



Climate Change

Climate predictions for climate services: current activities and future plans at ECMWF

Anca Brookshaw

on behalf of ECMWF and the Copernicus Climate Change Service (C3S)

Special acknowledgement:

T Stockdale, M Balmaseda, A Weisheimer, N Dunstone (UKMO)





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(U p d a t e d) O u t l i n e

ECMWF operational activities

ECMWF research: multi-year prediction experiments

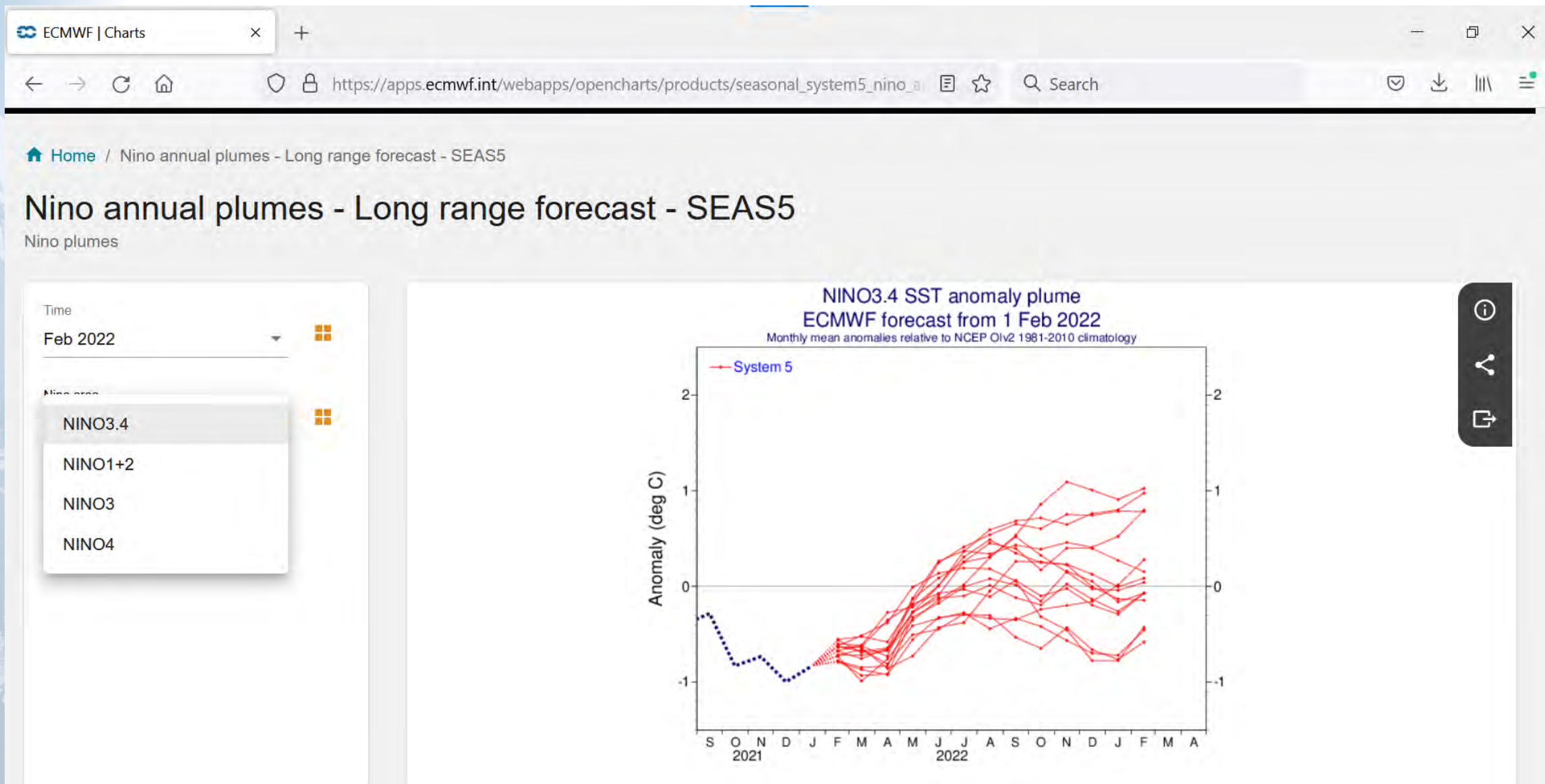
ECMWF's C3S: climate prediction data and information for climate services





