



User-driven climate modelling research for a better climate information

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“Governments, private banks and lenders such as the World Bank need to issue many more ‘green bonds’ to finance climate-mitigation efforts. This would create an annual market that, by 2020, processes more than 10 times the \$81 billion of bonds issued in 2016.”

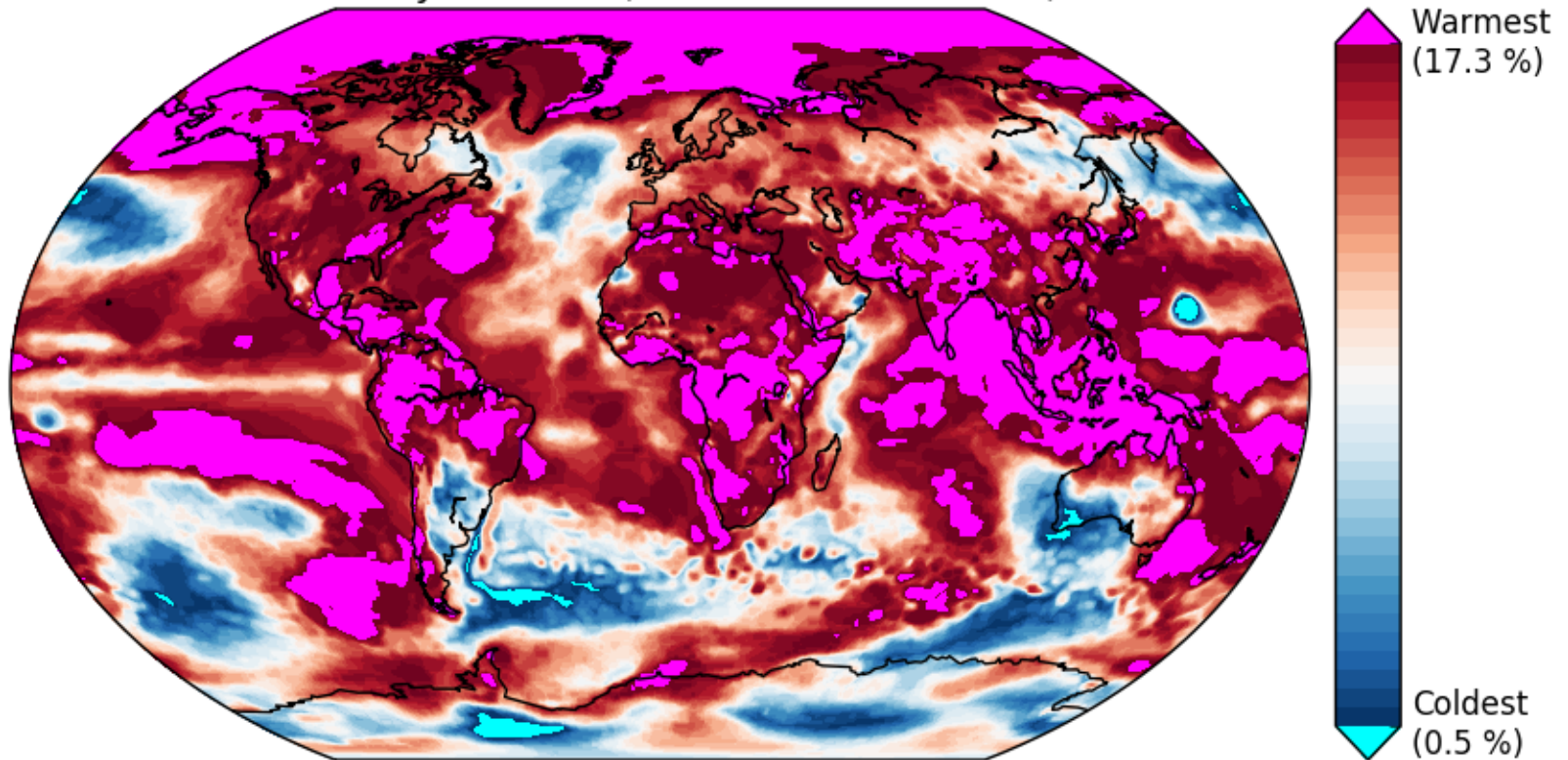
Figueres et al., Nature, 28 June 2017

What are we after

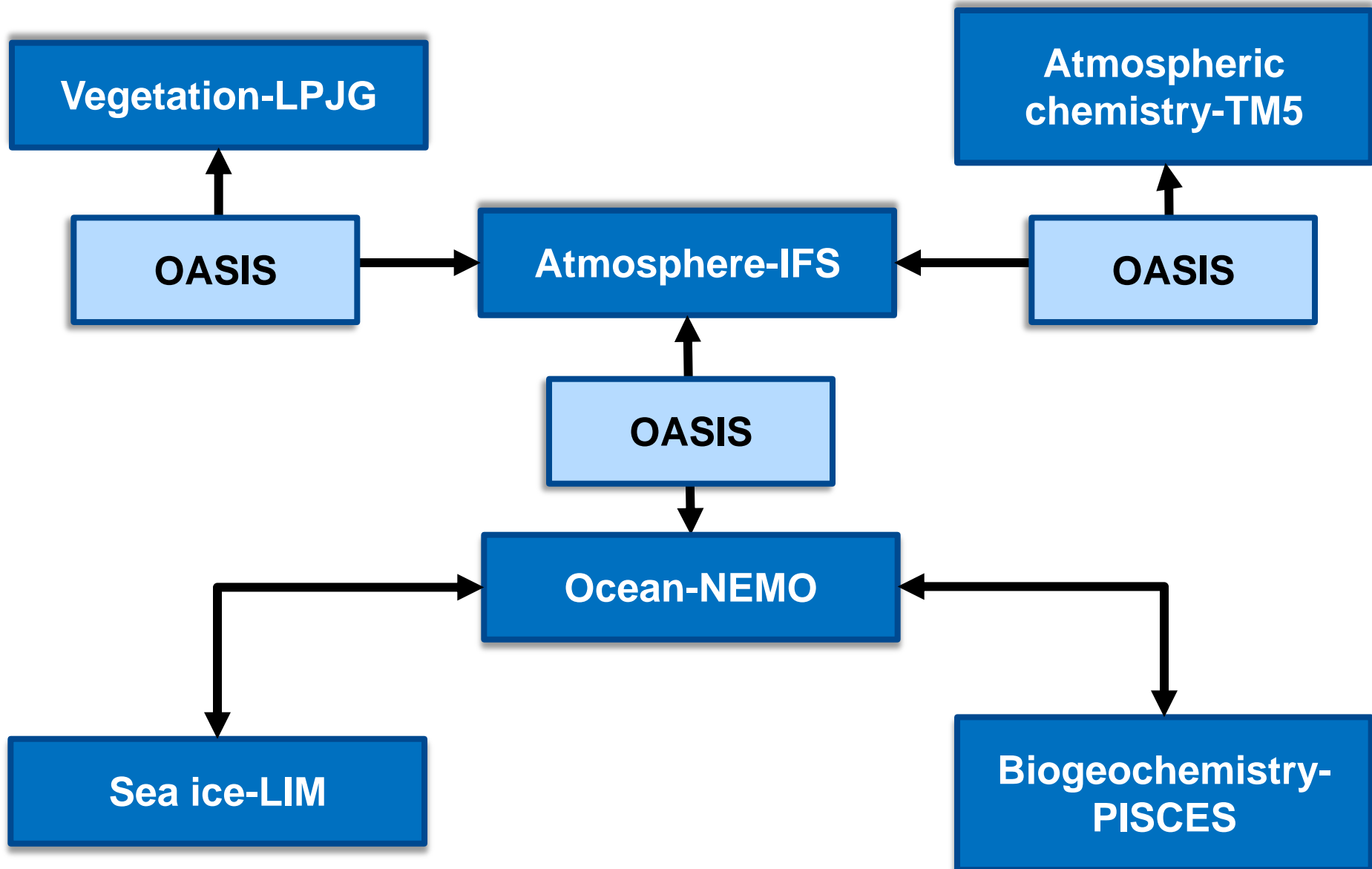
Ranking of the 2016 annual mean temperature over the last 37 years from ERA Interim.

