New AOPC members presentation

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GCOS Joint Panel meeting: 19-23 April 2021

Climate Change Service
climate.copernicus.eu

ECMWF

My background in short

Sectoral Information System Manager, Copernicus Climate Change Service, ECMWF

Scientist, Consiglio Nazionale delle Ricerche (CNR), Istitute of Marine Sciences (ISMAR), Roma

Ph.D. in Earth and Environmental Sciences at the “Ecole Polytechnique”, Paris - France
Degree in Physics at the University of Rome “La Sapienza”

As a scientist my research has been dedicated to :

- Evaluation and Quality Control of Essential Climate Variables
- Atmospheric dynamics, climate variability, climate modeling and predictions, at timescales from sub-seasonal to decadal, and long-term climate projections
- I have been teaching numerical modeling, climatology and geophysical fluid dynamics at University of Tor Vergata, in Rome – Radiation and Climate, PhD, Venice.
- 2018 WMO/UNEP Scientific Assessment of Ozone Depletion, Review Editor of Chapter 5: Stratospheric ozone changes and climate, Lead Authors: Alexey Karpechko, Amanda Maycock; Editors C Cagnazzo and L Polvani, (2019)

Climate Change

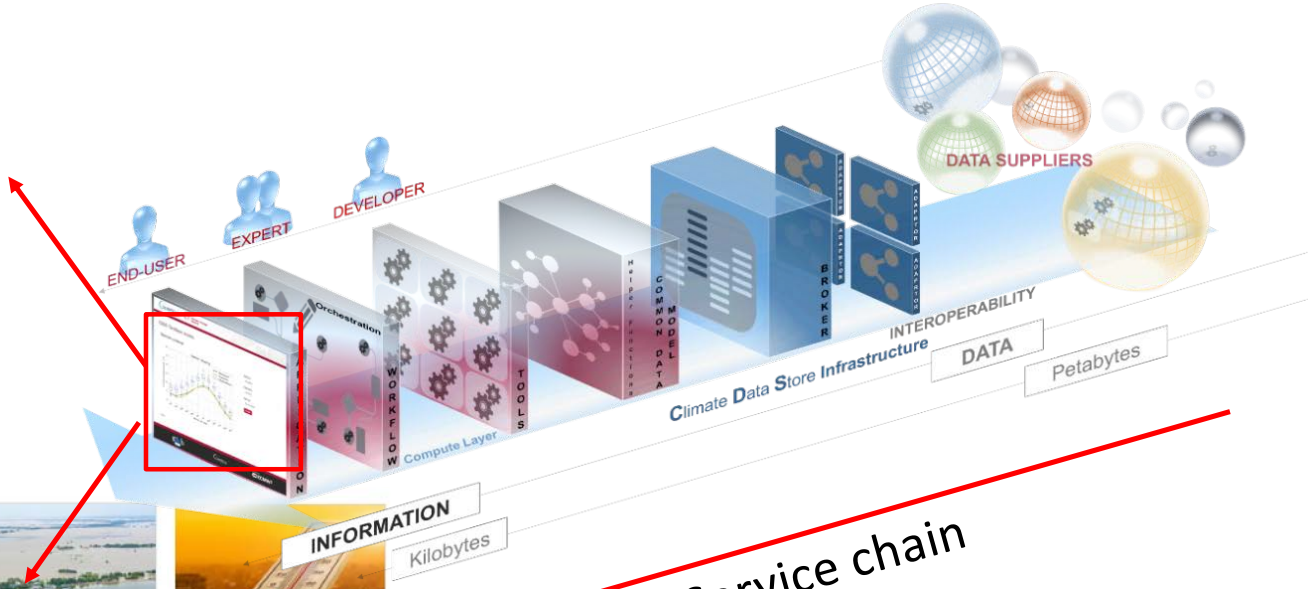
The Copernicus services

ECMWF Copernicus Europe's eyes on Earth European Commission

Climate information and knowledge

Climate Change

Monitoring




Infrastructure, Transport and Associated Standards


Biodiversity


Energy


Disaster risk reduction


Health


Water management


Insurance


Coastal areas


Agriculture and forestry


Tourism

Service chain

Quality assured information and tools for users ranging from scientists to practitioners and policy makers.