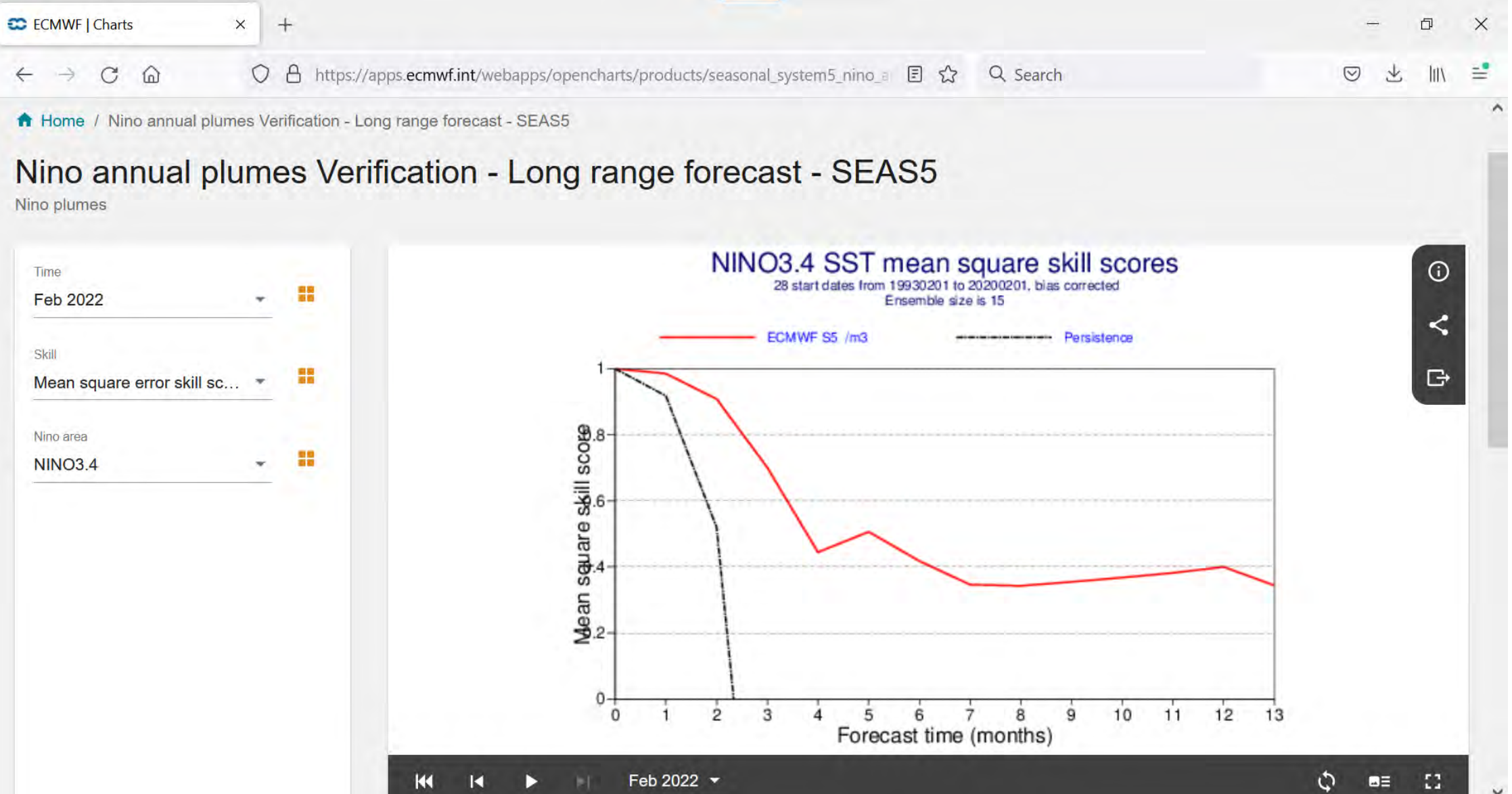
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ECMWF operational predictions



https://apps.ecmwf.int/webapps/opencharts/products/seasonal_system5_nino_annual_plumes?base_time=202202010000&nino_area=NINO3-4

