C3S
Copernicus
Climate Change Service

Pol-Air-Climate

Carlo Buontempo, Richard Engelen, ECMWF

CAMS
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Atmosphere Monitoring
Service

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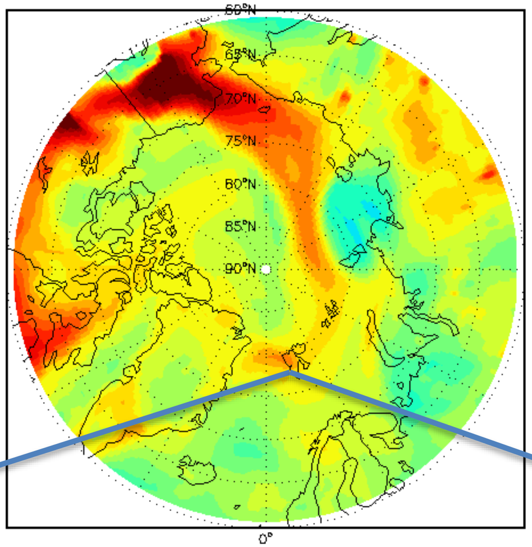
CAMS daily monitoring and forecasting of long-range pollution transport

Atmosphere Monitoring

CAMS biomass burning aerosol, 6-12 July



9 July 2015

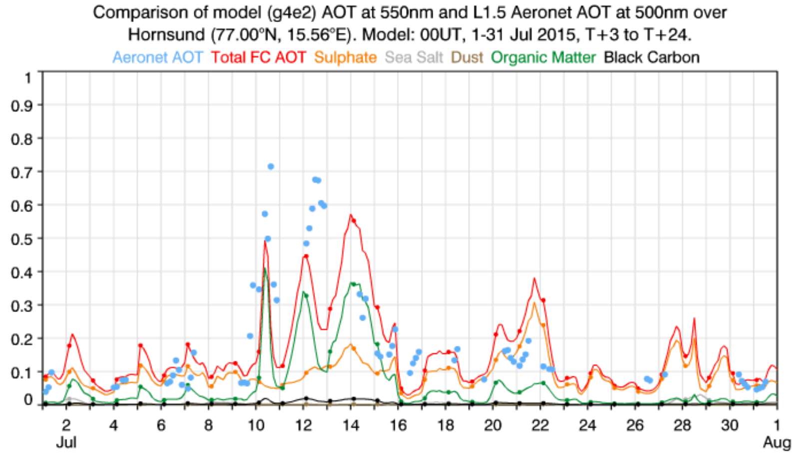
10 July 2015

Photos courtesy of Per Erik Hanevold (Norwegian Polar Institute)

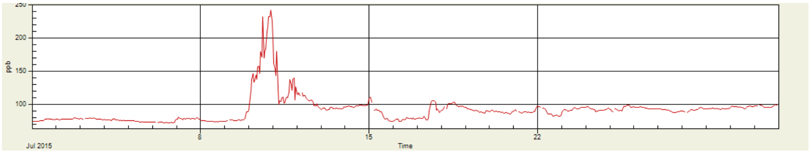
Transpolar transport of Alaskan smoke, July 2015

With its global forecasting system and fire emission estimation system, CAMS monitors the transport of wildfire smoke over the Arctic region.

Smoke can affect visibility, but also affect pristine snow and ice through deposition of aerosols.



Aerosol optical thickness, Hornsund Aeronet site



Carbon monoxide, Zeppelin station

10 July

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CAMS daily monitoring and forecasting of long-range pollution transport

Atmosphere
Monitoring

Transpolar transport of Californian smoke, Summer 2018

Smoke pollution regularly reached the Arctic from large wildfires in Siberia.
Smoke pollution from intense wildfires between California and British Columbia covered large parts of North America and reached as far as Europe.