ECMWF Copernicus Europe's eyes on Earth European Commission

Climate Change

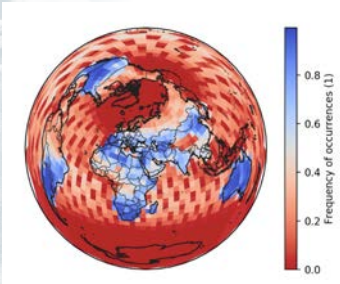
EQC: INDEPENDENT ASSESSMENT of CDS ECV

22 ECVs @C3S

Independent
Fully traceable
Replicable
Transparent to the users

Basic Check

Independent check on resolution
Dataset Completeness



Dataset Maturity

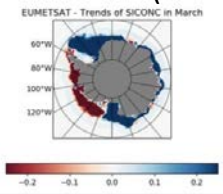
Independent maturity assessment

Implement and adapt EU-framework Quality functions and methods

GAIA-CLIM
Core Climax
QA4ECV

Fitness4Purpose, Through state-of-the-art scientific use cases

Means & variability
Trend detection
Cross-comparison observations, models & reanalysis
Extreme events (selected)



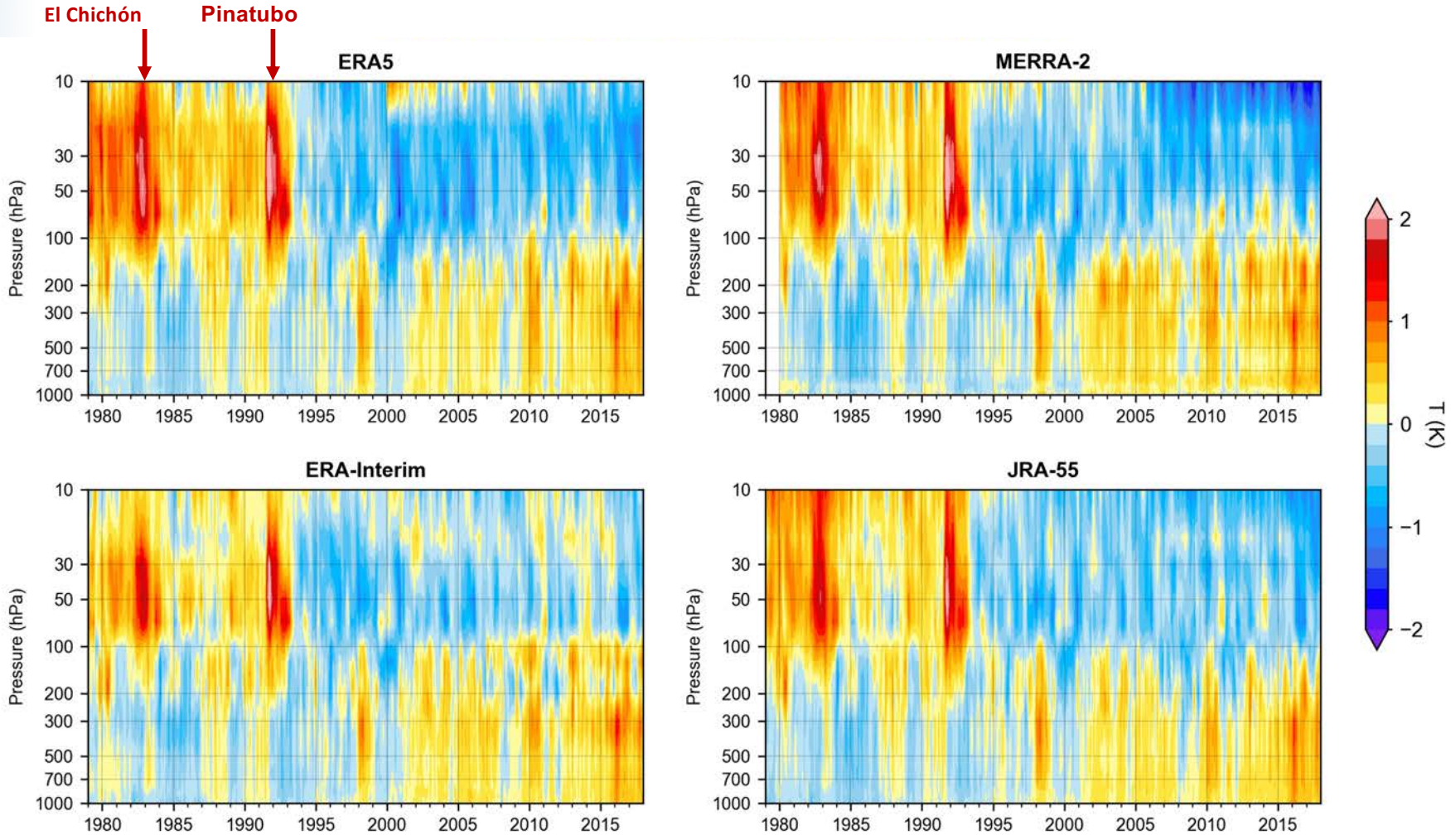
User Guidance

Summary for the User
User Guidance (Application Matrix):
Closeness of Datasets to User Applications