ECMWF operational predictions

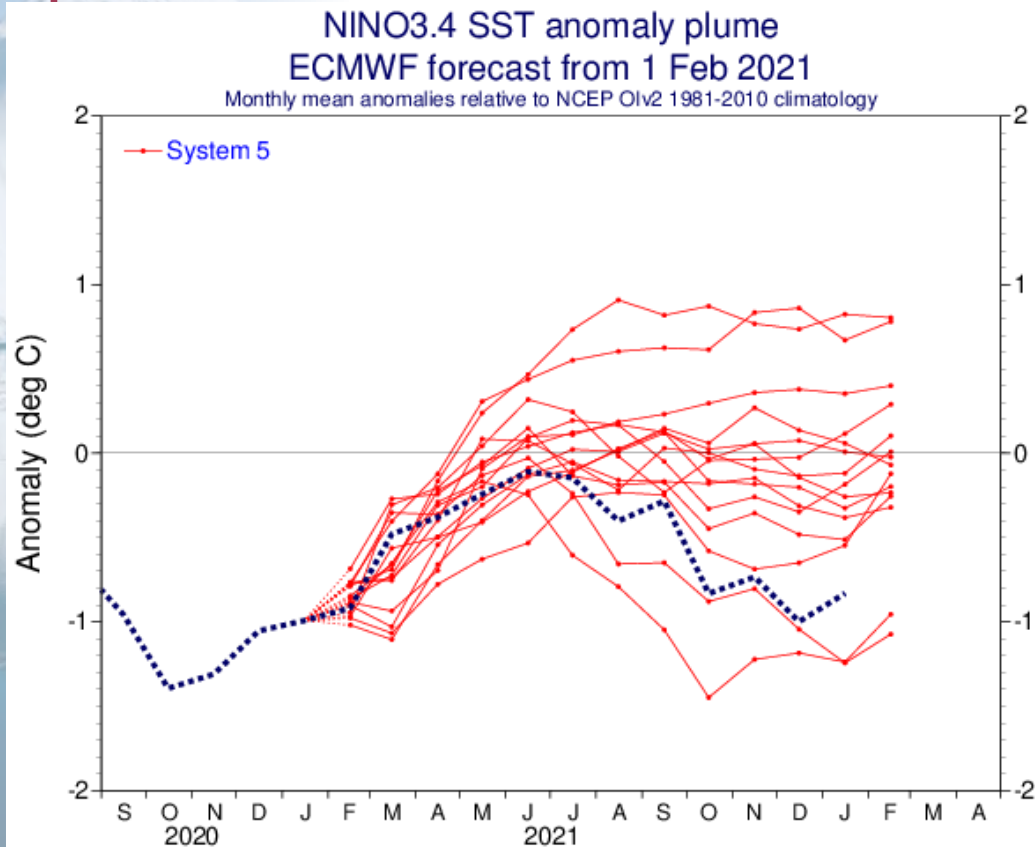




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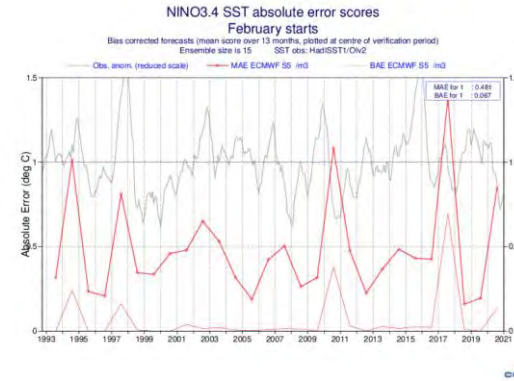
ECMWF operational predictions

Intialisation: February, May, August, November
Forecast length: 13 months
Real-time forecasts: 2017-present



ECMWF

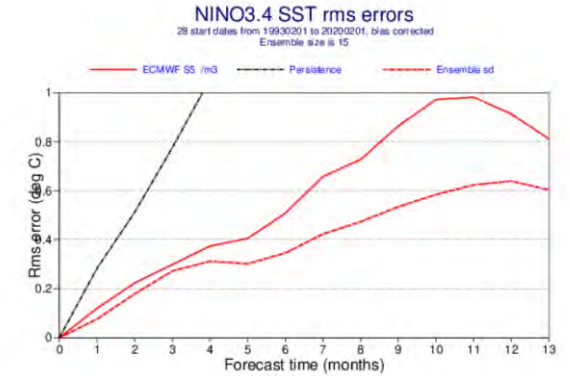
Nino annual plumes Verification - Long range
forecast - SEAS5



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ECMWF

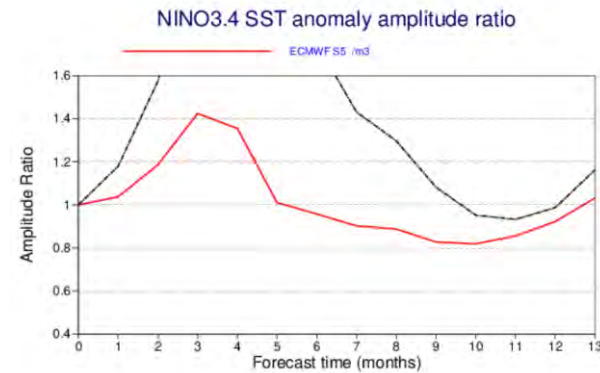
Nino annual plumes Verification - Long range
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ECMWF

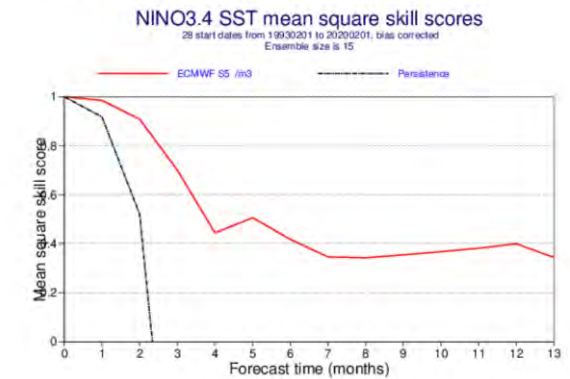
Nino annual plumes Verification - Long range
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ECMWF

Nino annual plumes Verification - Long range
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ECMWF