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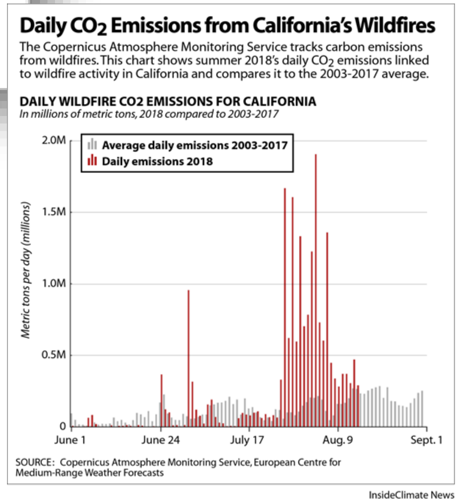
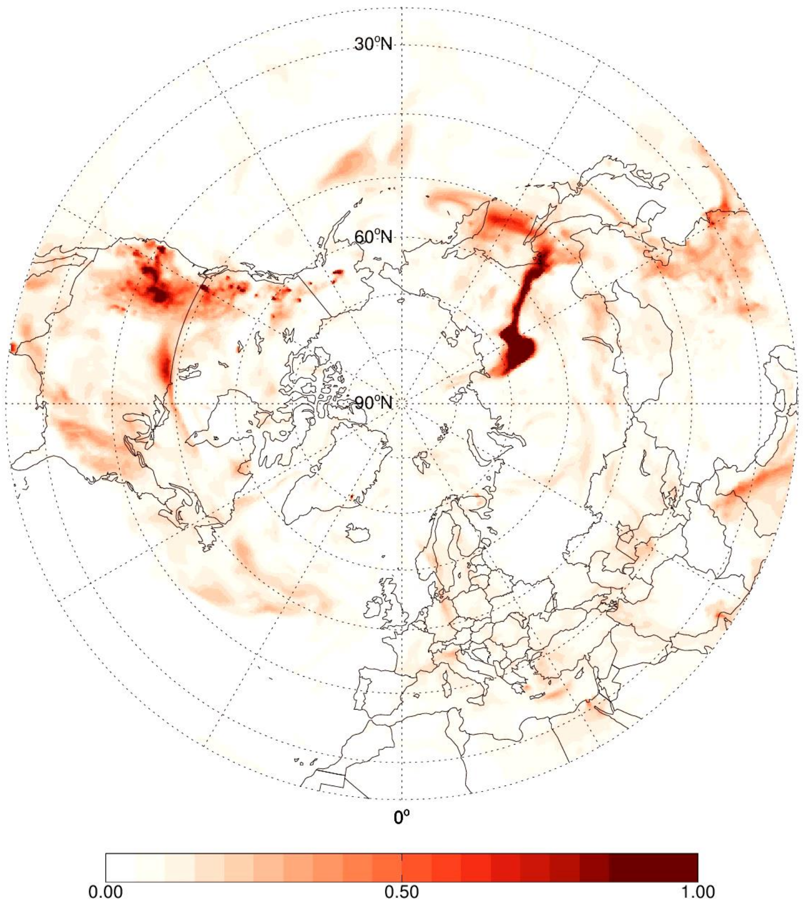
How Wildfires Can Affect Climate Change (and Vice Versa)



