




Overview of the Arctic IST/SST activities for the Copernicus Marine Service

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Overview

- Copernicus Phase 2 2022-2024
- Production Unit: Sea Ice TAC
- Products for the Arctic
 - NRT SST/IST L4 (2019-onwards)
 - REAN SST/IST L4 (1982-2021)
- New products in November 2022
 - Ocean Monitoring Indicators
 - REAN IST/SST L3S (1982-2021)

Implemented by Mercator Ocean International as part of the Copernicus Programme

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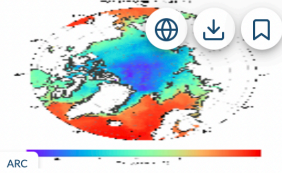
Search: 011
 Regional domain: Arctic Ocean
 From: 1992-01-01
 To: 2022-06-09
 Parameters: Temperature
 Protocols:

Only the whole selected time range
 Only with depth level

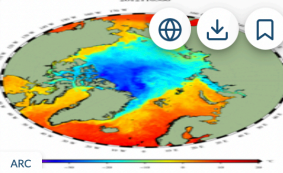
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There is 2 ocean products corresponding to your criteria



Arctic Ocean - Sea And Ice Surface Temperature Reprocessed
 SEAICE_ARC_PHY_CLIMATE_L4_MY_011_016
 SST IST
 From: 1982-01-01 To: 2021-05-31

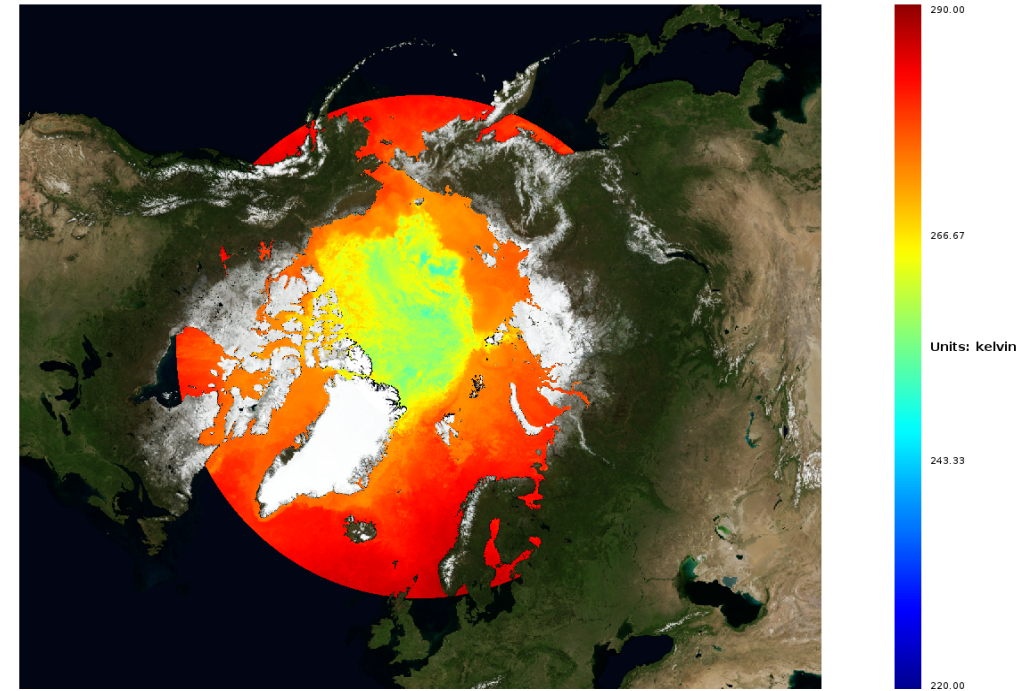


Arctic Ocean - Sea And Ice Surface Temperature
 SEAICE_ARC_SEAICE_L4_NRT_OBSERVATIONS_011...
 SST IST
 From: 2019-05-04 To: Present

[https://
marine.copernicus.eu](https://marine.copernicus.eu)

L4 NRT IST/SST

- Daily T+1 12:30, 0.5 degrees, 2019 -
- Night-time observations
- DMI OI scheme
- Evolution 2022: Implementing routine QC/Validation
- Validation statistics
 - SIMB3 2021 IST Bias: -3.52, StDev: 3.63, N: 621.
 - Drifters 2016-2017 SST Bias: -0.1, StDev: 0.55, N: 22544.
- Foreseen evolutions 2023-2024
 - 2023: Assess & improve uncertainty estimates.
 - 2024: Feasibility analysis and possible ingestion of SLSTR IST product, AMSR2 SST.