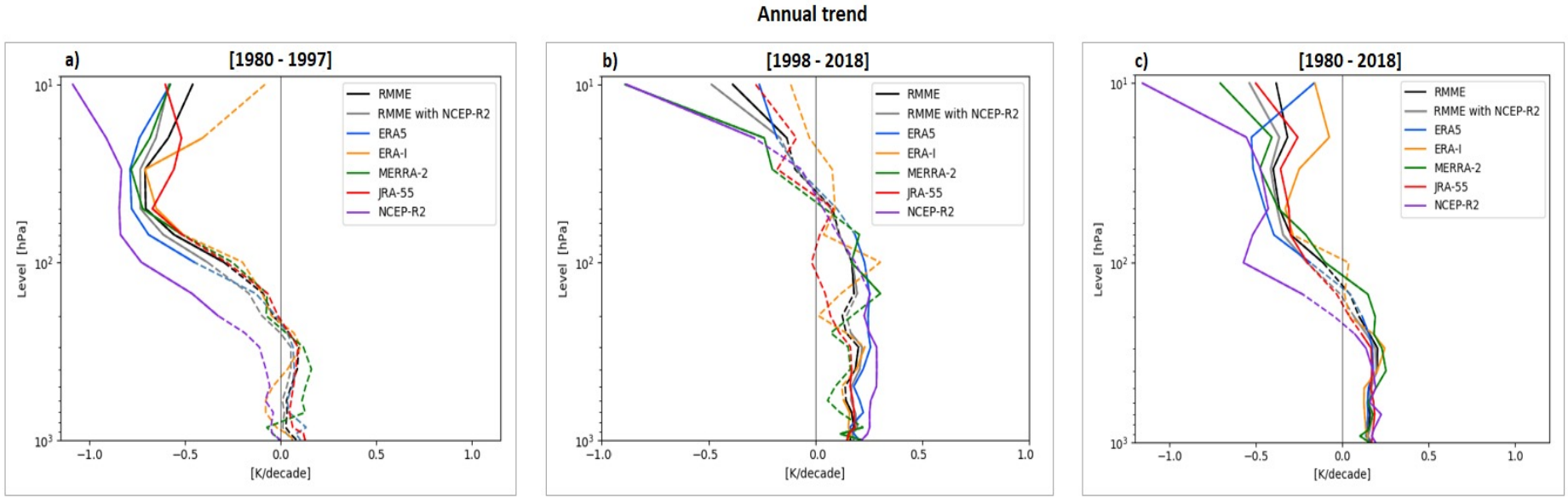
Open source software for reproducibility & versioning

Climate Change

Intercomparison of global reanalysis



Trends in Global reanalyses



Stratosphere

1980-2018: stratospheric cooling

1980-1997 : strongest ozone contribution

1998-2018: the stratospheric cooling is dominated by the increase in GHGs

Troposphere:

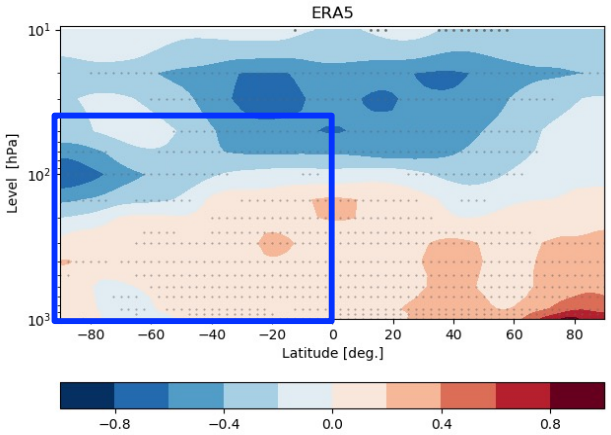
1980-2018 : Warming (order of 0.25 K/decade) dominated by the 1998-2018 trends

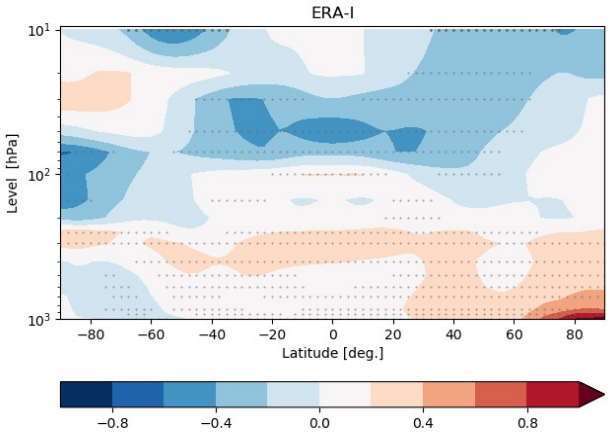
1980-1997: Insignificant warming over the previous ~2 decades

