

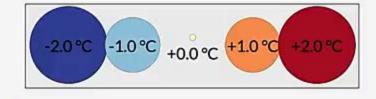
Climate Extremes: Heatwaves, Changes in Ice, Drought, Floods

Air Temperature Anomalies in Arctic Regions

Antti Lipponen, Finnish Meteorological Institute

Temperature Change by Country Years 1880 – 2022

1880

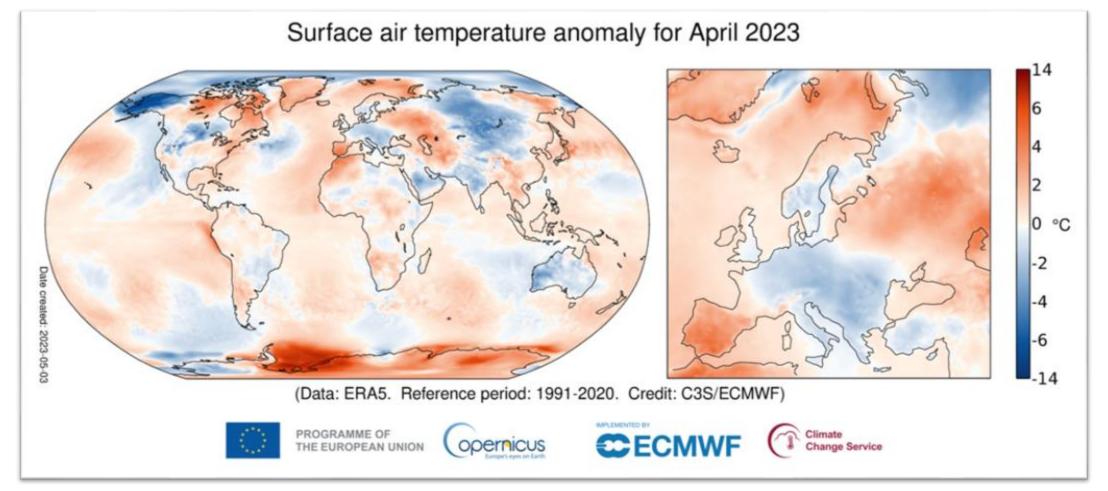


Afghanistan	Albania	Algeria	Andorra	Angola A	Antigua and Barbud	aArgentina	Armenia	Australia	Austria	Azerbaijan	Bahamas	Bahrain	Bangladesh	Barbados	Belarus
Belgium	Belize	Benin	Bhutan	Bolivia	Bosnia and H.	Botswana	Brazil	Brunei	Bulgaria	Burkina Faso	Burundi	Cabo Verde	Cambodia	Cameroon	Canada
Central African F	Rep. Chad	Chile	China	Colombia	Comoros	Congo, DR	Congo, R	Costa Rica	Croatia	Cuba	Cyprus	Czechia	Côte d'Ivoire	Denmark	Djibouti
Dominica D	Dominican Republ	ic Ecuador	Egypt	El Salvador	Equatorial Guinea	Eritrea	Estonia	eSwatini	Ethiopia	Fiji	Finland	France	Gabon	Gambia	Georgia
Germany	Ghana	Greece	Grenada	Guatemala	Guinea	Suinea-Bissau	Guyana	Haiti	Honduras	Hungary	Iceland	India	Indonesia	Iran	Iraq
Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya	Kiribati	Kuwait	Kyrgyzstan	Laos	Latvia	Lebanon	Lesotho	Liberia
Libya	Liechtenstein	Lithuania	Luxembourg	Madagascar	Malawi	Malaysia	Maldives	Mali	Malta	Marshall Islands	Mauritania	Mauritius	Mexico	Micronesia	Moldova
Monaco	Mongolia	Montenegro	Morocco	Mozambique	e Myanmar	Namibia	Nauru	Nepal	Netherlands	New Zealand	Nicaragua	Niger	Nigeria	North Korea	North Macedonia
Norway	Oman	Pakistan	Palau	Panama	Papua New Guinea	Paraguay	Peru	Philippines	Poland	Portugal	Qatar	Romania	Russia	Rwanda	Samoa
San Marino	Sao Tome and P.	Saudi Arabia	Senegal	Serbia	Seychelles	Sierra Leone	Singapore	Slovakia	Slovenia	Solomon Islands	Somalia	South Africa	South Korea	South Sudan	Spain
Sri Lanka	St. Kitts and Nevi	s St. Lucia	St. V. and the G.	Sudan	Suriname	Sweden	Switzerland	Syria	Tajikistan	Tanzania	Thailand	Timor-Leste	Togo	Tonga	Trinidad and Tobago
Tunisia	Turkmenistan	Tuvalu	Türkiye	UK	USA	Uganda	Ukraine Un	ited Arab Emirat	es Uruguay	Uzbekistan	Vanuatu	Venezuela	Viet Nam	Yemen	Zambia

Zimbabwe







Surface air temperature anomaly for April 2023 relative to the April average for the period 1991-2020. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF.