Example of the daily L4 IST/SST on the CMEMS catalogue.

Multi-Year L4 IST/SST

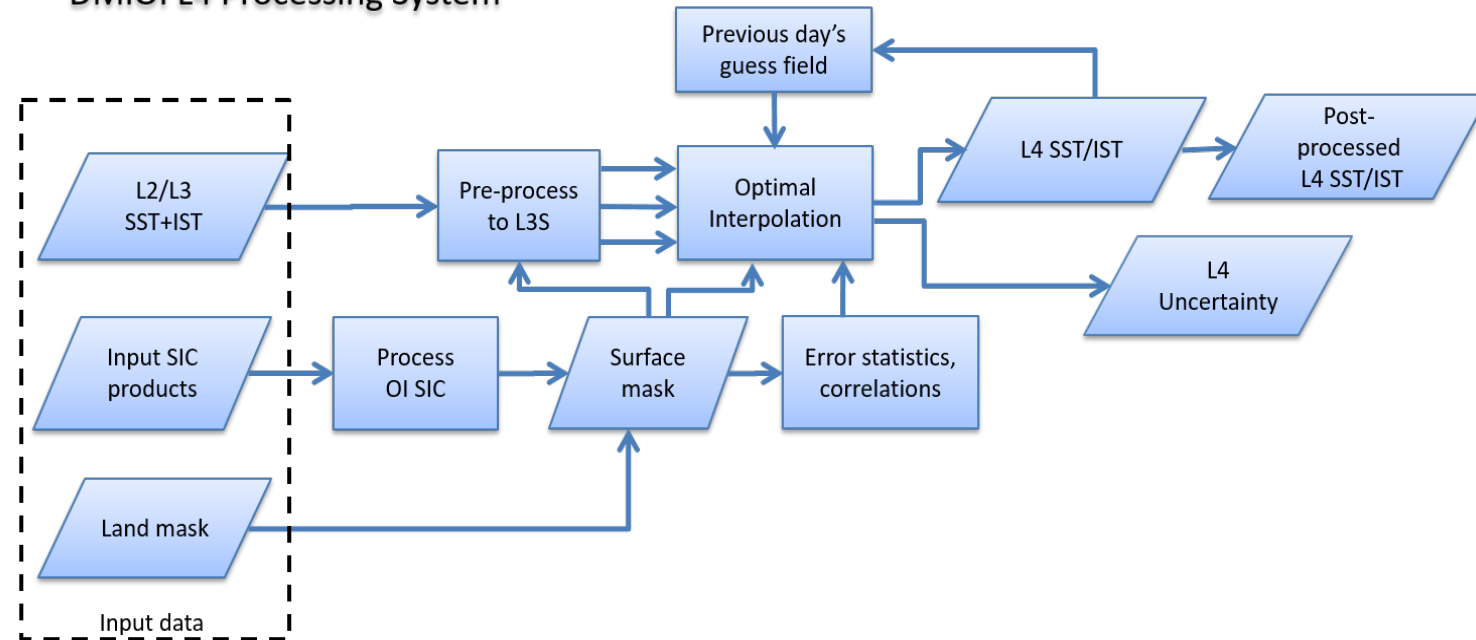
- Input data

- SST CCI L2P (ATSR, AATST, NOAA AVHRR)
- Copernicus C3S SST (SLSTR A/B, NOAA/Metop AVHRR 2016-2019)
- AASTiv2, OSISAF Metop AVHRR SST/IST

- Sea Ice Concentration

- SICCI-25km: ESA CCI SI, AMSR-E (Jun 2002- Oct 2011), AMSR2 (Jul 2012-present)
- OSI-450: EUMETSAT OSI-SAF v2, SMMR/SSM/I(S), 1979-2015
- High resolution SIC from SMHI/CMEMS