CAMS Analysis Organic Matter AOD at 550nm: 20180801, 00z



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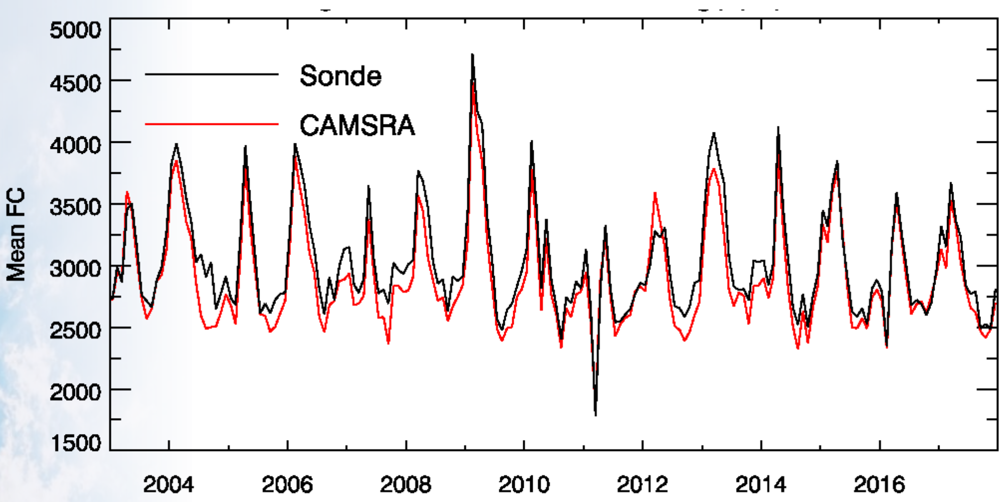
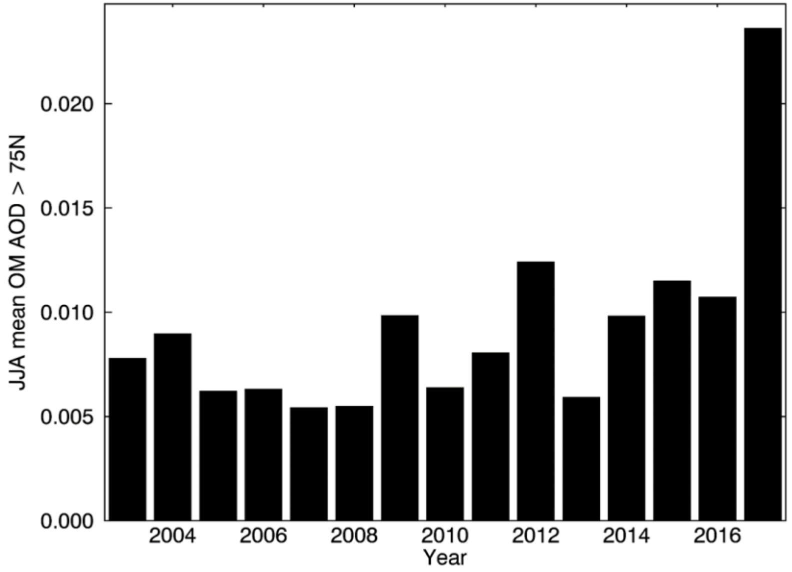
CAMS Global Reanalysis

Atmosphere Monitoring

Stratospheric Ozone (30-70hPa) observed by Ny Aalesund sonde and from CAMS Reanalysis



Summertime average Arctic Organic Matter Aerosol Optical Depth



The CAMS Reanalysis provides a consistent decadal data set, which can be used to look at trends and events for instance stratospheric ozone or organic matter aerosol over the Arctic region.
Organic matter aerosol is also polar-relevant when deposited on sea-ice.

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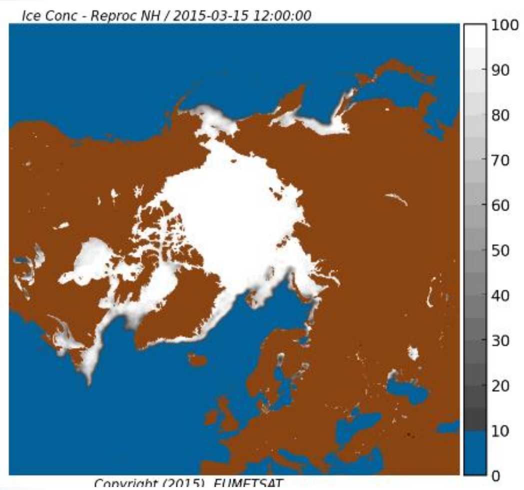
From data to key messages – Arctic sea ice

Climate Change

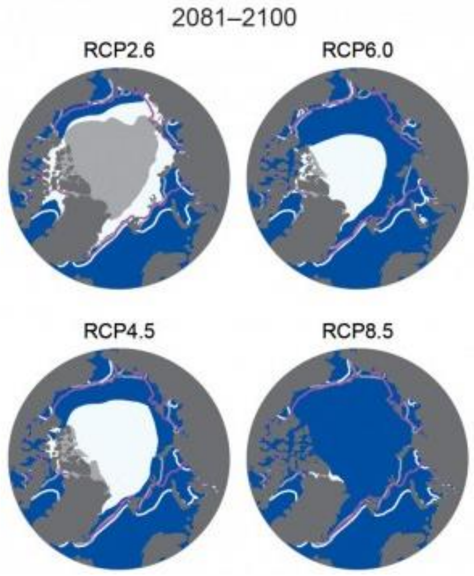
Satellite observations



Credit: EUMETSAT (2015)