This is the kind of signal that we expect to predict.

Annual mean 2m temperature
Rank of year 2016 (reference: 1979-2016)



Data: ERA-Interim. Figure: F. Massonnet - BSC



Reality

Model A

Observation A



Observation B

**All components have uncertainty.
Some observations might already
come from the users**

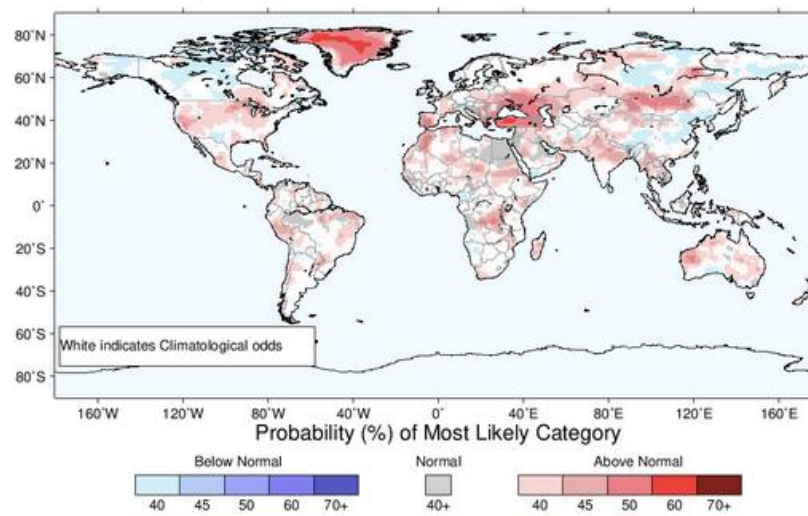
Models, observations, knowledge and quality control information are all used to produce climate information.

An example are the seasonal climate predictions issued by the International Research Institute for Climate and Society.

Seasonal Climate Forecast

Region: Global | Type: Temp | Issue Year: 2017 | Issue Month: June | Leads: JAS17

IRI Multi-Model Probability Forecast for Temperature for July–August–September 2017, Issued June 2017