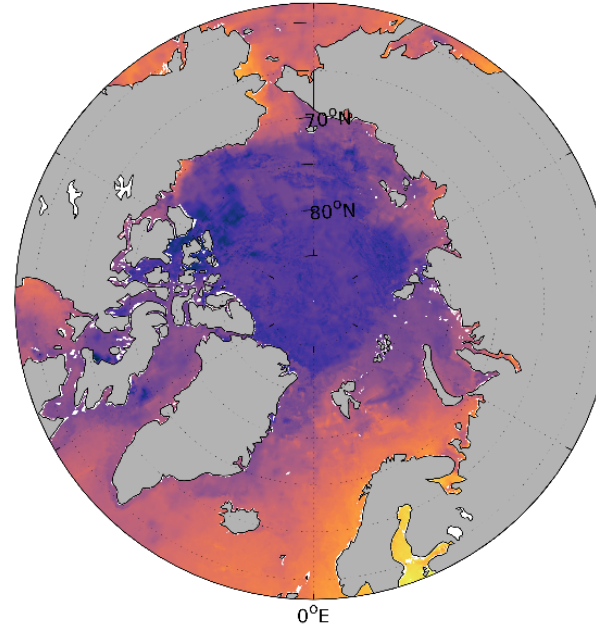
DMIOI L4 Processing System



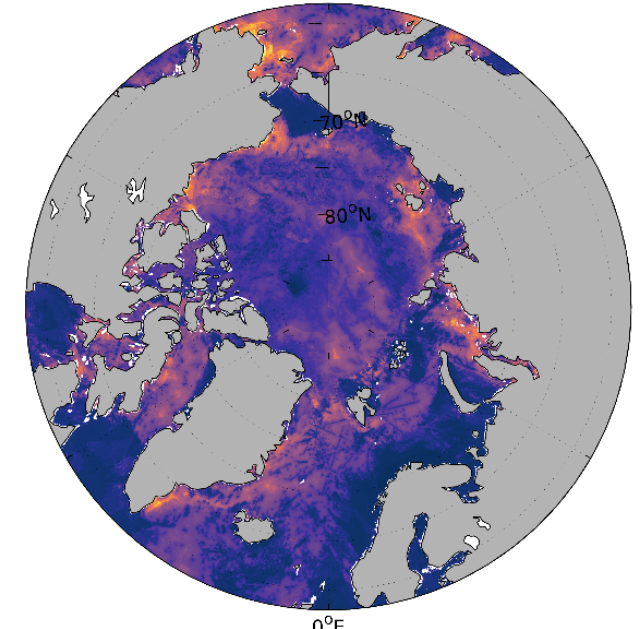
Multi-Year L4 IST/SST*

- Example of L4 SST/IST and associated uncertainty field
- Validation with various types of sensors

L4 SST/IST
2018-08-01



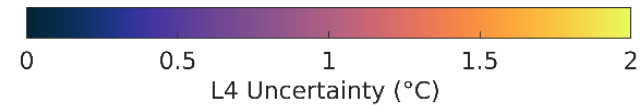
L4 Uncertainty
2018-08-01



b)