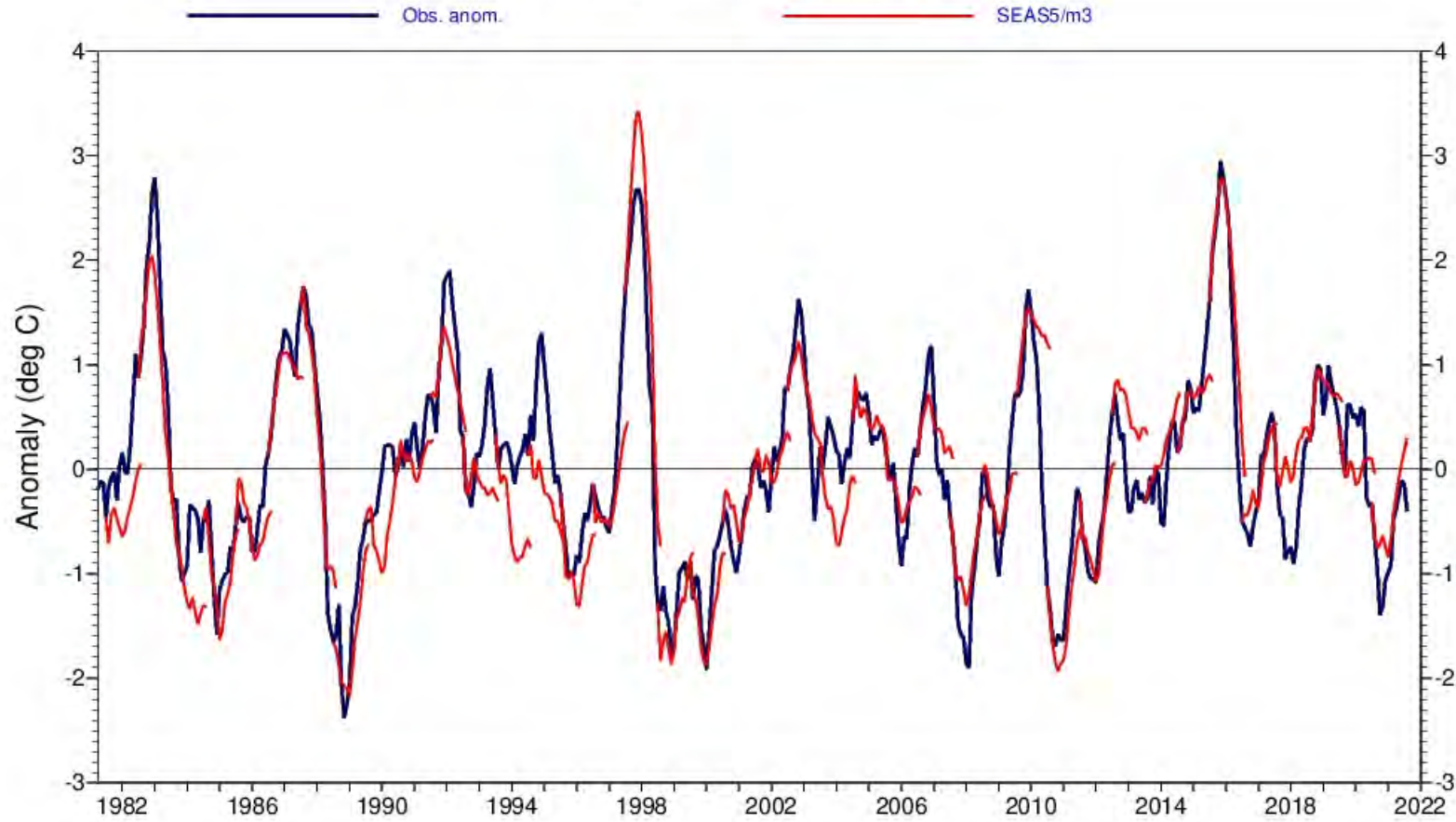


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August forecasts at a glance

NINO3.4 SST forecast anomalies

Bias corrected forecasts at month 13
Ensemble size is 15 SST obs: hd1_o12



European
Commission

Copernicus
Europe's eyes on Earth





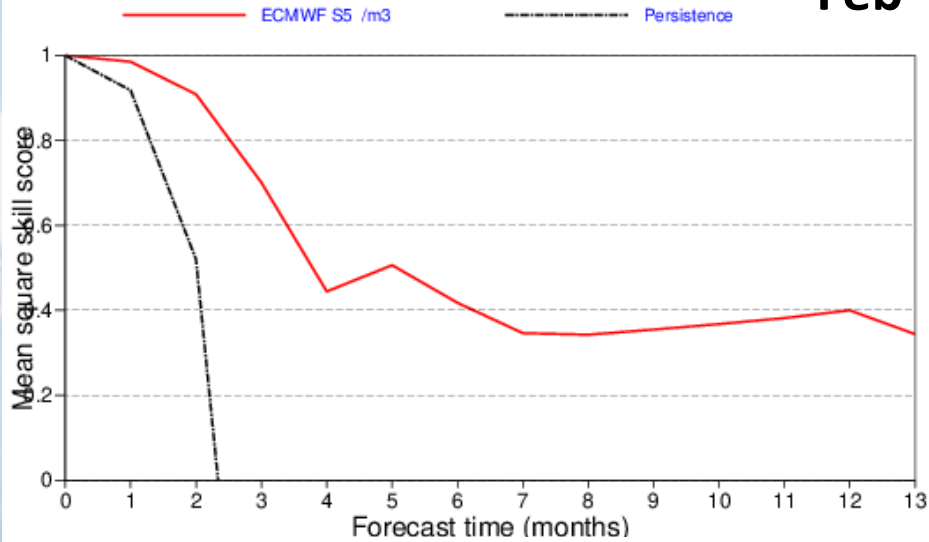
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Verification: MSSS