Reanalysis

Climate model simulations



Credit: IPCC (2013), AR5

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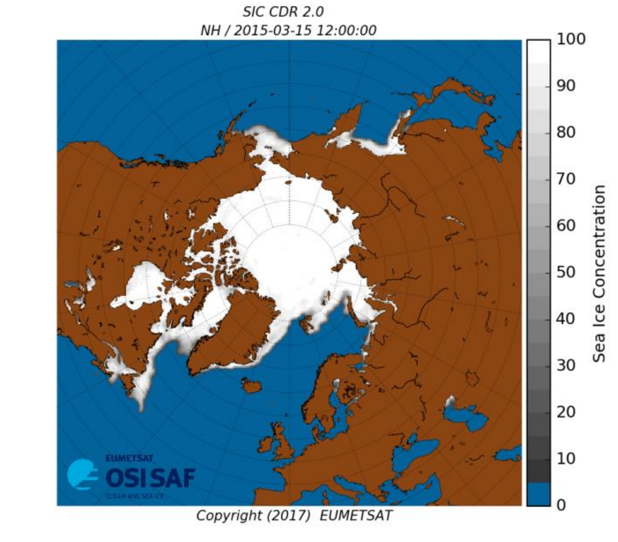
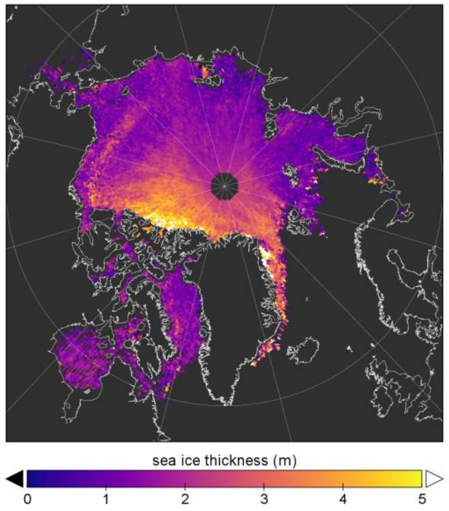
Climate Change

ECVs sea ice

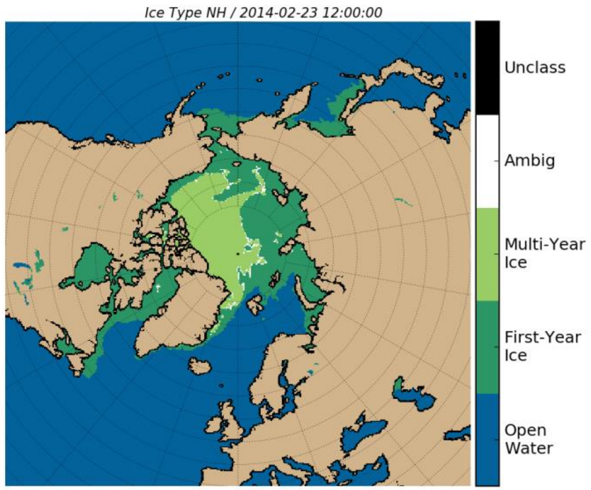
Sea Ice Concentration (SIC)



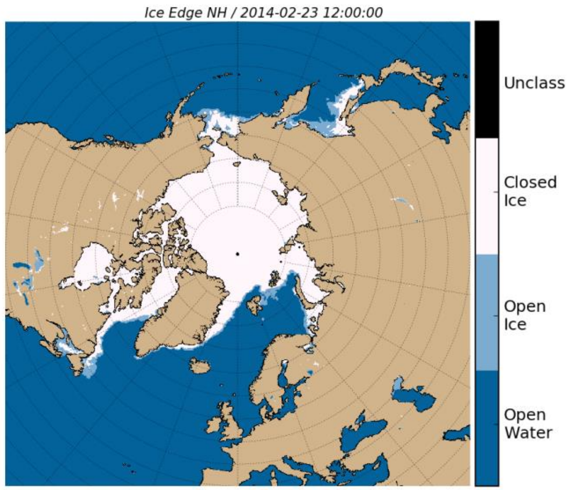
Sea Ice Thickness (SIT)