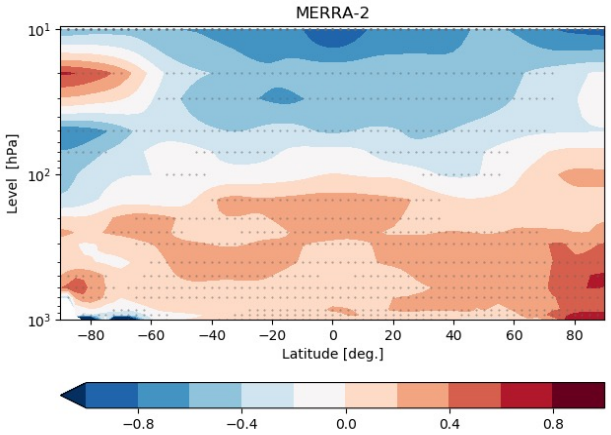
insignificant trends in the upper troposphere are found, due to large internal variability and observational uncertainties

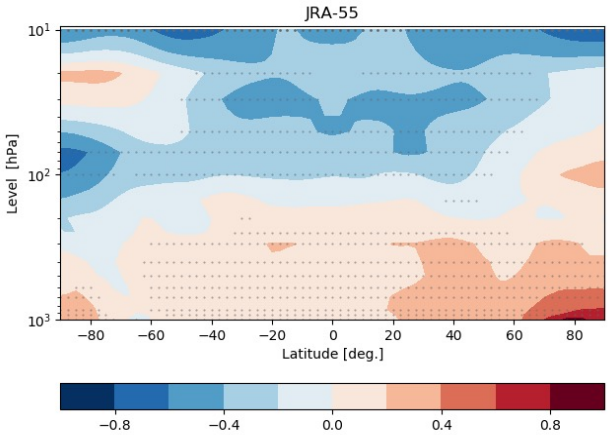
Global warming trends are indistinguishable from variability for 1980-1997 clearly emerge from it after 1998

Trends in Global reanalyses









Spatial distribution of zonal mean trends:

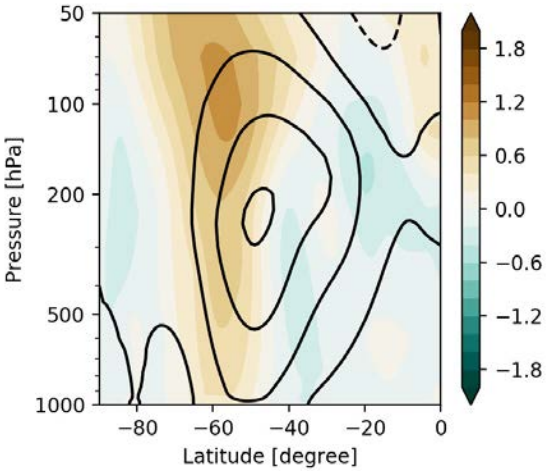
NH polar warming: Arctic Amplification

Upper atmosphere: role of poleward heat transport

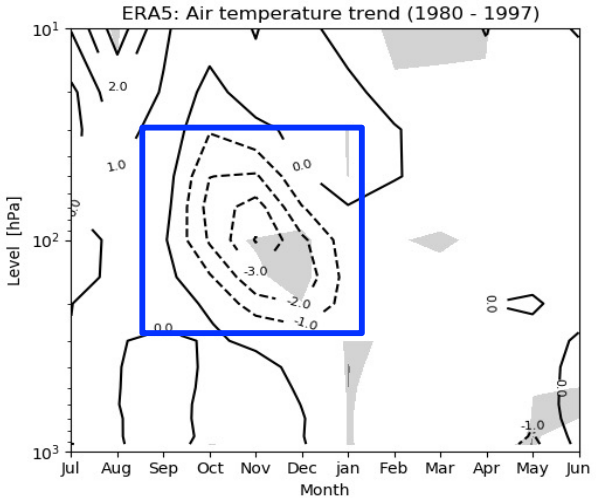
Surface: snow and sea-ice feedbacks

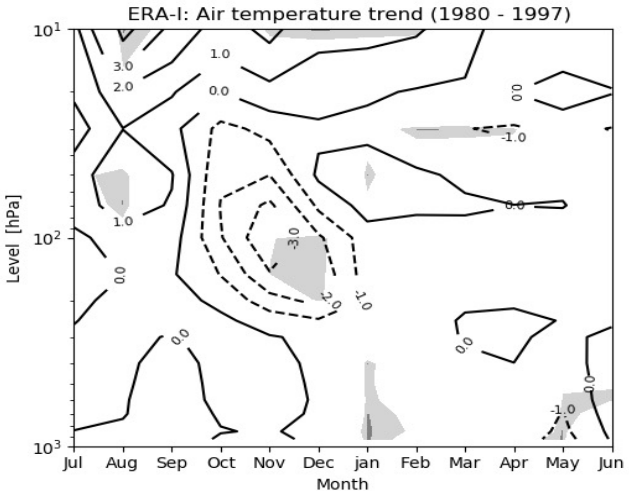
Stratosphere: cooling associated to radiative forcing, peaking in the SH