NINO3.4 SST mean square skill scores

28 start dates from 19930201 to 20200201, bias corrected
Ensemble size is 15

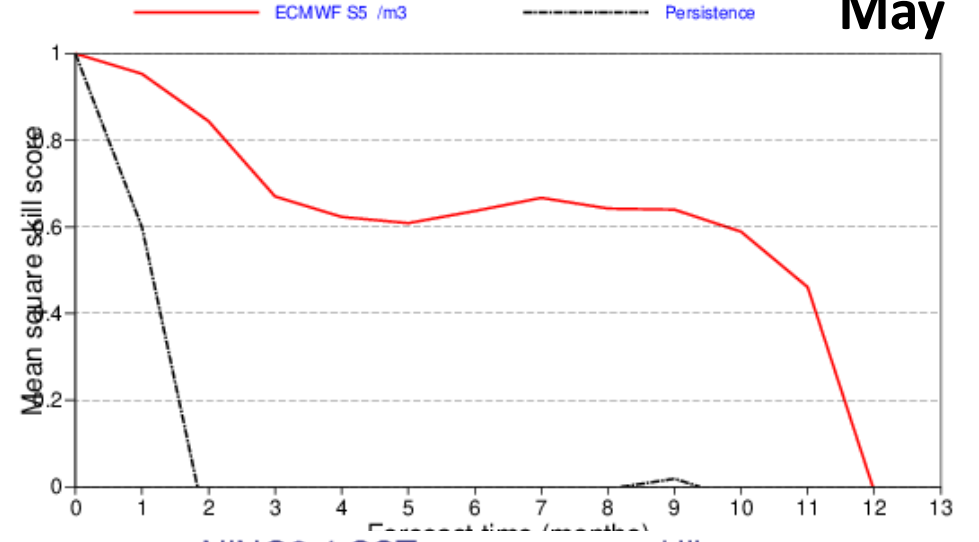
Feb



NINO3.4 SST mean square skill scores

27 start dates from 19930501 to 20190501, bias corrected
Ensemble size is 15

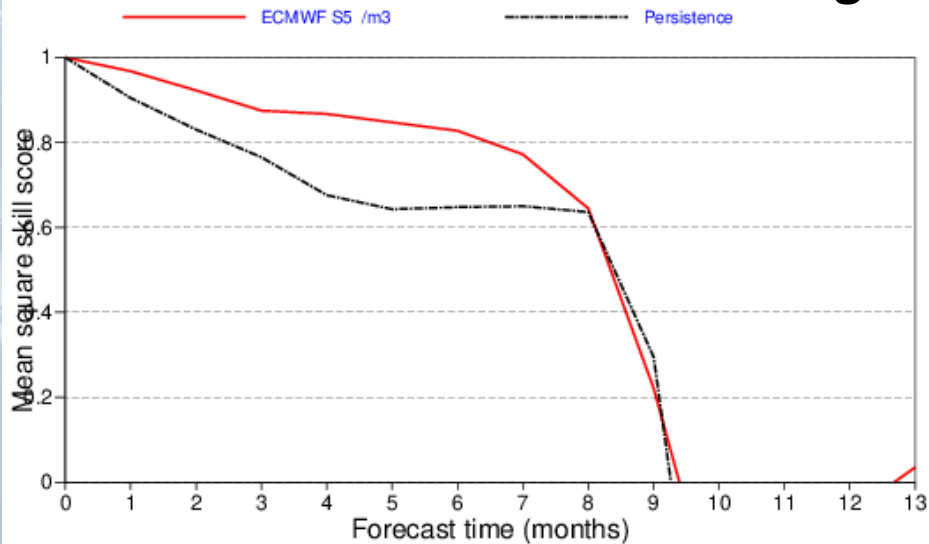
May



NINO3.4 SST mean square skill scores

27 start dates from 19930801 to 20190801, bias corrected
Ensemble size is 15

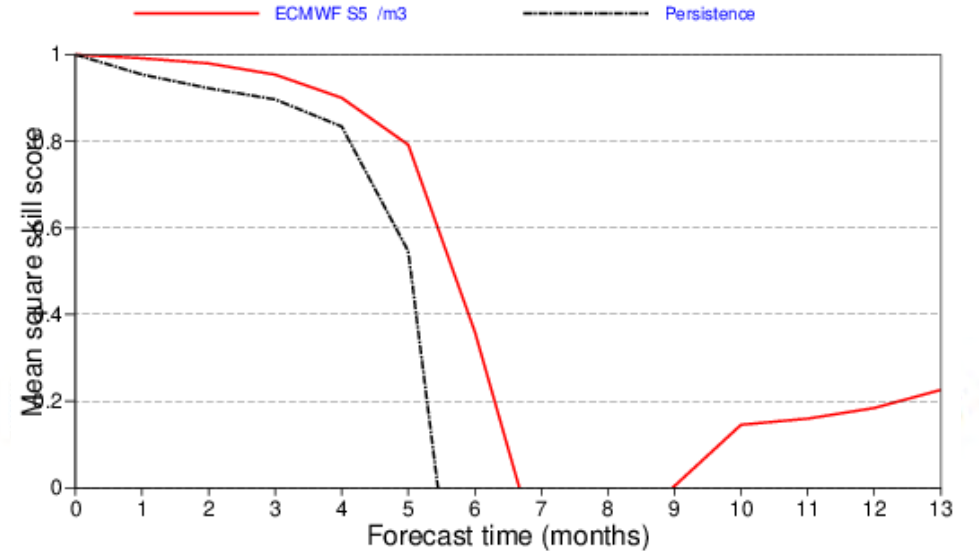
Aug



NINO3.4 SST mean square skill scores

27 start dates from 19931101 to 20191101, bias corrected
Ensemble size is 15

Nov





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ECMWF research: 2-year forecasts of 20th Century



Atmosphere



Land



Wave



Ocean



Sea ice

Atmosphere:

- IFS cycle CY43R1; Tco199L91 ca 60 km

Ocean:

- NEMO ORCA1L42 1 degree

Sea ice:

- LIM2

Initial conditions:

- CERA-20C

CERA-20C:

- ECMWF's 10-member ensemble of coupled climate reanalyses of the 20th century
- 1901-2010
- Assimilates surface pressure and marine winds as well as ocean temperature and salinity profiles
- *Laloyaux et al. (JAMES, 2018)*

