

کاربرد Xarray در تحلیل کلان داده‌های زیست‌محیطی


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دانشگاه خوارزمی





**“Data is
the
new oil**

Clive Humby - 2006



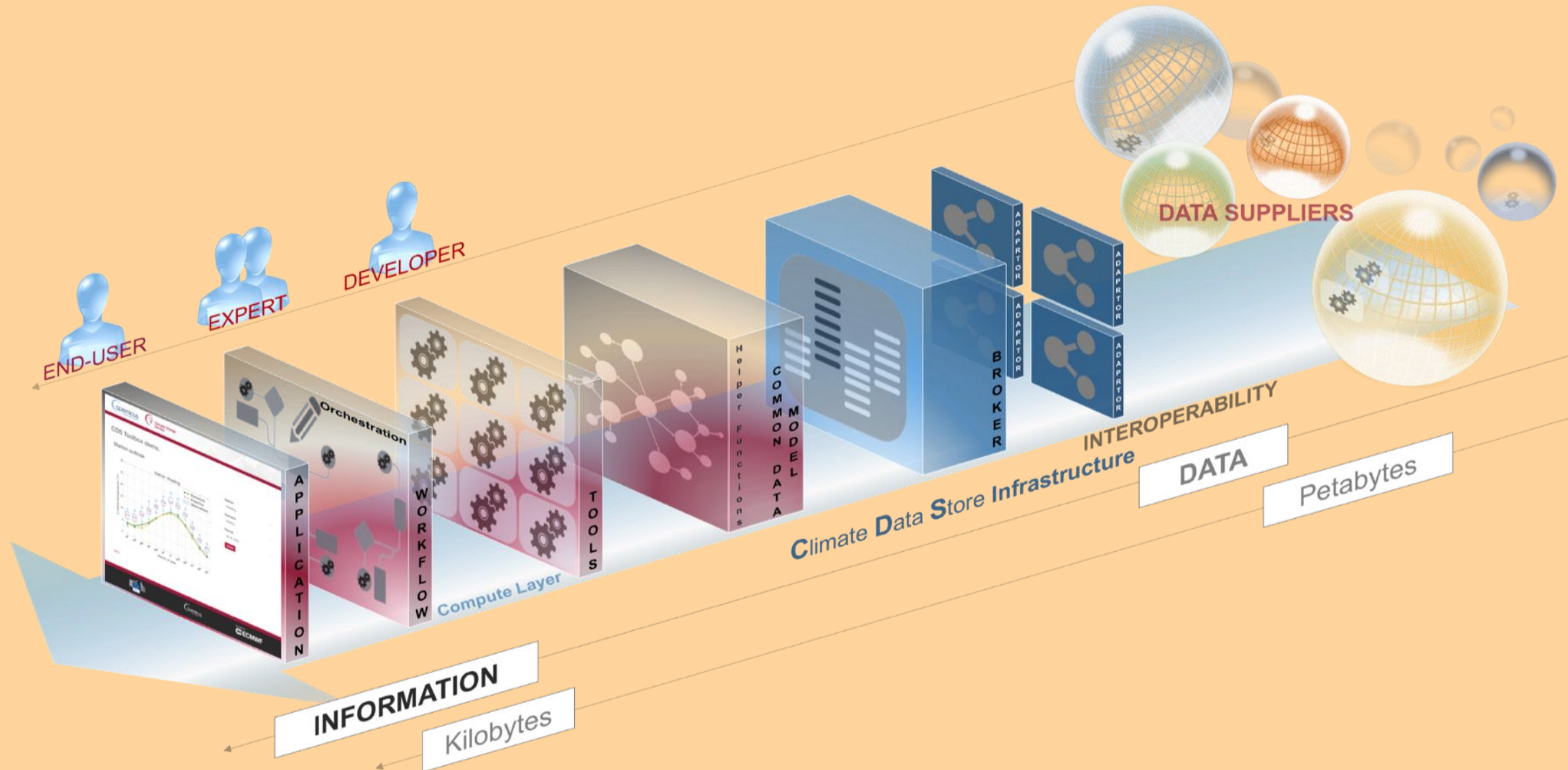


Copernicus

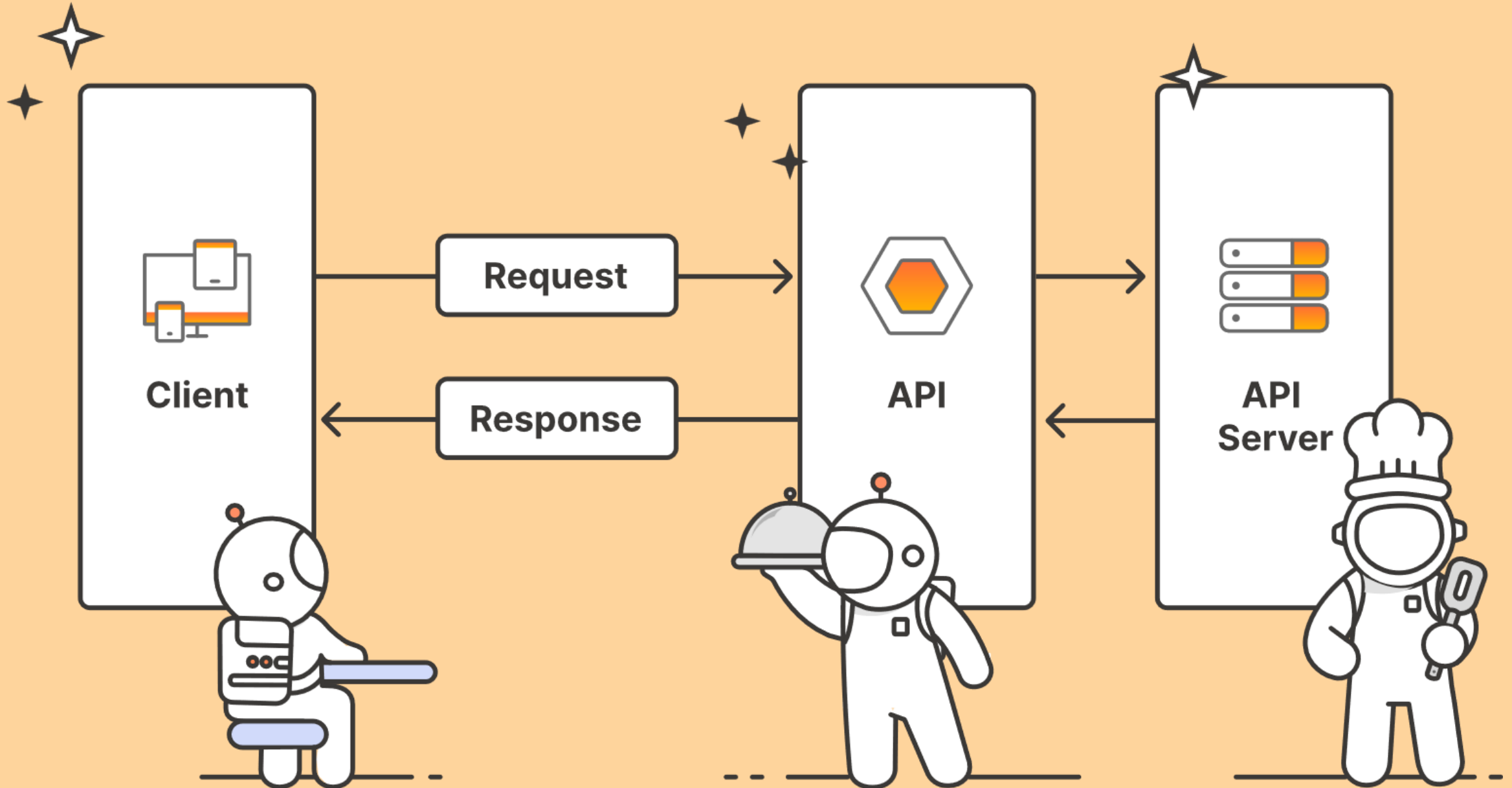
The European Earth Observation Programme

CDS API

Climate Data Store



Application Programming Interface



ERA5-land reanalysis dataset

ERA5-Land reanalysis dataset is the European Centre for Medium-Range Weather Forecasts (ECMWF). It's part of the Copernicus Climate Change Service (C3S) of the European Commission. The ERA5-Land dataset provides high-resolution, hourly data on surface variables and is a replay of the land component of the ERA5 climate reanalysis with a finer spatial resolution of approximately 9km grid spacing. The dataset covers the period from 1950 to the present, with continuous updates to support land monitoring applications. It's designed to describe the evolution of the water and energy cycles over land in a consistent manner over the production period.