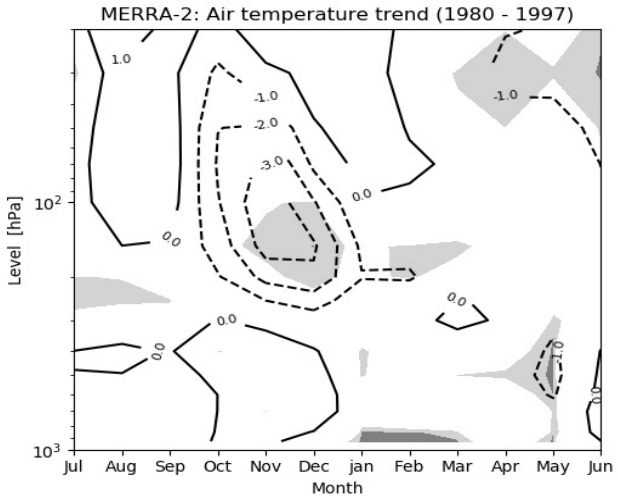
Zonal mean zonal wind

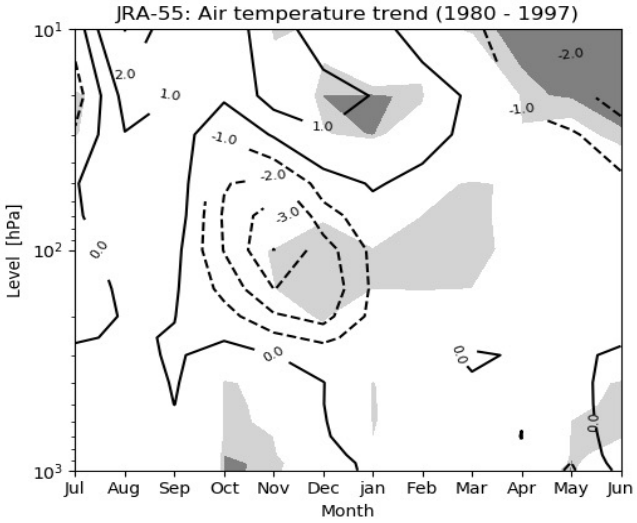


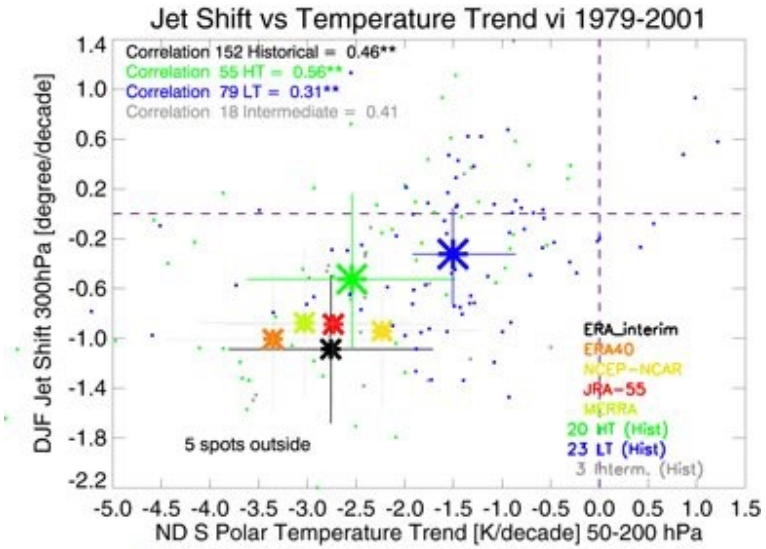
Trends in Global reanalyses: the Southern Hemisphere