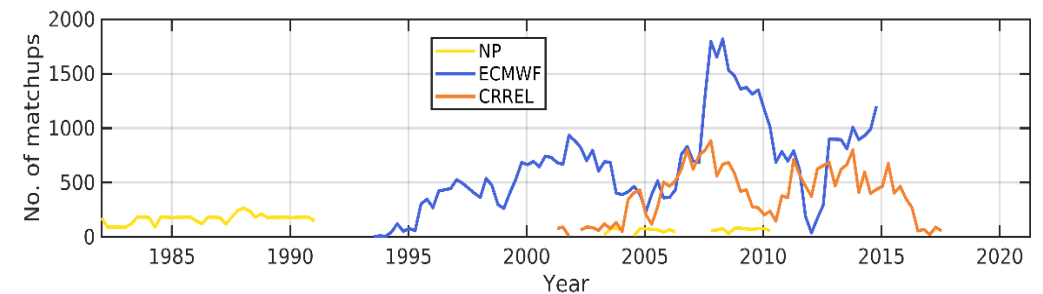
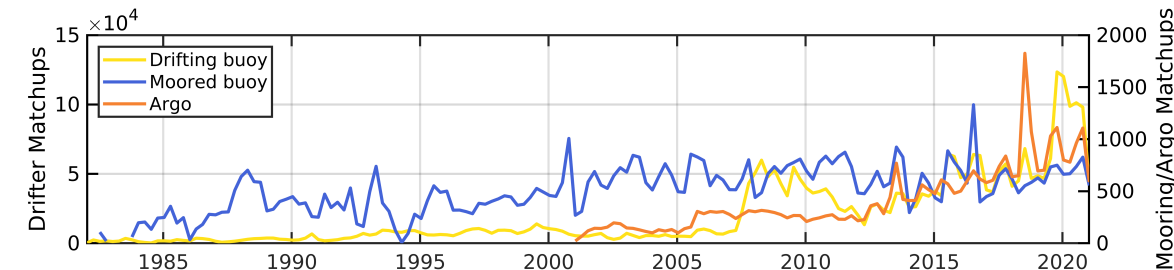
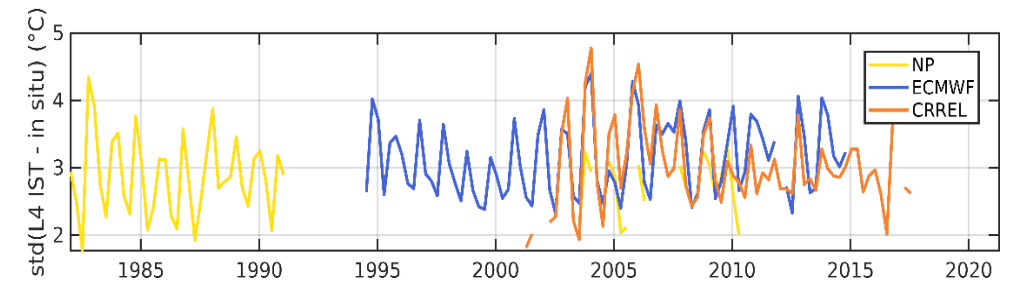
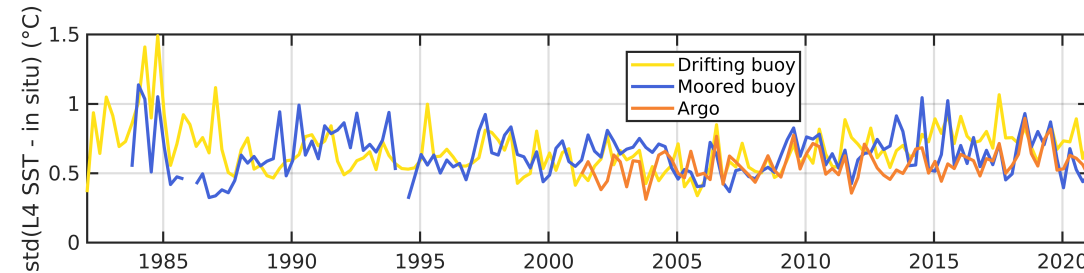
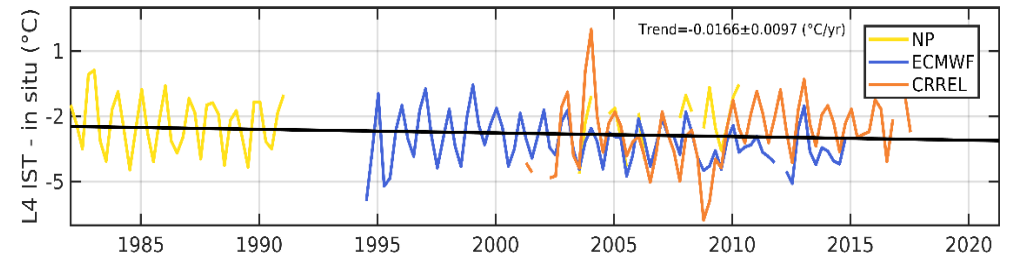
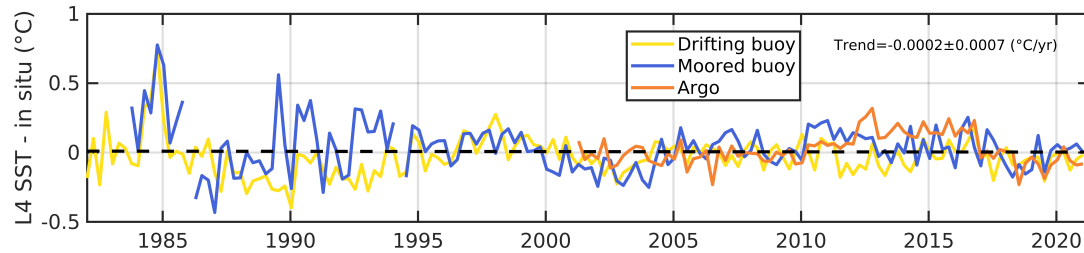
d)