Sea Ice Type (SITy)



Sea Ice Edge (SIE)



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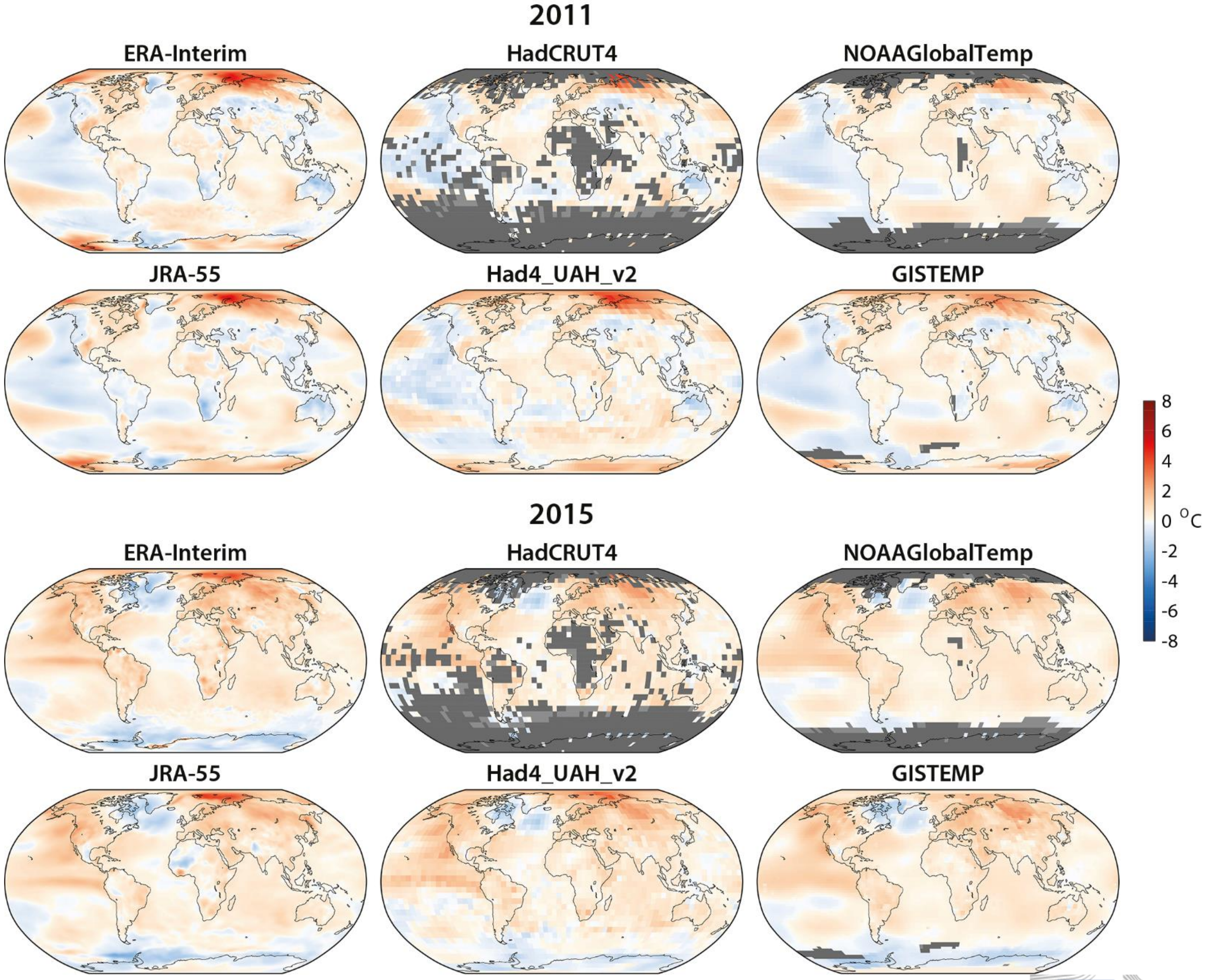
Reanalysis: a key input



Datasets differ in geographical coverage and spatial resolution

Values are plotted if annual coverage is complete, and coverage of 1981-2010 is at least 90%.