Discussion

Jun 2017 Climate Forecast Discussion for Jul-Sep through Oct-Dec

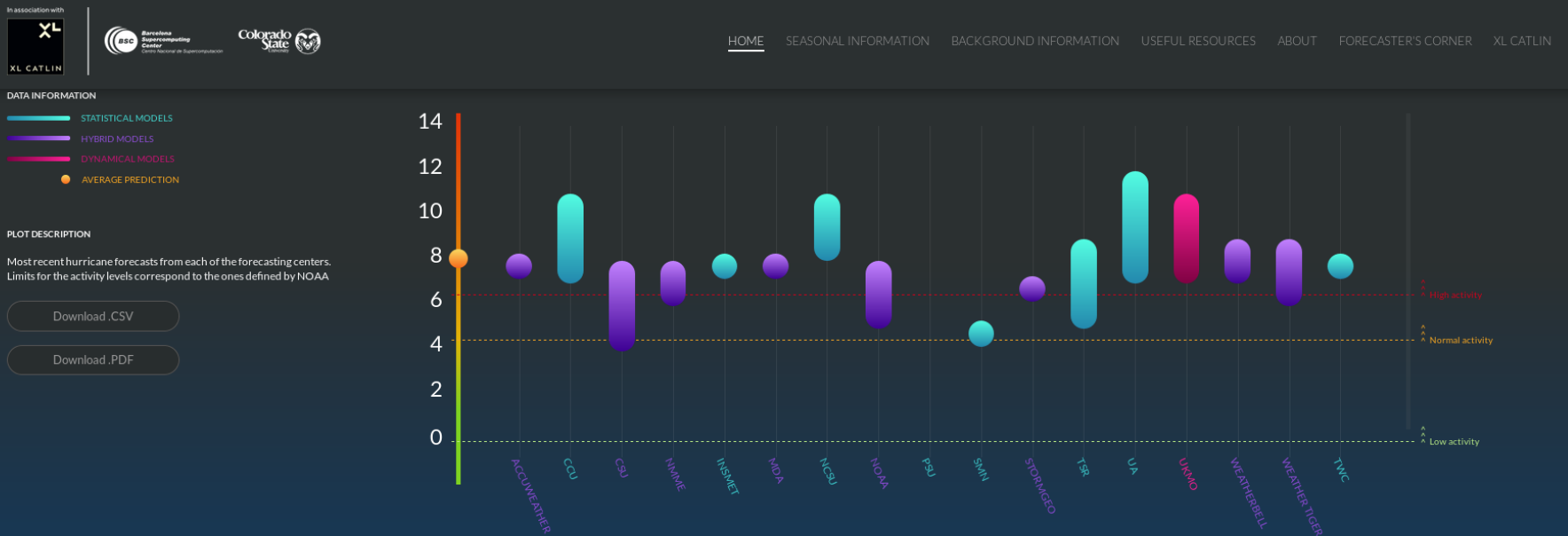
Climate information: tropical storms



BSC, Univ. of Colorado State and XL Catlin have created the first comprehensive service of predictions of tropical cyclone seasonal frequency.



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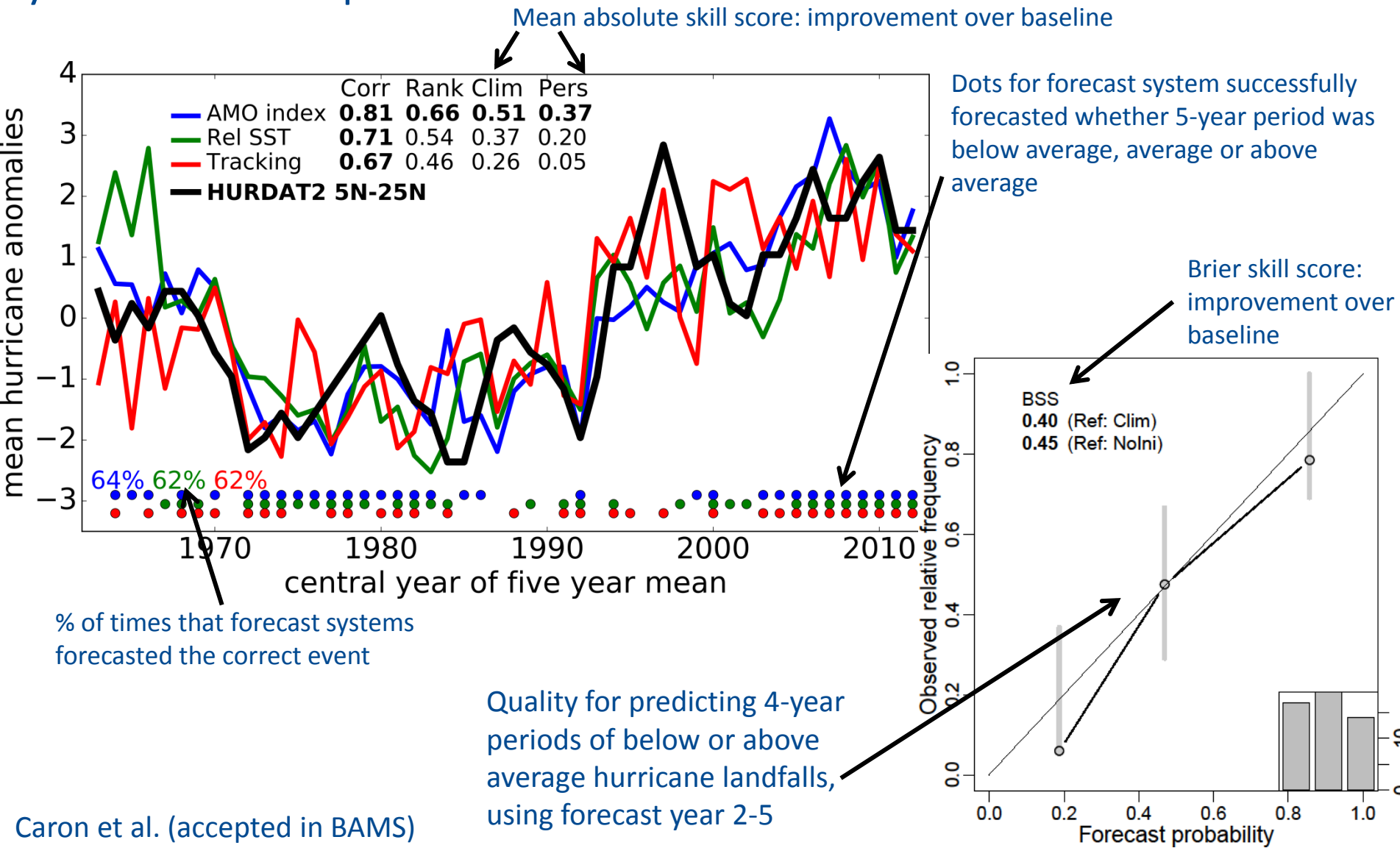
FORECAST EXPLANATION