Type	Parameter	Mean	Std	RMS	Nobs
Drifting buoys	SST (°C)	0.00	0.54	0.54	3062549
Moored buoys	SST (°C)	0.03	0.56	0.56	76052
Argo floats	SST (°C)	0.03	0.51	0.51	32953
NP drifting ice stations (T2m)	IST (°C)	-2.35	3.12	3.91	7665
Drifting buoys ECMWF (T2m)	IST (°C)	-3.21	3.34	4.63	55288
Drifting buoys CRREL (T2m)	IST (°C)	-2.87	3.36	4.42	22979
Icebridge KT-19 (IST, SIC>=15%)	IST (°C)	1.52	3.12	3.48	36638

*Nielsen-Englyst P, et al. (2022): A combined sea and ice-surface temperature climate dataset of the Arctic 1982-2021. Remote Sensing of Environment, under review.

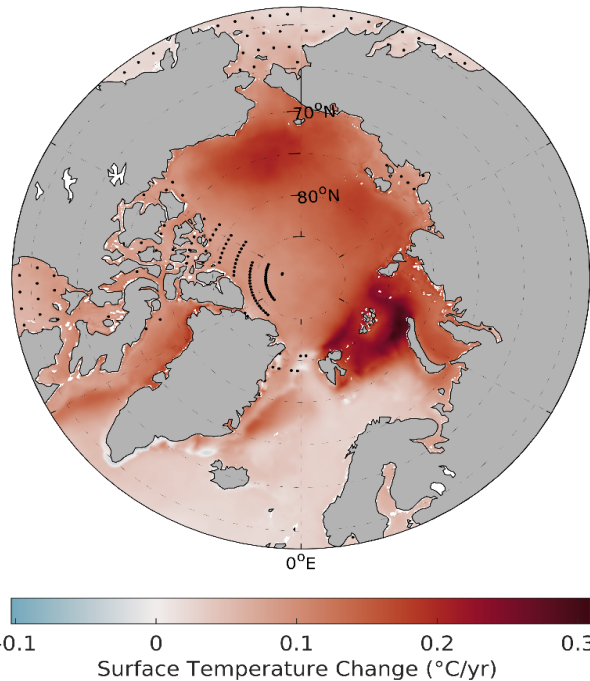
Annual Validation of Multi-Year L4 IST/SST*