GISTEMP and Had4_UAH_v2 extend coverage in a way consistent with the reanalyses, but have weaker polar anomalies, GISTEMP in particular

Credit: A. Simmons

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C3S Arctic reanalysis

Climate Change

- Contract recently awarded to met.no

- 2.5 km resolution
- 3D-Var

- Can be seen as precursor of C3S 2.0 pan-Arctic reanalysis (2021-..)

Norwegian Meteorological Institute

Credit: H. Schyberg

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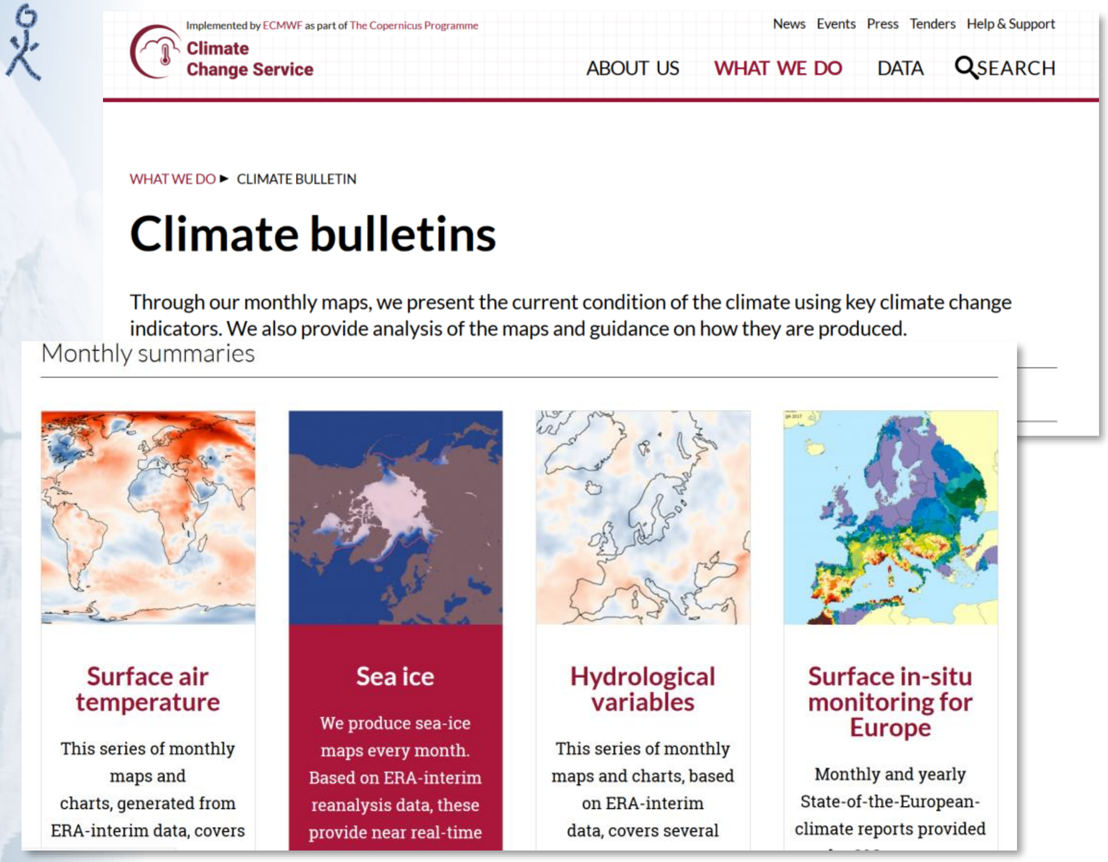
Climate Change

Accessing climate information – Monthly climate bulletins

How has Arctic Sea Ice changed over the last 40 years? What about 2018?