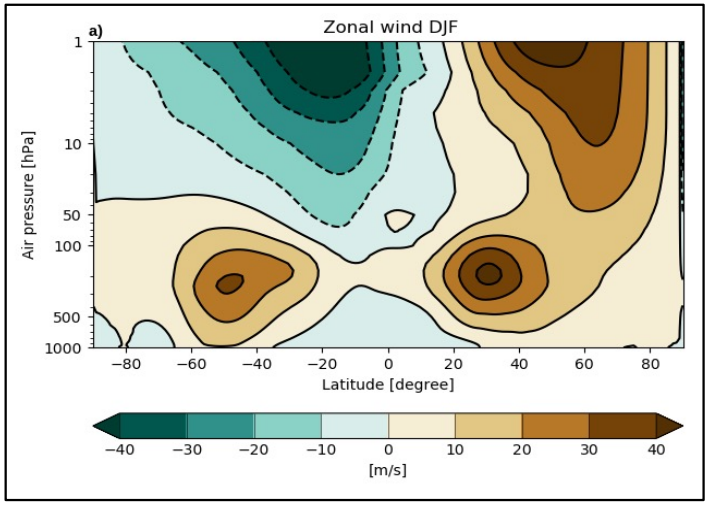


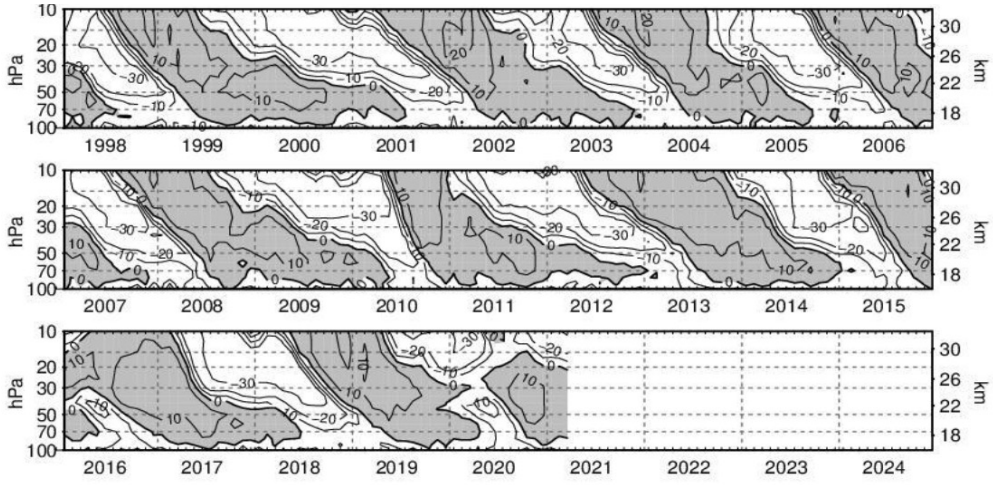


Stratospheric cooling

Rea et al , 2018

Reanalyses: wind- the stratosphere

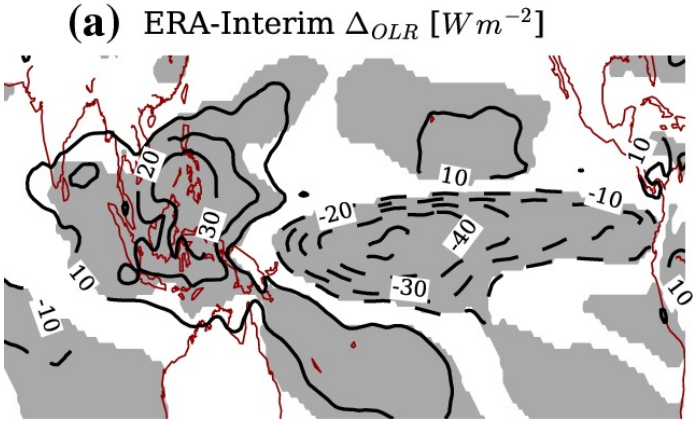




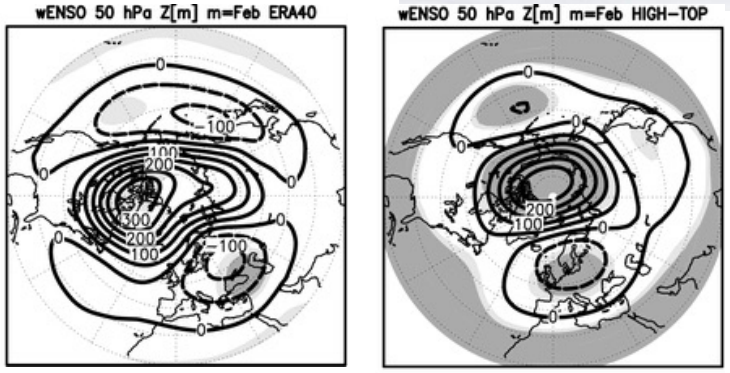
The QBO- (Figure from FU-Berlin)

QBOi initiative
SPARC
Stratosphere-troposphere
Processes And their Role in Climate