Ensemble size: 10

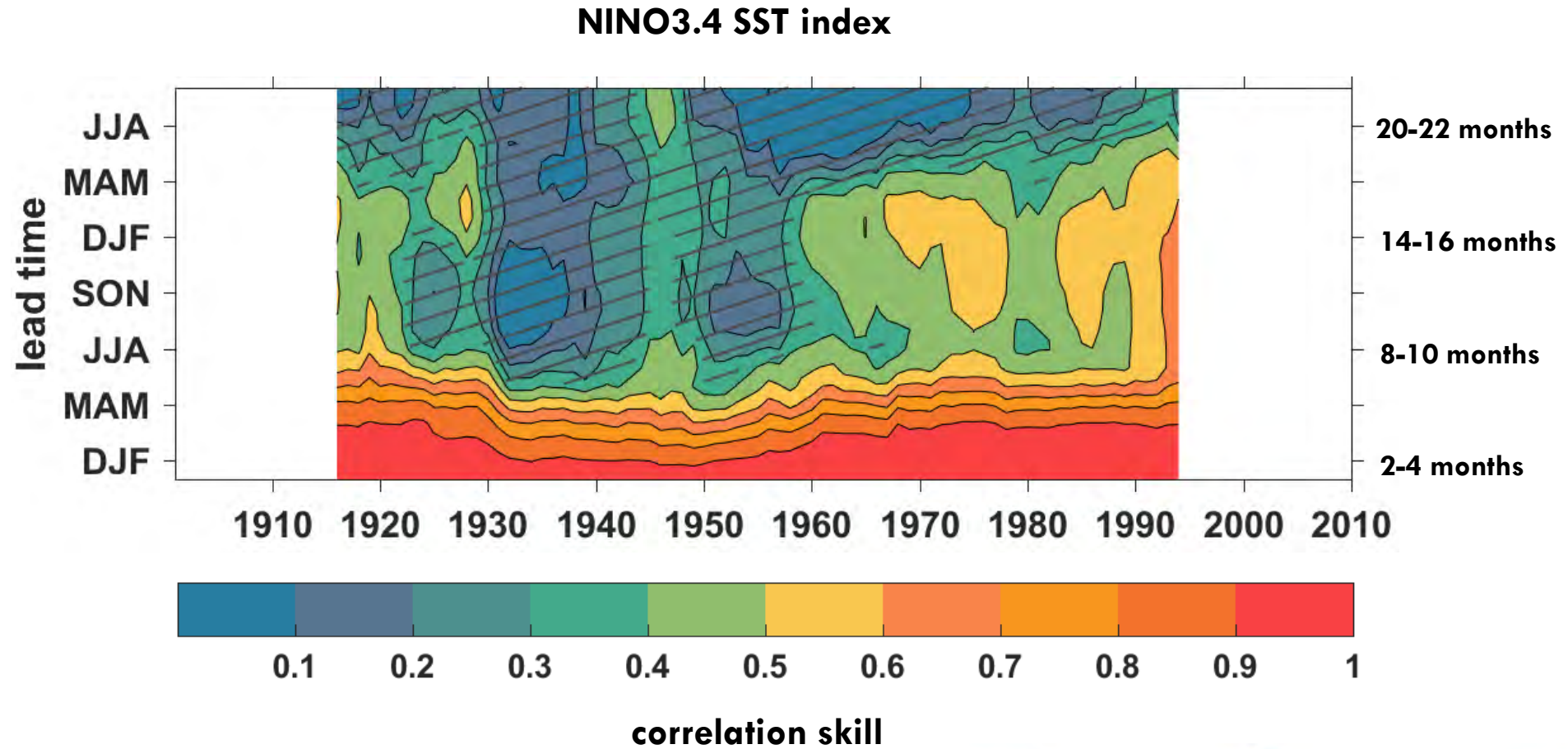
Forecast length: 24 months

Forecast start dates: 1st May/Nov

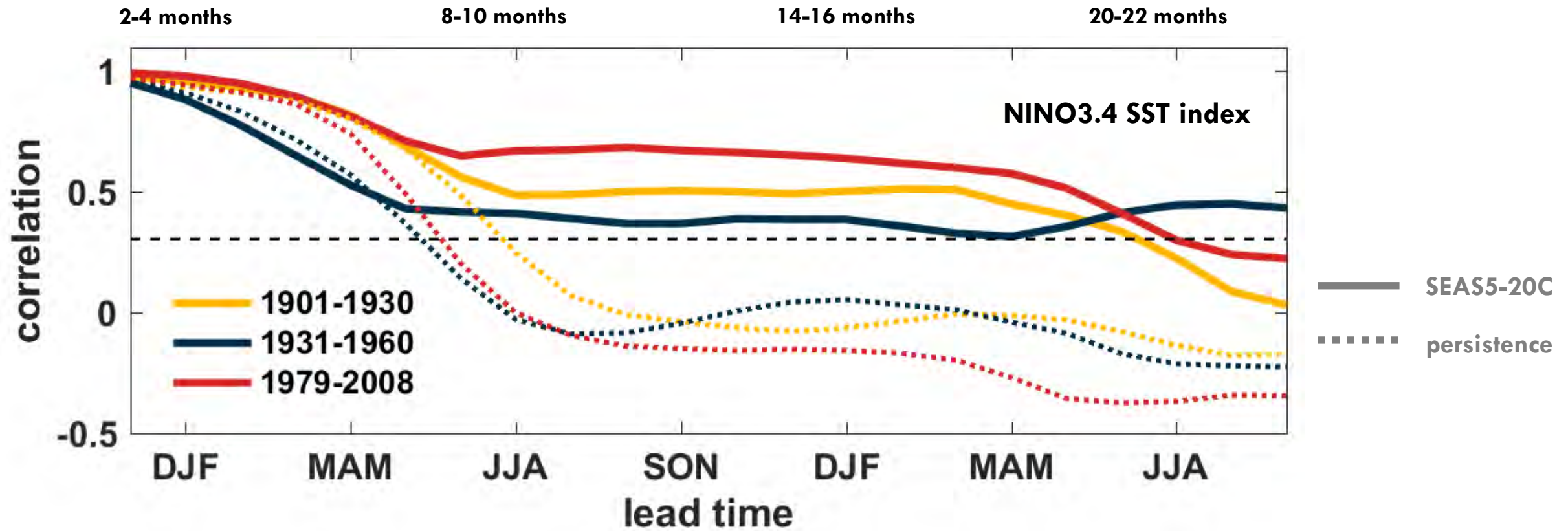
Hindcast period: 1901 – 2010



Multi-decadal skill variations of 2-year ENSO forecasts



Multi-decadal skill variations of 2-year ENSO forecasts



- Copernicus: European Union's Earth Observation Programme, based on Earth Observation satellite data and "in-situ" observations;
- Copernicus Climate Change Service (C3S) operated by ECMWF on behalf of the EC since 2015; phase 2 of the programme (Cop2) started in 2021.

C3S includes

- Seasonal predictions: operational since 2016
- Decadal prediction (service) prototype: published 2021
(<https://climate.copernicus.eu/sectoral-applications-decadal-predictions>)
- Multi-year predictions planned for Cop2.