The Atlantic basin hurricane season is underway, and there is a divergence in opinions on how active this season is likely to be. Seasonal hurricane forecasts broadly diverge into two camps: while several agencies are calling for a near-average season, other groups call for an above-average season. There is virtually uniform agreement that cool neutral to La Niña conditions are likely to be present for the hurricane season, but there is much more uncertainty as to what the Atlantic looks like. Cool neutral to La Niña conditions favor an active Atlantic hurricane season, due to reductions in levels of vertical wind shear.

The tropical Atlantic is currently warmer than normal, but the far North Atlantic is quite cold. In general, groups predicting an above-average season believe that the tropical Atlantic will remain warm throughout the hurricane season, creating an environment conducive for Atlantic hurricane development. On the other hand, groups predicting a near-normal season believe that the far North Atlantic will generate wind and pressure patterns that result in anomalous tropical Atlantic cooling and associated sinking motion that stifle hurricane development.

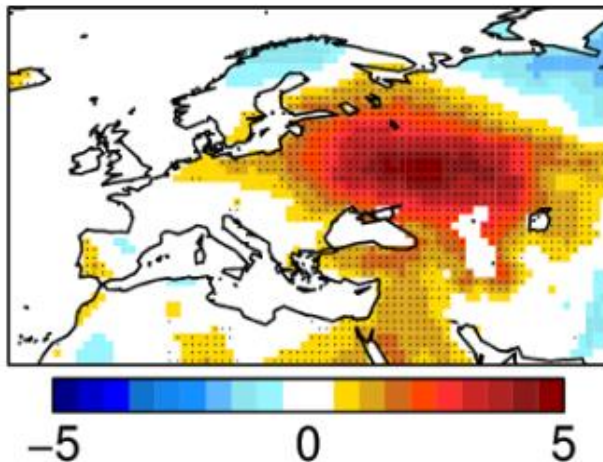
Service-driven predictions

Soon multi-model decadal predictions of 1-5 year mean number per year will be also provided.