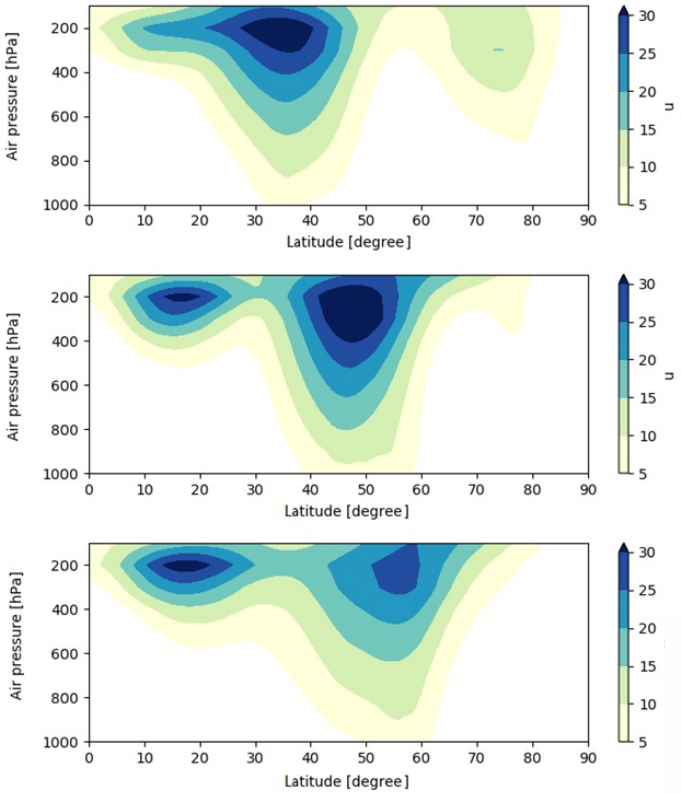
ENSO & the QBO
Serva et al., 2020

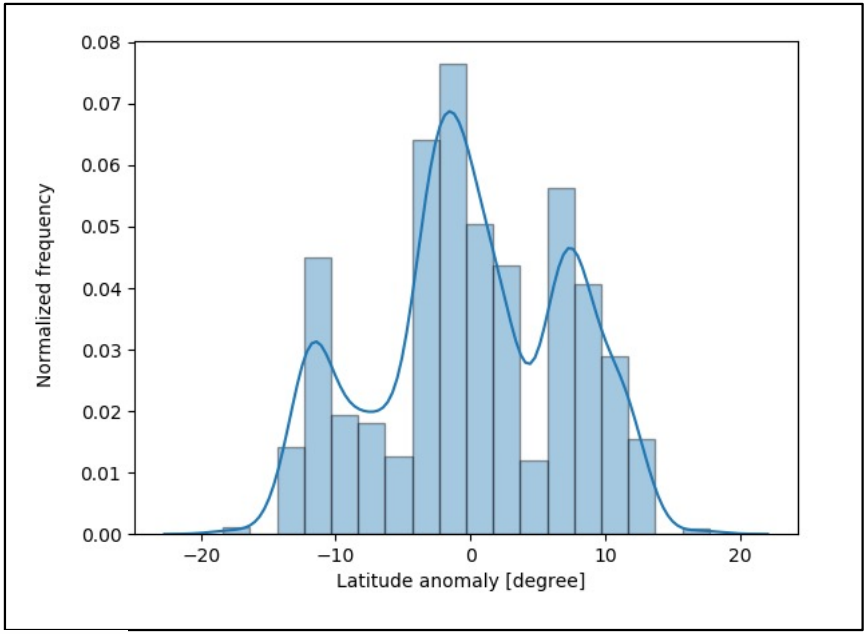


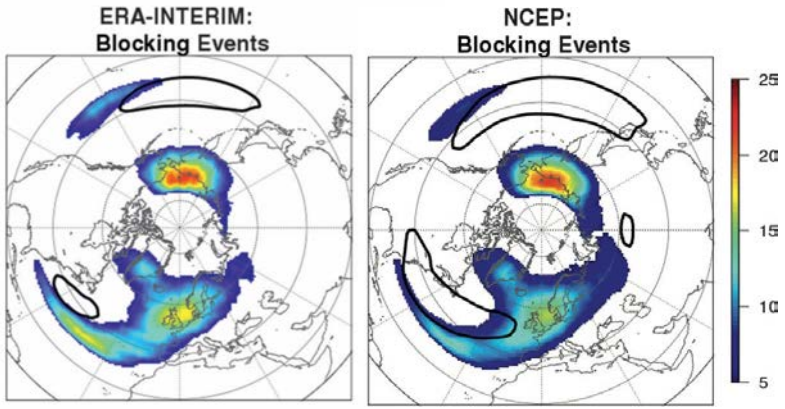
ENSO & the Polar Vortex
Cagnazzo et al, 2009