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"As an arctic country, Finland is particularly concerned about the fast-warming Arctic region. Everyone else should be concerned too: if we lose the Arctic, we lose the globe. In the Arctic, reducing black carbon and methane emissions is essential."

Sauli Niinistö, president of Finland



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communications earth & environment

ARTICLE

Check for updates

https://doi.org/10.1038/s43247-022-00498-3

OPEN

The Arctic has warmed nearly four times faster than the globe since 1979

Mika Rantanen ^{1™}, Alexey Yu. Karpechko¹, Antti Lipponen ², Kalle Nordling^{1,3}, Otto Hyvärinen¹, Kimmo Ruosteenoja¹, Timo Vihma ¹ & Ari Laaksonen^{1,4}



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What would I need for a map of Arctic?

- Good data source, preferably near-real-time, open data!
- Easy, repeatable workflow for monthly updates

A temperature map of the Arctic + time series graphic



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```
ARCTIC anomalies - ERA5 T...
                            Console
                                                             Runtime profile
                                       History
                                                Your queue
                                                             Save
                                              Copy
                                                                          # Run
■ Layout ▼
      import cdstoolbox as ct
      month = 4
      year = 2023
      @ct.application(title='ERA5 2m temperature anomalies')
      @ct.output.download()
      def application():
           variable = '2m_temperature'
 9
          data = ct.catalogue.retrieve(
10
               'reanalysis-era5-single-levels-monthly-means',
11
12
13
                   'product_type': 'monthly_averaged_reanalysis',
                   'variable': variable,
14
                   'year': ['{:d}'.format(ii) for ii in range(1940, year + 1)],
15
16
                   'month': ['{:02d}'.format(month)],
17
                   'time': '00:00',
18
19
          data_month_anomalies = ct.climate.anomaly(
20
21
               data,
               interval=['1951','1980']
24
           return data_month_anomalies
```

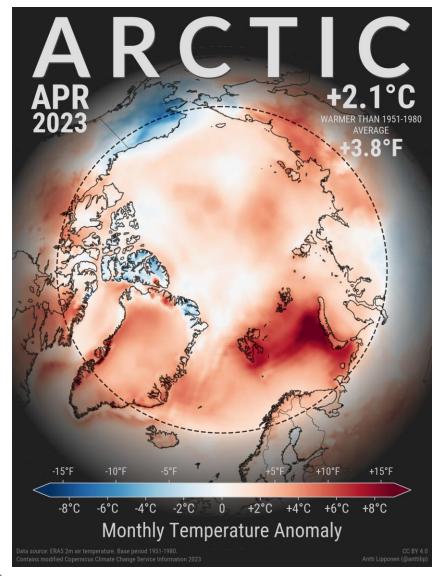
ERA5 data

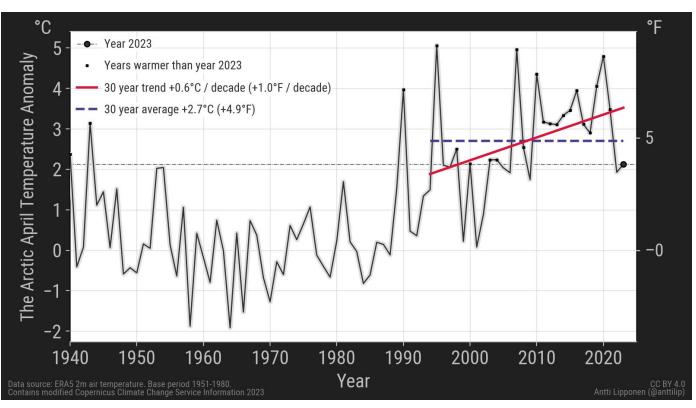
Copernicus Climate Data Store Toolbox

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What I like about Copernicus data

- Easy data access (especially climate & atmosphere data store + online toolbox), this has improved a lot over the last years! Thank you!
- Open data
- Trustworthy, widely used
- Wide variety of variables available
- Available when needed! (only a short delay)

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