Implemented by ECMWF as part of The Copernicus Programme

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WHAT WE DO ▸ CLIMATE BULLETIN

Climate bulletins

Through our monthly maps, we present the current condition of the climate using key climate change indicators. We also provide analysis of the maps and guidance on how they are produced.

Monthly summaries

Surface air temperature

This series of monthly maps and charts, generated from ERA-interim data, covers

Sea ice

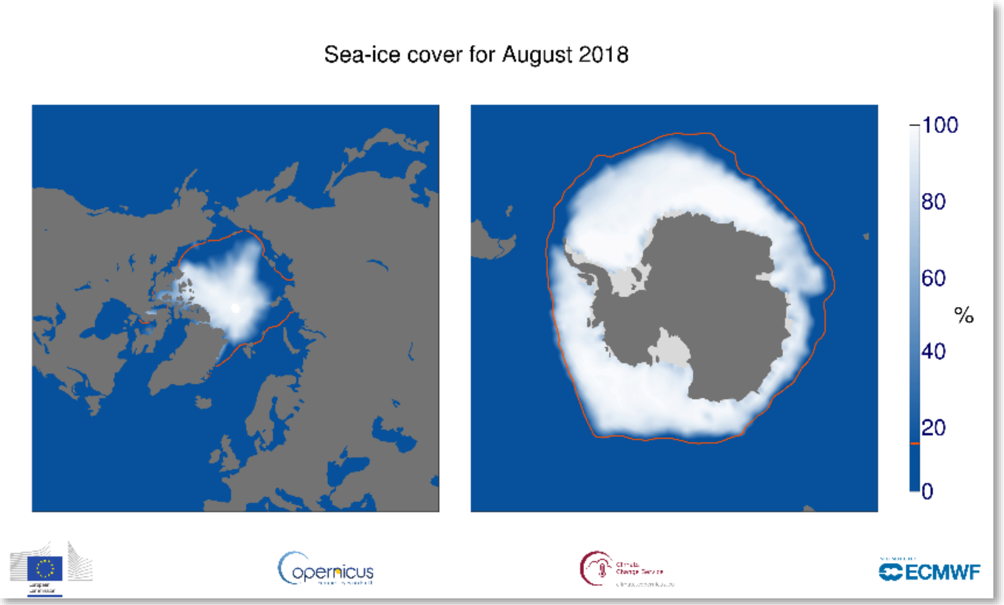
We produce sea-ice maps every month. Based on ERA-interim reanalysis data, these provide near real-time

Hydrological variables

This series of monthly maps and charts, based on ERA-interim data, covers several

Surface in-situ monitoring for Europe

Monthly and yearly State-of-the-European-climate reports provided



➢ climate.copernicus.eu/climate-bulletins

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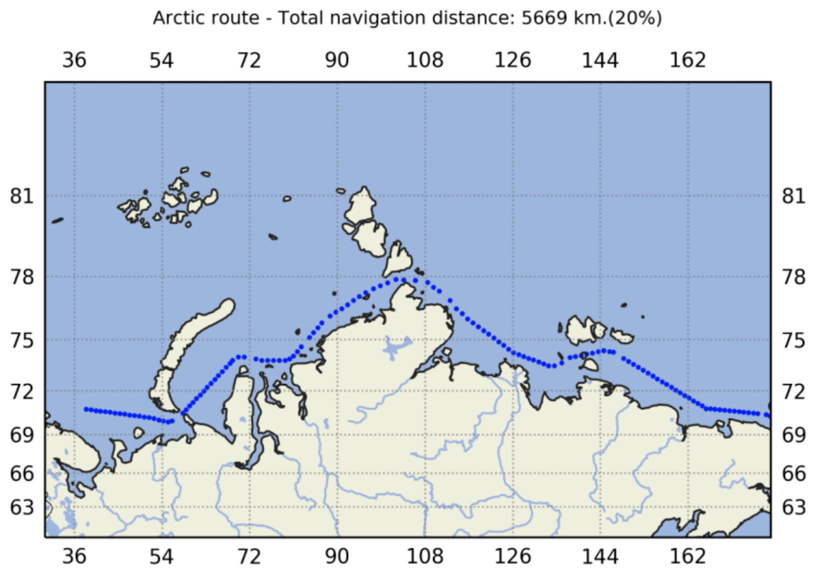
Polar applications