Reanalyses: wind- the troposphere







e.g. Davini et al., 2012

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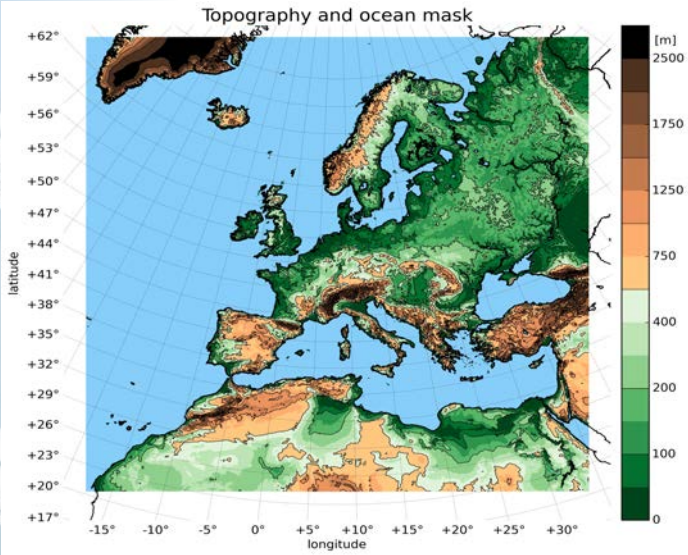
Regional reanalyses @ C3S

European Domain

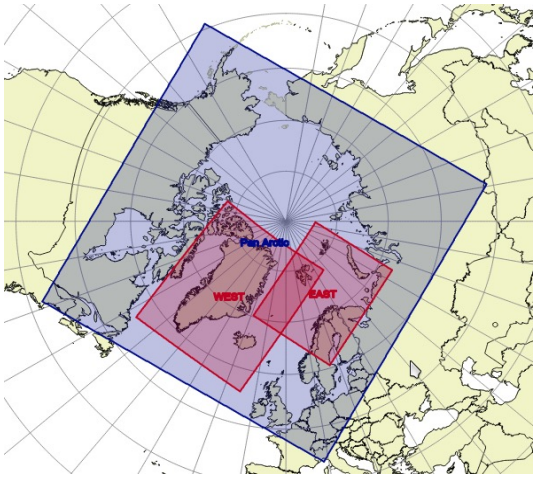


Available in the CDS (> 900 users):
UERRA, **1961 – mid 2019 @ 11/5.5km**
Based on system as developed in the EU FP7 UERRA project

Currently in production: CERRA, **early 1980 –May 2021 @5.5km**
Production started in Feb 2020

SMHI, Météo-France - MET Norway

Arctic Domain



Currently in production: (red sub domains)
CARRA, **July 1997 – June 2020 @ 2.5km**
Special emphasis on "cold surfaces"
68% complete (@20/05/2020)

Proof of concept: (grey domain)
1-year pan-Arctic reanalysis, **Sep 2017/18 @ 3.75km**

Met Norway, Nordic countries and Météo-France.

ECMWF Copernicus Europe's eyes on Earth European Commission

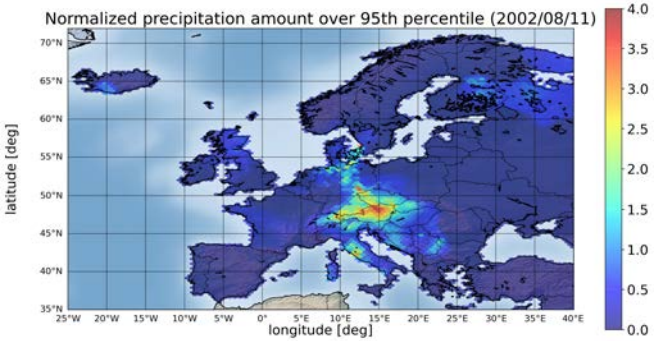
Observations to monitor extreme event

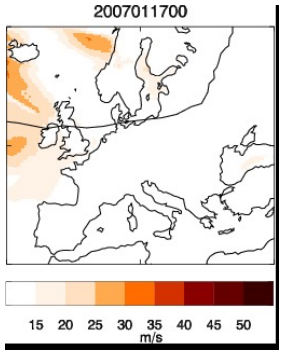
Climate Change

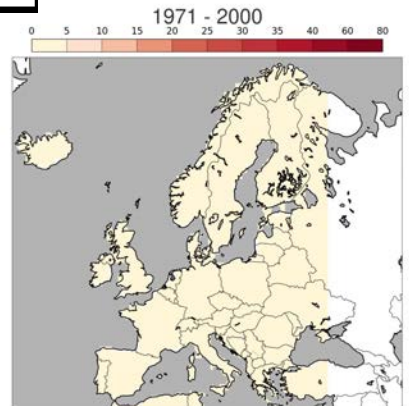
- **Extreme** as something **very rare**
  - How low is the frequency of occurrence to say “rare”?
- **Extreme** as something **very large**
  - How do we decide the threshold defining what is large?
- **Extreme** as something of **very high impact**
  - How do we measure the the impact?

what is the characteristic **time scale** of the system, and what is the **temporal length and spatial extent** of the event, e.g. slow onset versus fast onset events

F4P data and tools (e.g. high spatial and temporal resolution, time coverage, homogeneity, presence of drifts, usability)







Keywords

Needs for long term climate monitoring, including consistency and quality

Linking data to user communities, in an operational way

Linking climate variables to key indicators