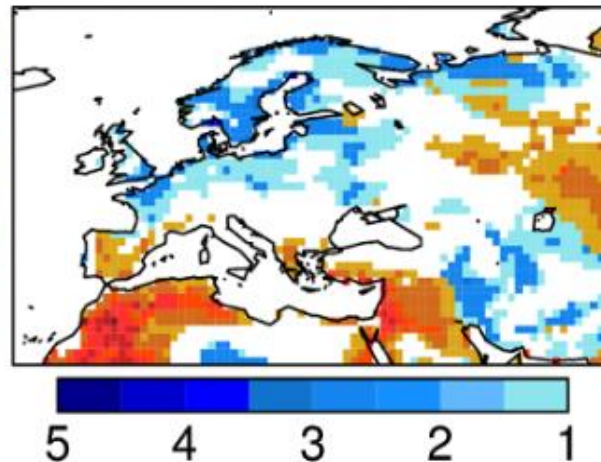


JJA near-surface temperature anomalies in 2010 from ERAInt (**left**) and odds ratio from experiments with a climatological (**centre**) and a realistic (**right**) land-surface initialisation. Results for EC-Earth2.3 started in May with initial conditions from ERAInt, ORAS4 and a sea-ice reconstruction over 1979-2010.

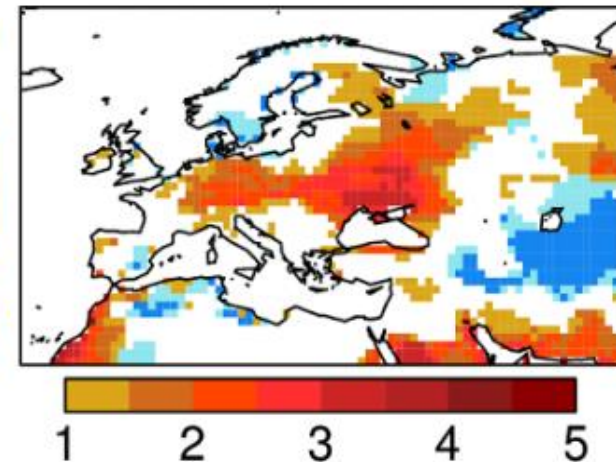