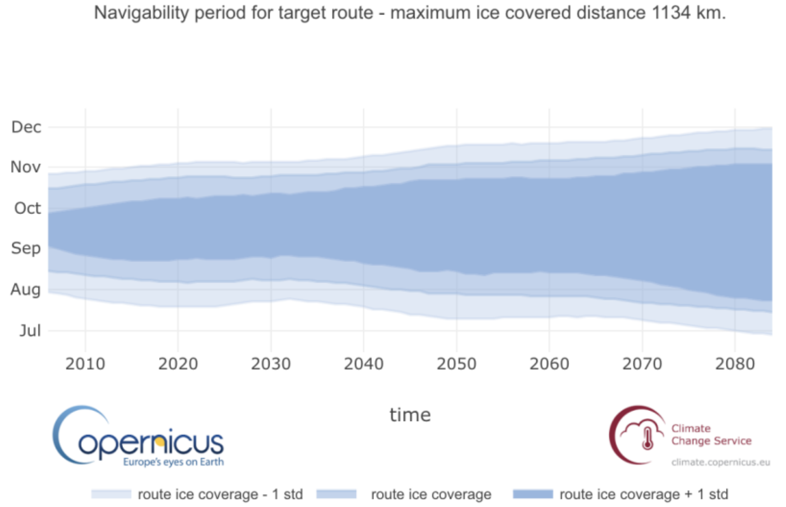
Climate Change

Future arctic route navigability

Maximum ice covered distance (%)

20





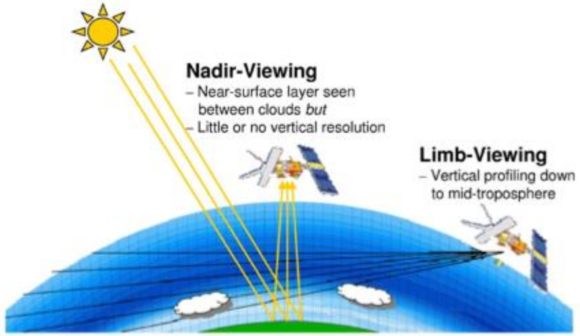
Version: 3.3.2 - build b271b97

Atmosphere Monitoring

CAMS requirements

Continuation of polar wildfire monitoring (Sentinel-3, Sentinel-5(p)) and increase in ground validation sites.

Microwave Limb Sounder is critical to monitor stratospheric ozone and related chemical species in and out of the polar night. American MLS sounder is aging.



C3S requirements

Give continuity to the existing missions to facilitate the maintenance of a high-quality climate data record of sea-ice ECVs (SIC, SIT, SITy, SIE,..), and ozone.

Highly Elliptical Orbit (HEO) instrument to monitor for instance CH4 over permafrost regions or polar transport of wildfire emissions would bring added value to current observing system

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Thank you

Climate Change

Humans are affecting the Arctic but the change in the Arctic is also affecting the climate we live in. We need to improve our understanding of the key processes in atmosphere, snow, sea ice, and ocean responsible for linking the polar regions with the lower latitudes. Progress hinges on an improved observational base and on bringing expertise in high-latitude and midlatitude dynamics together.

This means improving our understanding and our capacity to model key process including improved Arctic-centered model development. Carry out coordinated model experiments to thoroughly assess possible remote impacts of polar climate change. Emphasis should be put on both local and possible global consequences of Arctic amplification.

Ensure that environmental prediction and model assessment requirements will have a high priority in the future development of the polar observing systems. The Year of Polar Prediction (YOPP) provides a unique opportunity for the international community to jointly advance our observational capacity.

Create a working group to tackle the specificity of polar service provision. This working group could illustrate the benefits that stakeholders with interests at lower latitudes might have in improving polar predictions.

T. Jung, et al. , 2015: Polar Lower-Latitude Linkages and Their Role in Weather and Climate Prediction. Bull. Amer. Meteor. Soc., 96, ES197–ES200,https://doi.org/10.1175/BAMS-D-15-00121.1