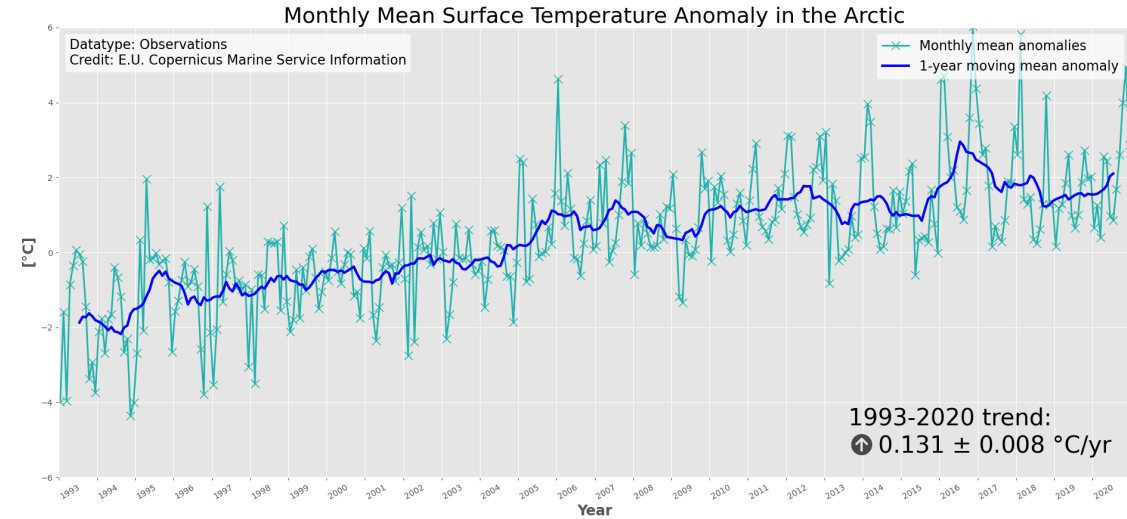
*Nielsen-Englyst P, et al. (2022): A combined sea and ice-surface temperature climate dataset of the Arctic 1982-2021. Remote Sensing of Environment, under review.

Ocean Monitoring Indicators

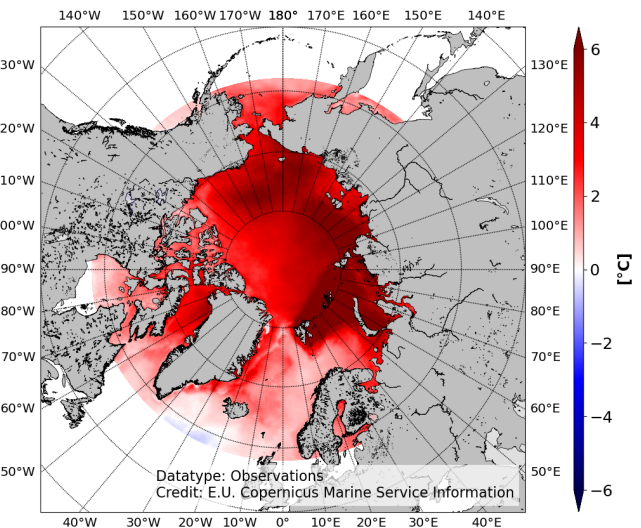
- Temporal extension of Multi-Year L4 IST/SST up to 12/2021
- To be released in 2022
 - Monthly mean anomalies from 1993-2014 climatology.
 - Cumulative trend in IST/SST anomalies 1991-2021.



Average rate of surface temperature change (°C) per year (1982 to May 31, 2021). Black dots: trends are not significant.