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Seasonal timescales

- Data – from world-leading producers

- large set of variables

- data service:

- download from forms and API
 - detailed documentation
 - guidance and user support
 - monthly, daily, sub-daily frequency

- Graphical illustrations

http://climate.copernicus.eu/charts/c3s_seasonal/

- Operational schedule

- Tools and computational environment



C3S seasonal prediction multi-system

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Prototype decadal climate services

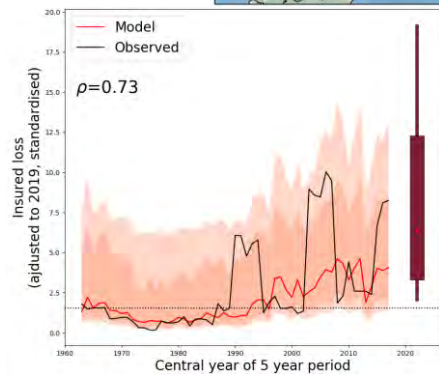
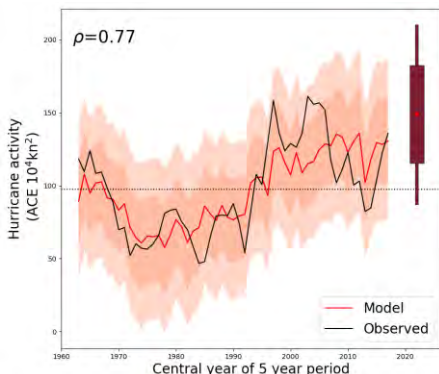
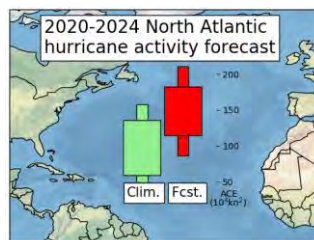
N. Dunstone, J. Lockwood, B. Solaraju Murali, K. Reinhardt, E. Tsartsali + many others



INSURANCE

(partner: Willis Re)

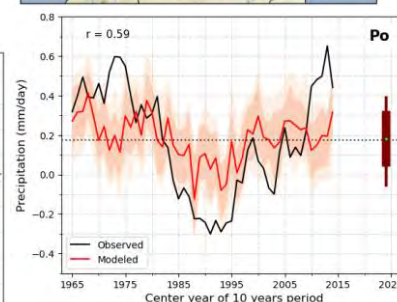
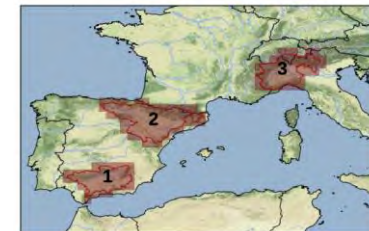
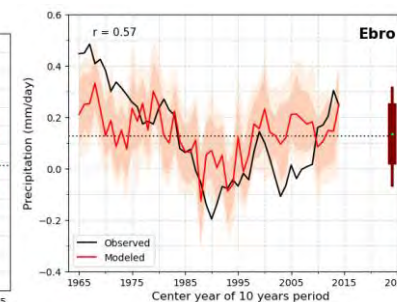
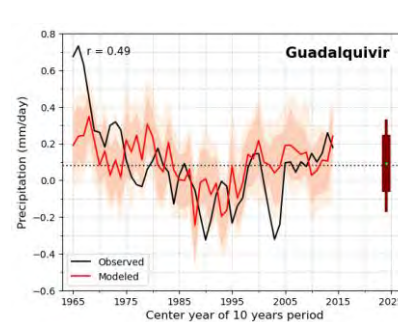
Predictions of 5 year N. Atlantic hurricane activity and US total insured losses



ENERGY

(partner: Enel)

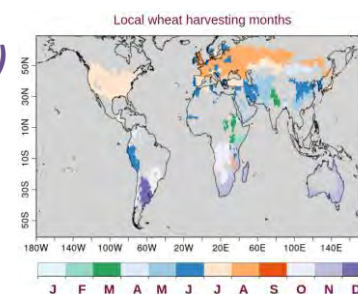
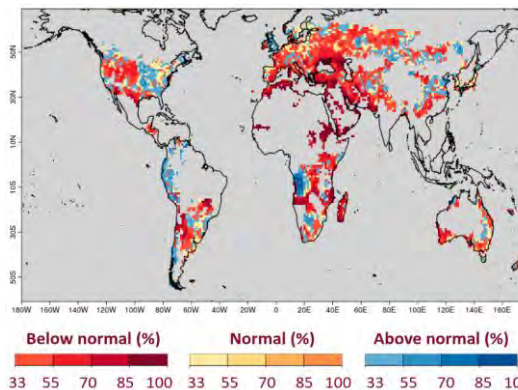
Predictions of 10 year precipitation for hydropower industry



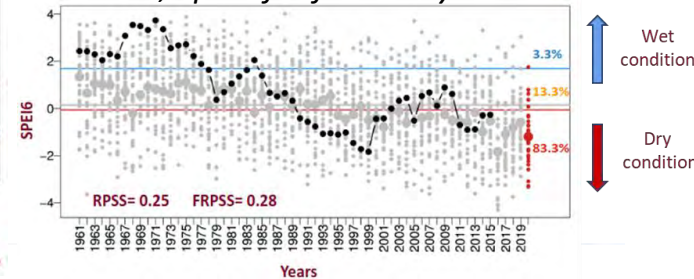
AGRICULTURE

(partner: Joint Research Centre)

Predictions of 5 year SPEI drought for global wheat producing regions



Granada, Spain for forecast years 1-5:



INFRASTRUCTURE

(partner: Wupperverband)

Predictions of 3 year high-resolution SPEI drought index for water management.