▼ Wind, Pressure and Precipitation

- ☐ 10m u-component of wind
☐ Surface pressure

- ☐ 10m v-component of wind
☒ Total precipitation

Select all Clear all

▼ Vegetation

- ☒ Leaf area index, high vegetation

- ☒ Leaf area index, low vegetation

Clear all

Select all Clear all

Year

- ☐ 1950
☐ 1956
☐ 1962
☐ 1968
☐ 1974
☐ 1980
☐ 1986
☐ 1992
☐ 1998
☐ 2004
☐ 2010
☐ 2016
☒ 2022

- ☐ 1951
☐ 1957
☐ 1963
☐ 1969
☐ 1975
☐ 1981
☐ 1987
☐ 1993
☐ 1999
☐ 2005
☐ 2011
☐ 2017
☐ 2023

- ☐ 1952
☐ 1958
☐ 1964
☐ 1970
☐ 1976
☐ 1982
☐ 1988
☐ 1994
☐ 2000
☐ 2006
☐ 2012
☐ 2018
☐ 2024

- ☐ 1953
☐ 1959
☐ 1965
☐ 1971
☐ 1977
☐ 1983
☐ 1989
☐ 1995
☐ 2001
☐ 2007
☐ 2013
☐ 2019

- ☐ 1954
☐ 1960
☐ 1966
☐ 1972
☐ 1978
☐ 1984
☐ 1990
☐ 1996
☐ 2002
☐ 2008
☐ 2014
☒ 2020

- ☐ 1955
☐ 1961
☐ 1967
☐ 1973
☐ 1979
☐ 1985
☐ 1991
☐ 1997
☐ 2003
☐ 2009
☐ 2015
☒ 2021

Select all Clear all

Month

- ☒ January
☒ July

- ☒ February
☒ August

- ☒ March
☒ September

- ☒ April
☒ October

- ☒ May
☒ November

- ☒ June
☒ December

Clear all


```
import cdsapi

c = cdsapi.Client()

c.retrieve(
    'reanalysis-era5-land-monthly-means',
    {
        'product_type': 'monthly_averaged_reanalysis_by_hour_of_day',
        'variable': [
            'leaf_area_index_high_vegetation', 'leaf_area_index_low_vegetation', 'skin_temperature',
            'snow_cover', 'snow_depth', 'total_evaporation',
            'total_precipitation',
        ],
        'year': [
            '2020', '2021', '2022',
        ],
        'month': [
            '01', '02', '03',
            '04', '05', '06',
            '07', '08', '09',
            '10', '11', '12',
        ],
        'time': [
            '00:00', '01:00', '02:00',
            '03:00', '04:00', '05:00',
            '06:00', '07:00', '08:00',
            '09:00', '10:00', '11:00',
            '12:00', '13:00', '14:00',
            '15:00', '16:00', '17:00',
            '18:00', '19:00', '20:00',
            '21:00', '22:00', '23:00',
        ],
        'format': 'netcdf.zip',
    },
    'download.netcdf.zip')
```

data.nc



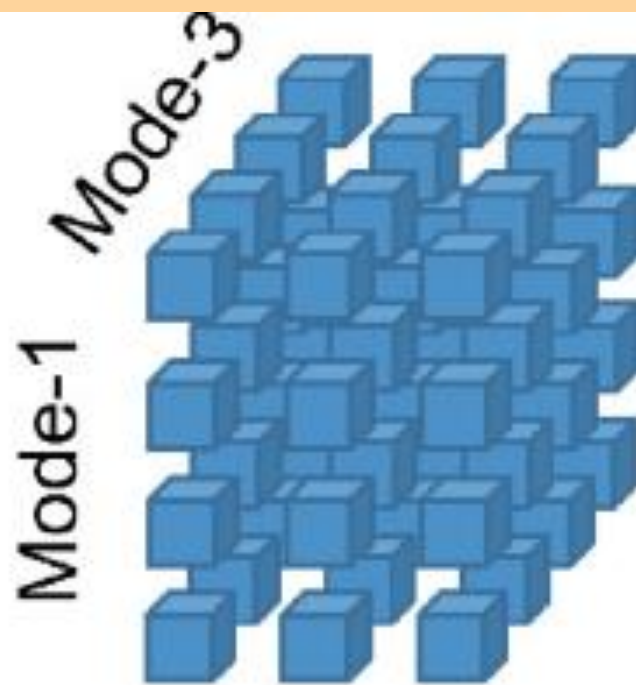
scalar



vector
(1st order)