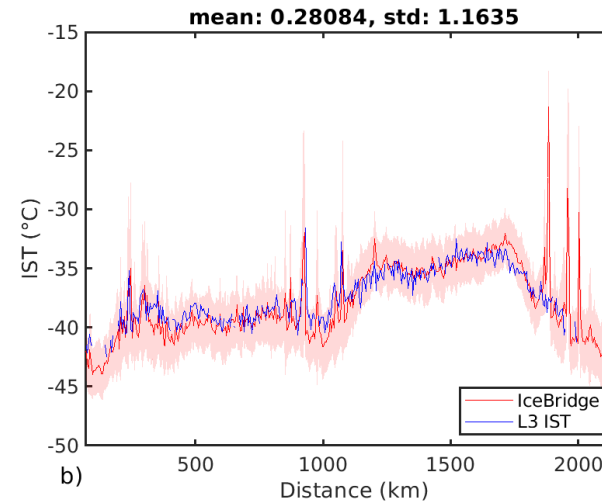
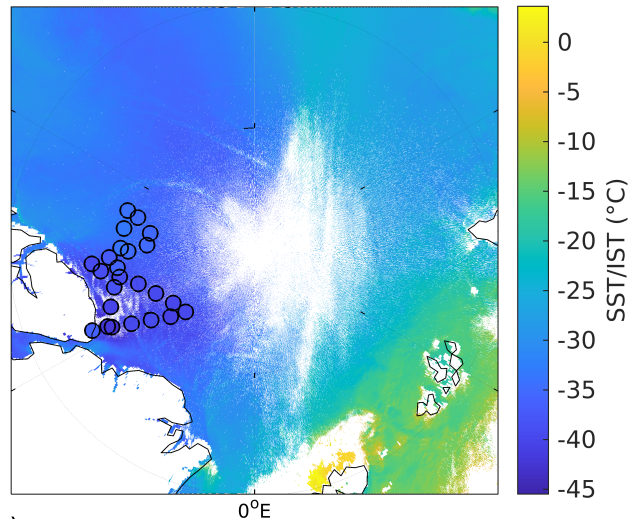
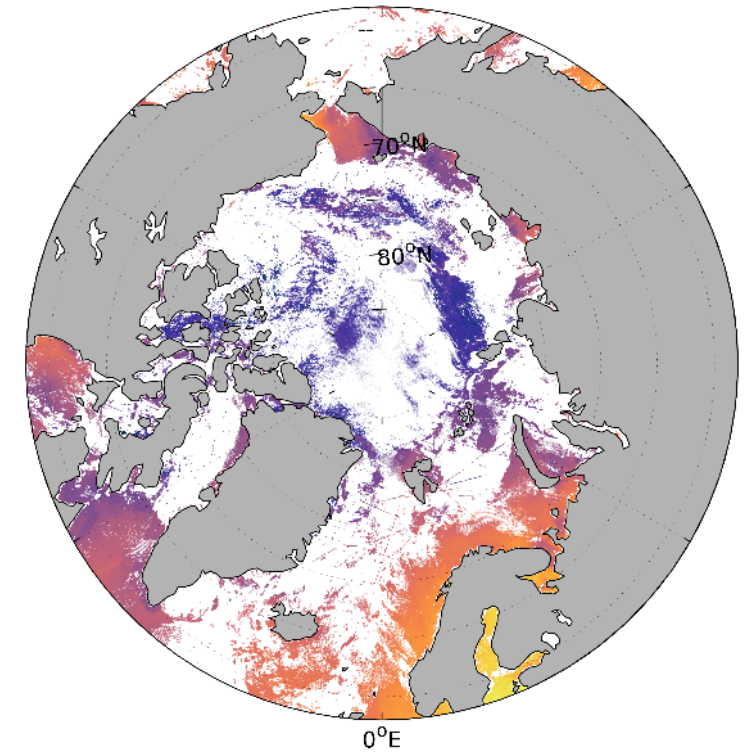
Surface Temperature Trends in the Arctic 1993-2020



Multi-Year L3S IST/SST

Type	Parameter	Mean	Std	RMS	Nobs
Drifting buoys	SST (°C)	0.07	0.43	0.44	876709
Moored buoys	SST (°C)	0.10	0.53	0.54	29946
Argo floats	SST (°C)	0.12	0.40	0.41	10312
NP drifting ice stations (T2m)	IST (°C)	-1.81	2.51	3.09	1183
Drifting buoys ECMWF (T2m)	IST (°C)	-3.22	3.36	4.65	26502
Drifting buoys CRREL (T2m)	IST (°C)	-2.69	3.38	4.32	11149
Icebridge KT-19 (IST, SIC >= 15%)	IST (°C)	0.69	3.11	3.18	33057

L3S SST/IST
2018-08-01



Conclusions and Outlook

- 1 Near-Real-Time and 2 Multi-Year products for the Arctic Ocean.
- Release of Ocean Monitoring Indicators
- Continuous assessment & evolution of the products through annual release cycles.
- Major developments for the next years include uncertainty analysis, ingestion of new sensors/products.
- Multi-Year product useful for analysis of IST/SST variability and trends.
 - Arctic ocean surface temperature (SST+IST+MIZT) has increased $>4^{\circ}\text{C}$ since 1982.
- Bonus: ESA LST CCI User Case, ingest new IST products to Multi-Year OI Chain.

Thank you for your attention.
Questions welcome through Moodle or
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