a) t2m: ERAInt



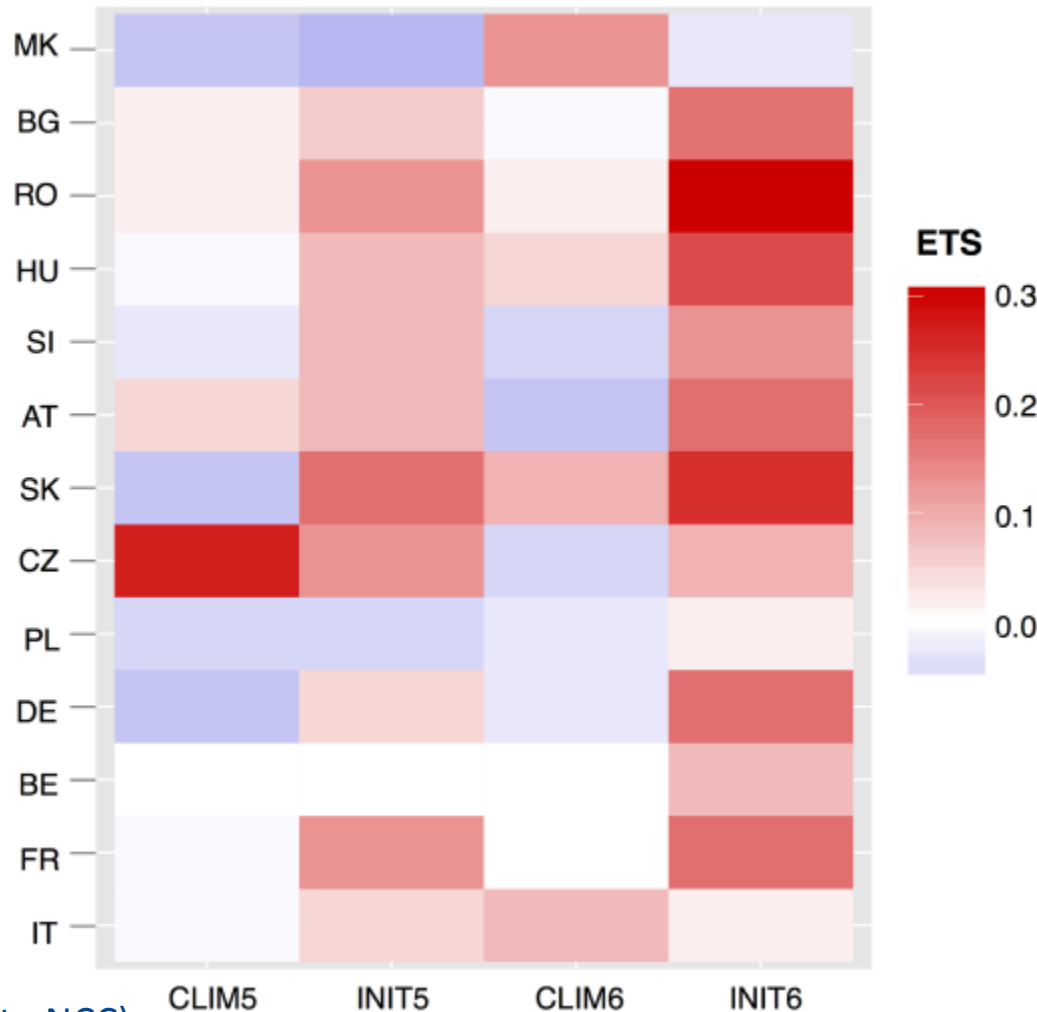
b) t2m: CLIM



c) t2m: INIT



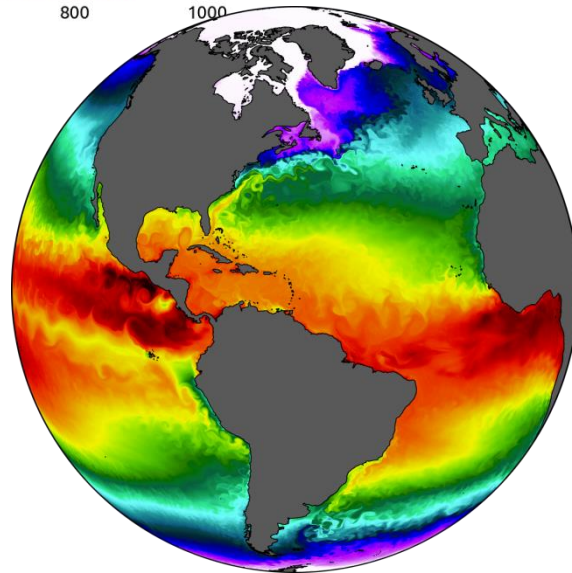
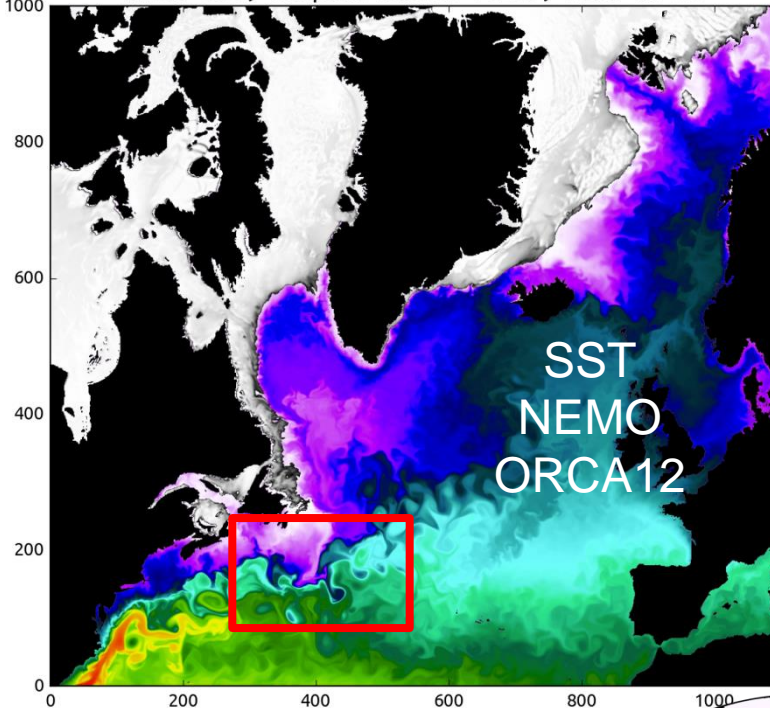
Equitable threat score (ETS) of predictions of poor maize yield (lower quartile) from EC-Earth seasonal predictions when land-surface is initialised with realistic initial conditions (INIT) wrt no information (CLIM).