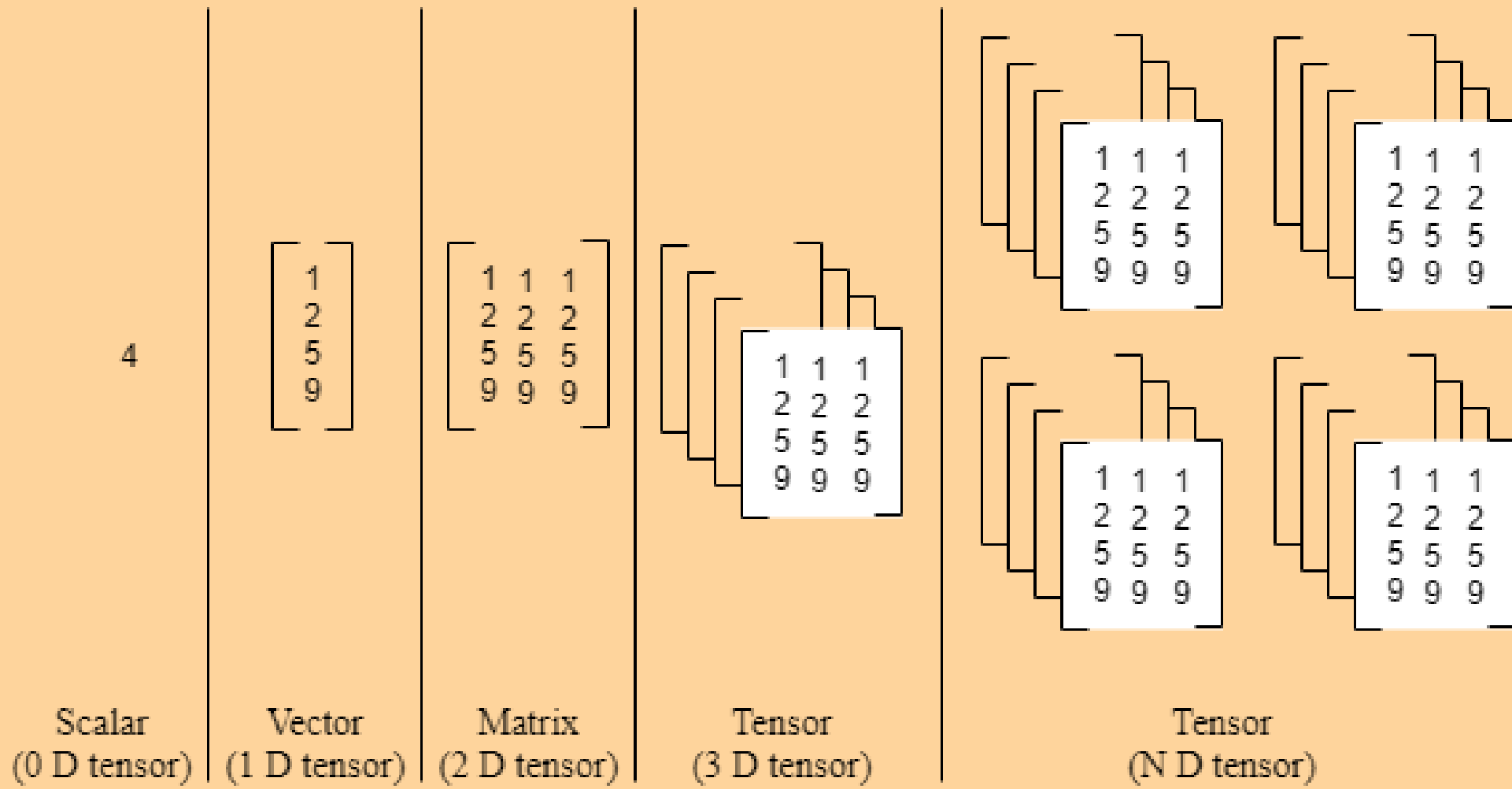


matrix
(2nd order)



