmax&rescale=-10,30&colormap_name=inferno

Performances ?

It can be good but it can be bad
It all depends on the chunking dimension and size
No Overviews so no low zoom level support

Ping Me!

@_VincentS_
@cogeotiff
@developmentseed

We have 🍪

Join the team & make a better planet.
https://developmentseed.org/careers