High-resolution global modelling

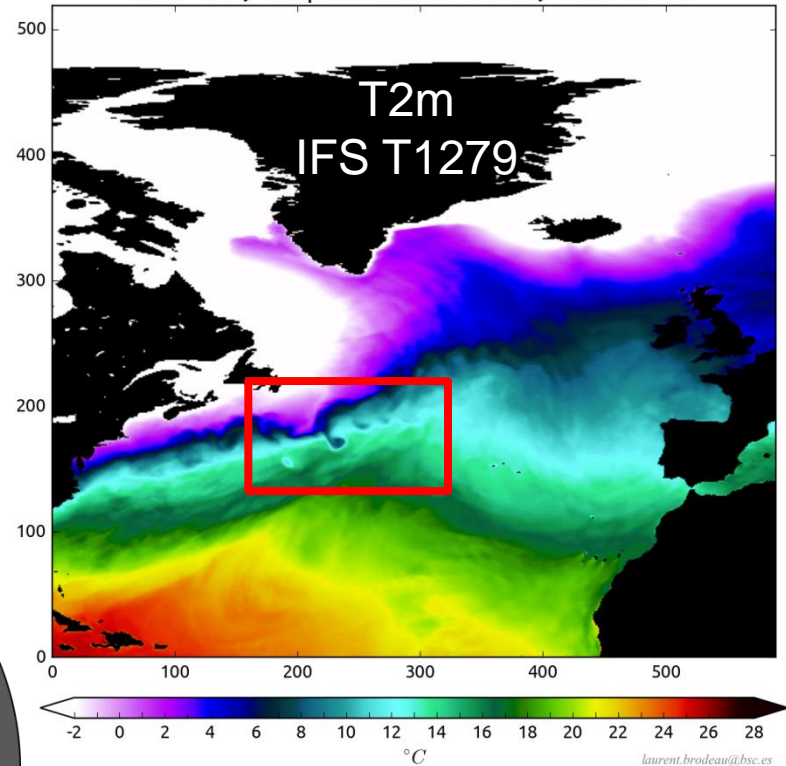


NEMO: SST, coupled ORCA12-T1279, 1990-03-10



EC-Earth GLOBAL ORCA12-T1279 (ocean and atmosphere at ~10 km!)

IFS: T2M, coupled ORCA12-T1279, 1990-03-10



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A new paradigm has come to stay: user-driven research

- **Progress:** opportunities appear in a context where research and services grow closer together.
- **Heterogeneity:** link to and merge our data with communities with larger impact (urban, arts, social).
- **Education:** in the era of open data, take advantage of the open education opportunities.
- **Standards:** in a collaborative environment standards are a must and everyone's (users and providers) responsibility.
- **Technology:** make the most of a rapidly evolving technology (heterogeneous nodes, software, mobile data capture, visualisation, storage/compression, computing and storage outsourcing).
- **Industry engagement:** how can the private sector be involved in improving systems more efficiently?