Mode-1
Mode-2
Mode-3

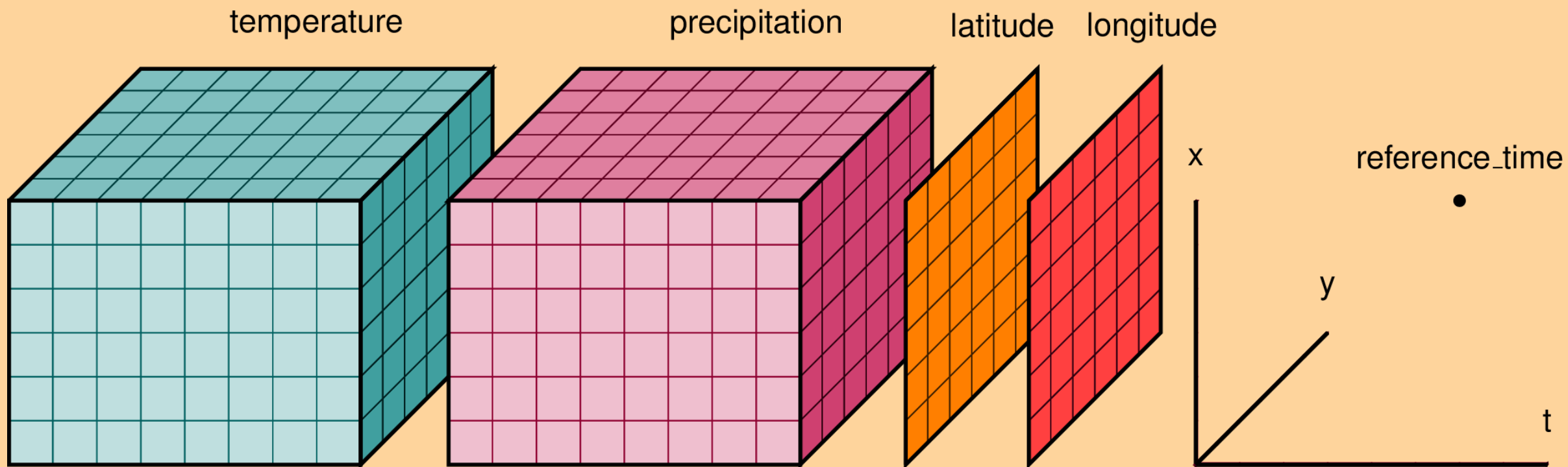
tensor
(3rd order)



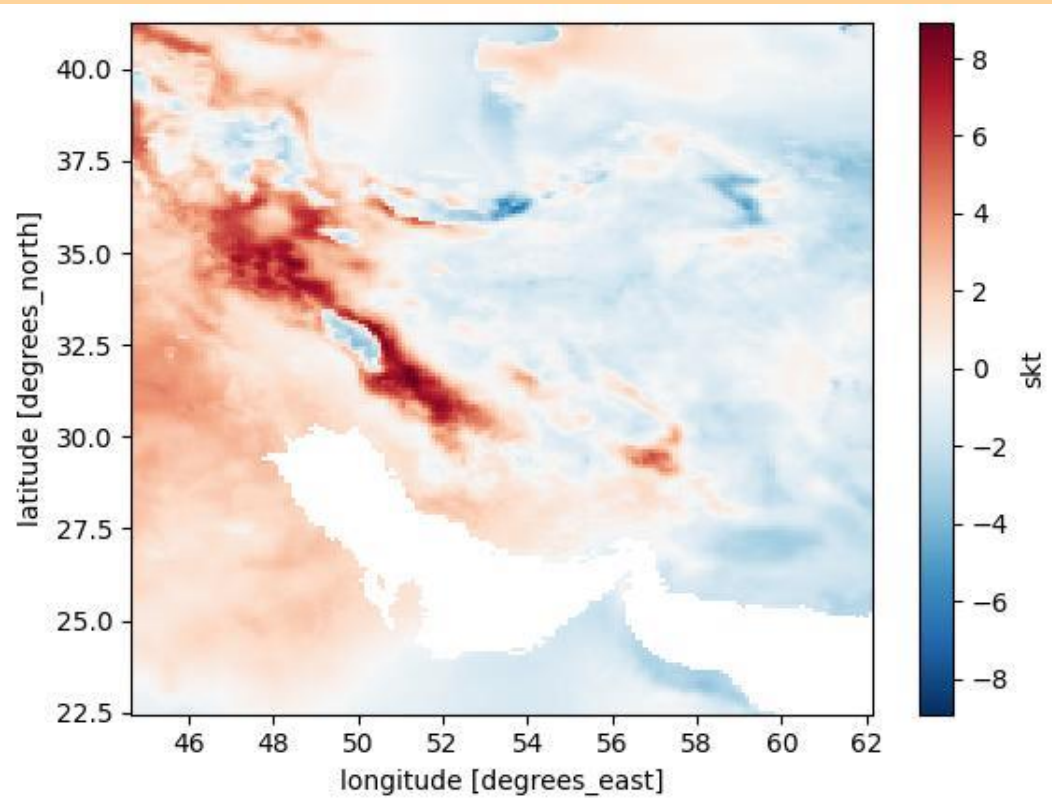
N-dimensional data



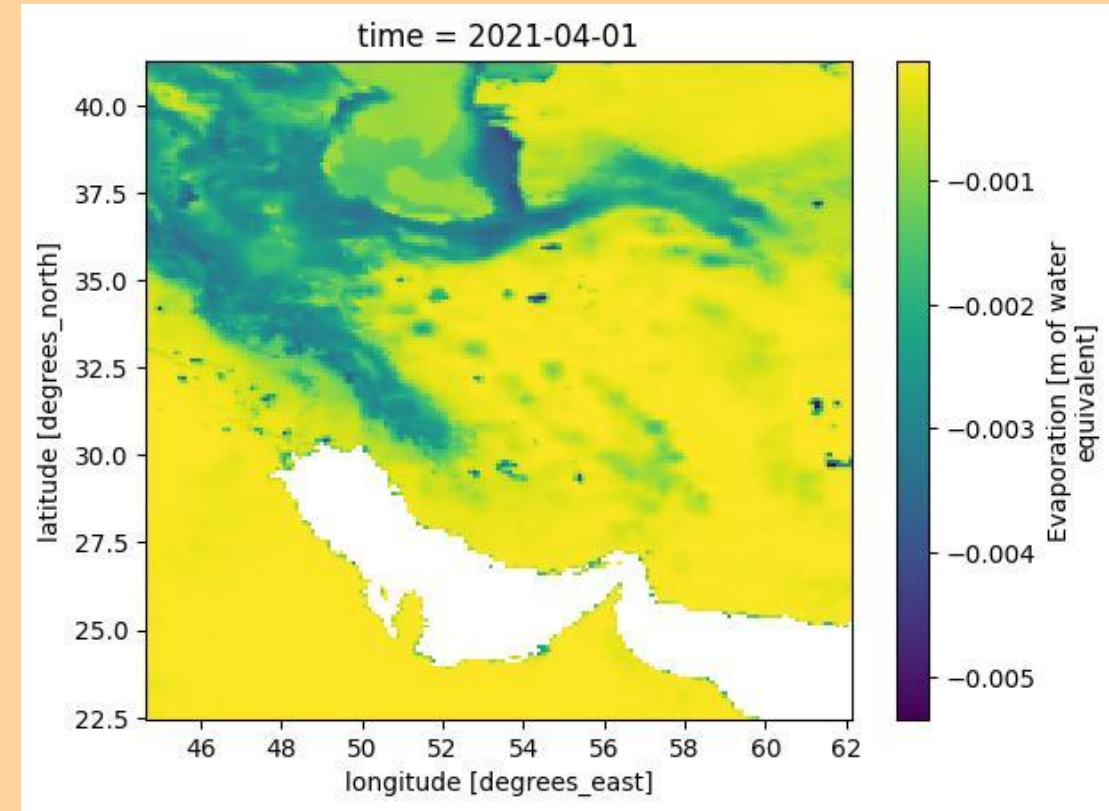
xarray



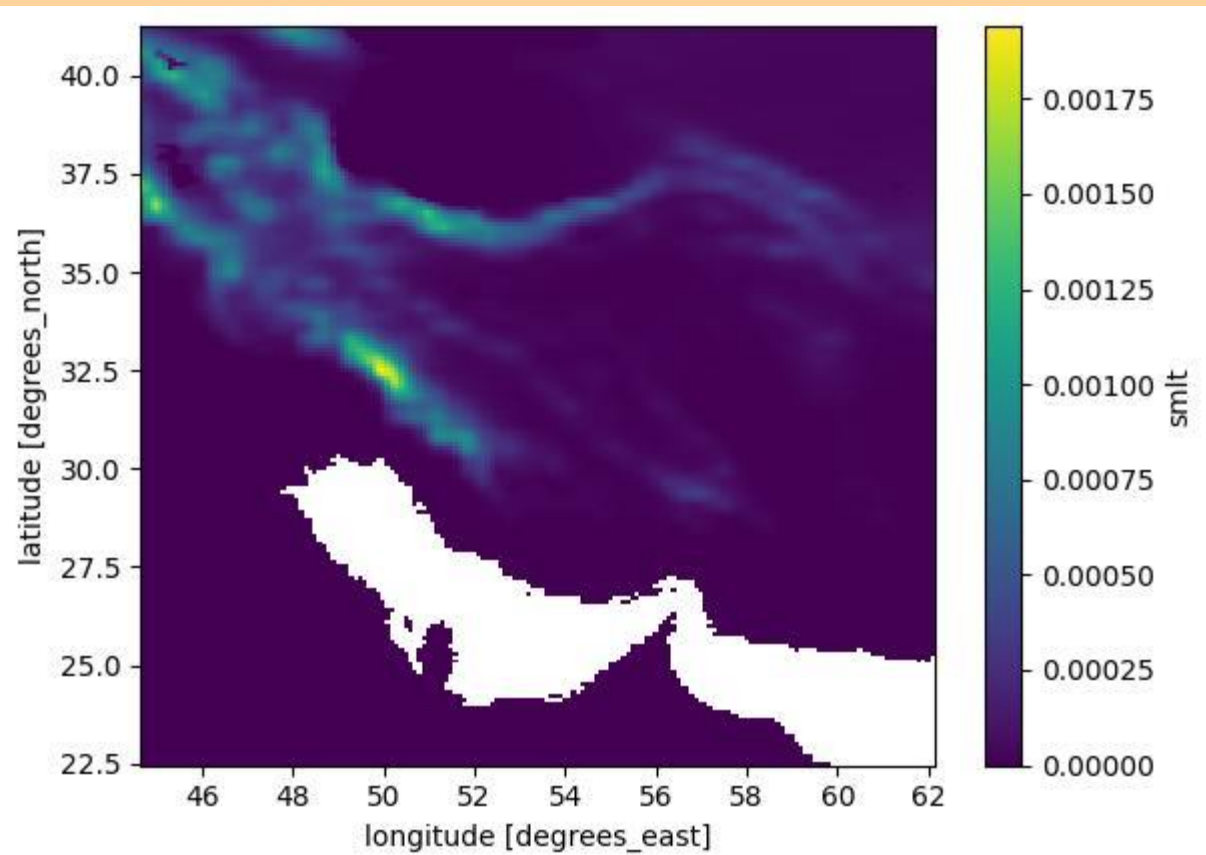
Temperature Change 2000-2020



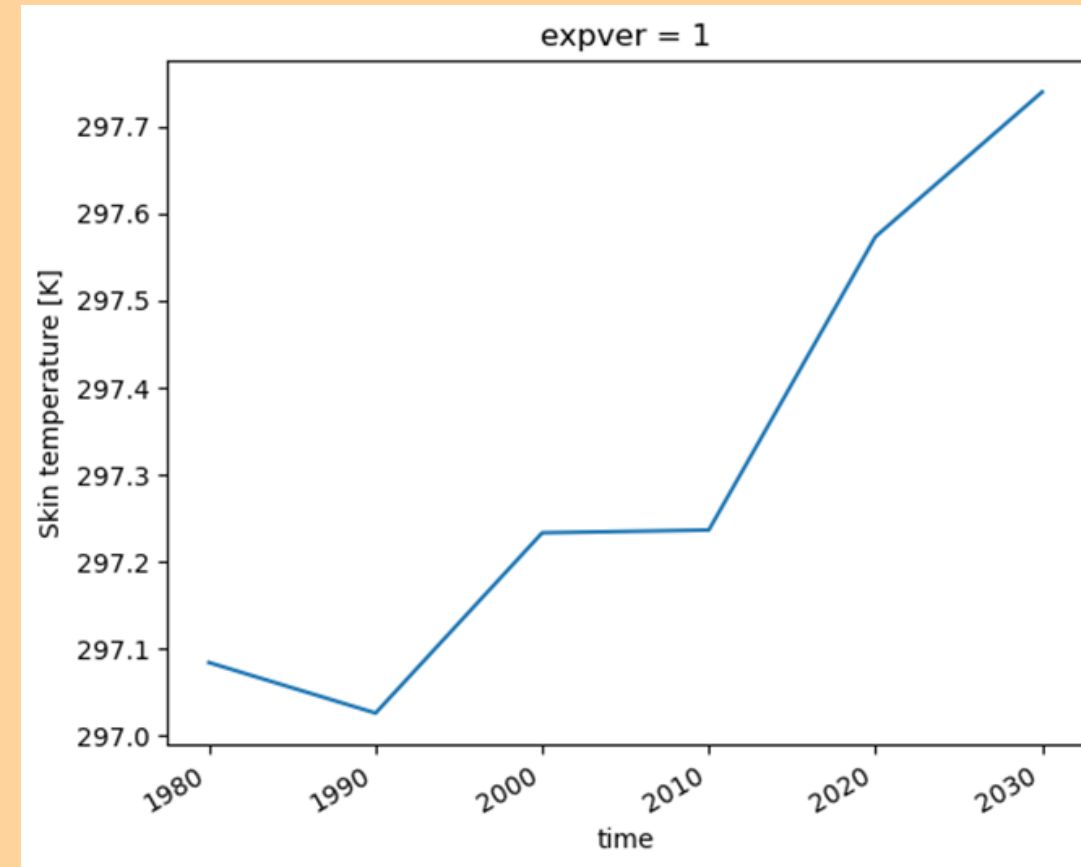
Total Evaporation on 2021-04-01



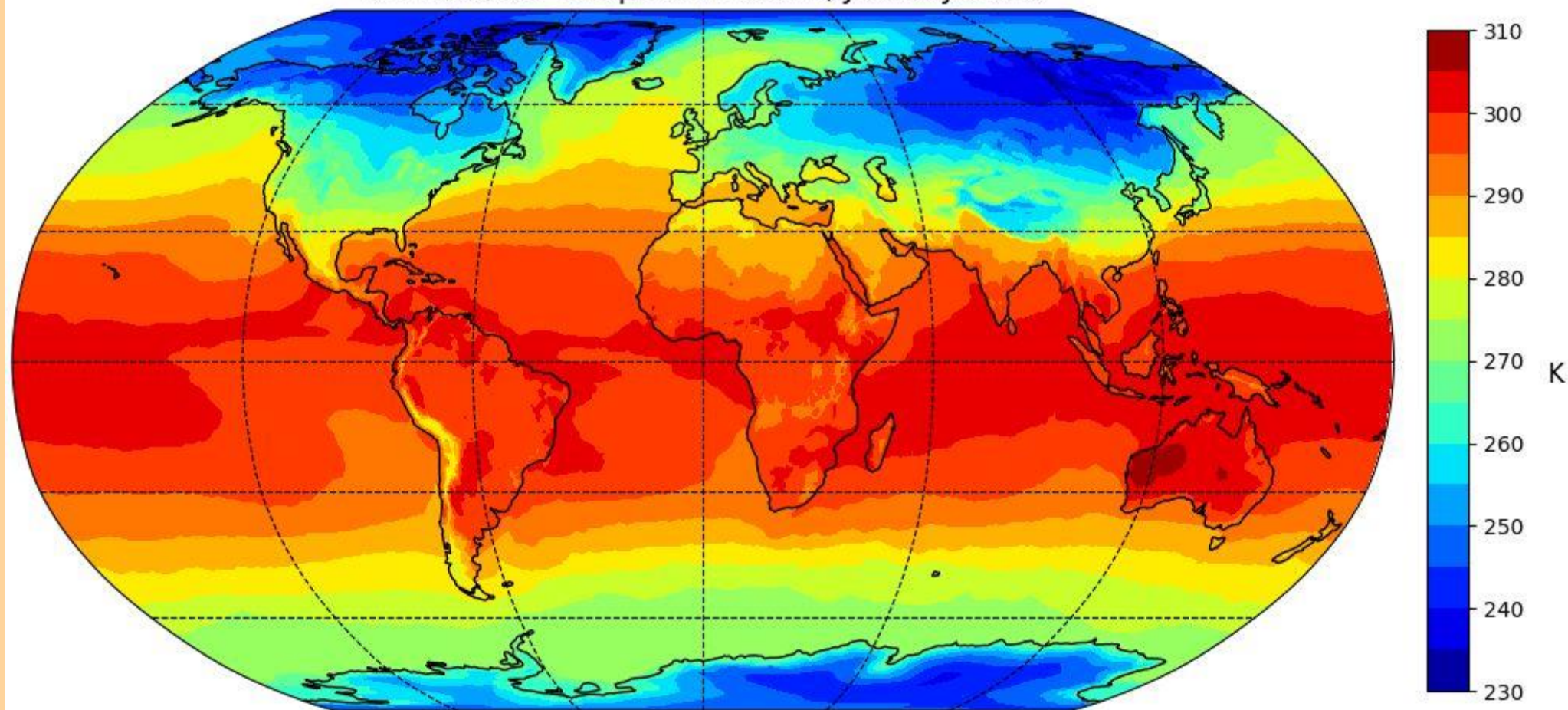
Mean Snowmelt



k-Nearest Neighbor (kNN)



MERRA-2 Air Temperature at 2m, Januray 2010



1. Hoyer, S., & Hamman, J. (2017). xarray: ND labeled arrays and datasets in Python. Journal of Open Research Software, 5(1), 10-10.
2. Bourgault, P., Huard, D., Smith, T. J., Logan, T., Aoun, A., Lavoie, J., ... & Whelan, C. (2023). xclim: xarray-based climate data analytics. Journal of Open Source Software, 8(85), 5415.
3. Post, F. H., Nielson, G., & Bonneau, G. P. (Eds.). (2002). Data visualization: The state of the art.

End of Presentation



ANY QUESTIONS?

memecreator.org