



Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile

Managing the impact of drought through seasonal forecasts of hydroelectric production

Addressing the Energy-Water Nexus through R&D Planning and Policies
Brussels, Belgium, 28-29 May 2018


Marcello Petitta and Matteo de Felice, SSPT-MET-CLIM



Is it possible to forecast the weather for the next season?

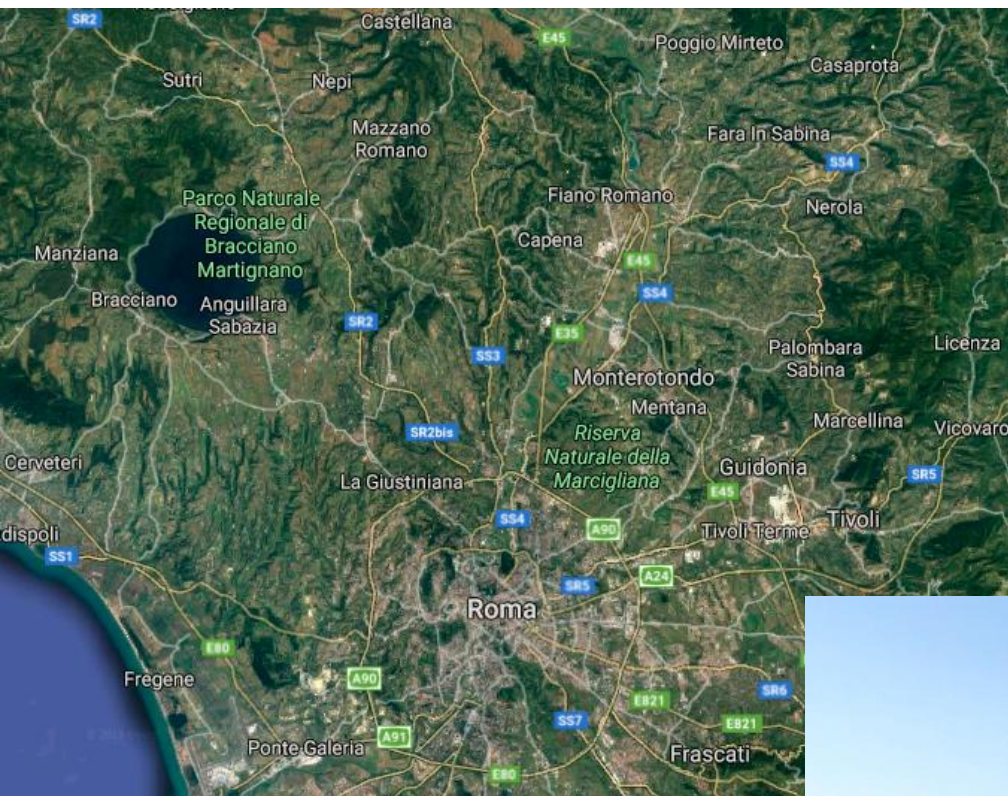
**Is it possible to forecast the weather for
the next 3 months?**

NO



Bracciano, summer 2017

Summer 2017, drought



the Butterfly effect



$$\begin{aligned}\frac{dx}{dt} &= \sigma(y - x) \\ \frac{dy}{dt} &= x(\rho - z) - y \\ \frac{dz}{dt} &= xy - \beta z\end{aligned}$$

1972 conference - Predictability: Does the flap of a butterfly's wings in Brazil set off a Tornado in Texas?

Deterministic Nonperiodic Flow, Journal of Atmospheric Science, Vol.20, 1963



Sliding doors



Donnie Darko

Chaos

What is chaos?

Disorder



Entropy

Random
systems



Stochastic

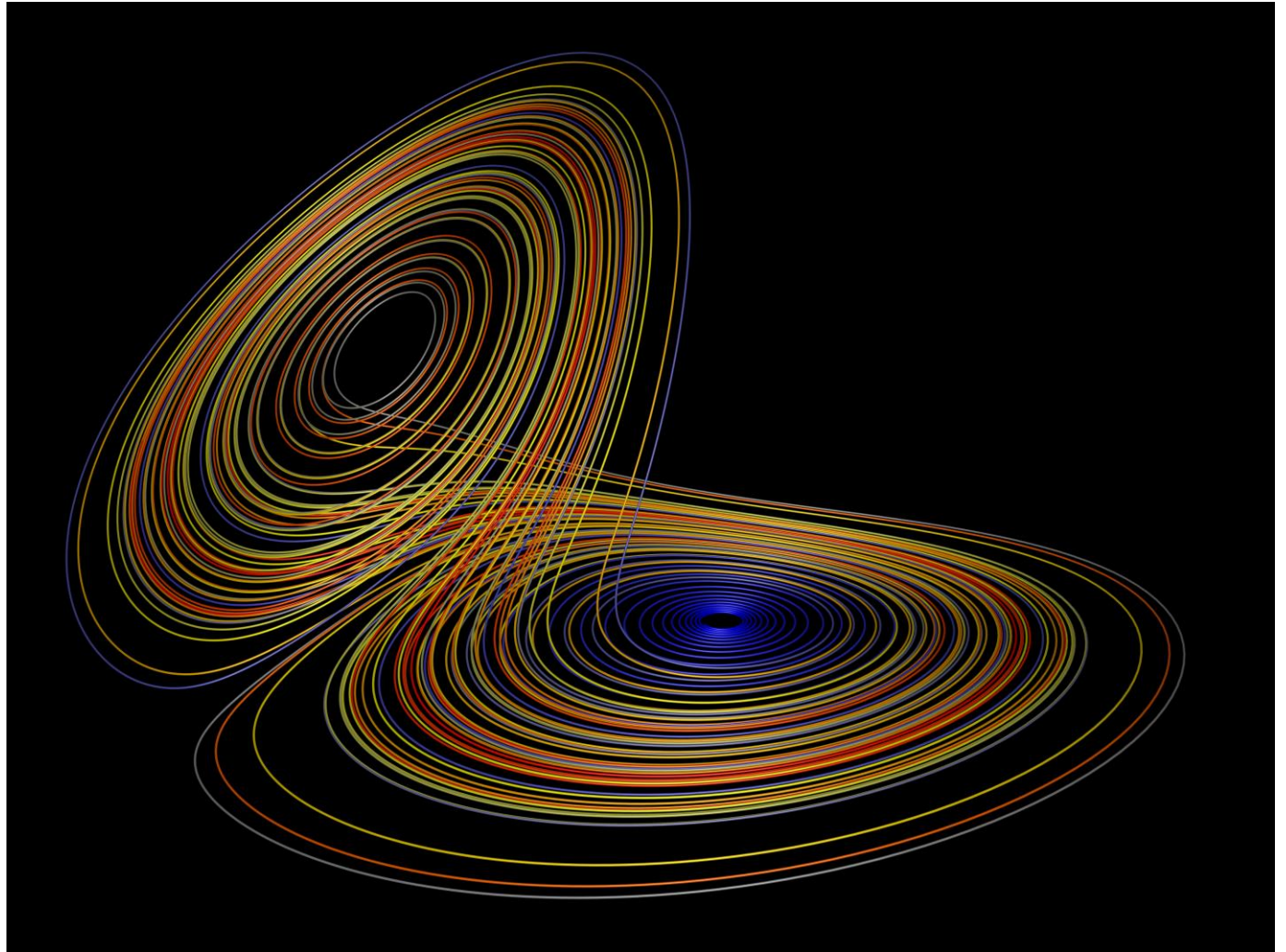
Chaos

- Chaos was the first thing to exist in the Greek Mythology
- It means “open space”, “abyss”

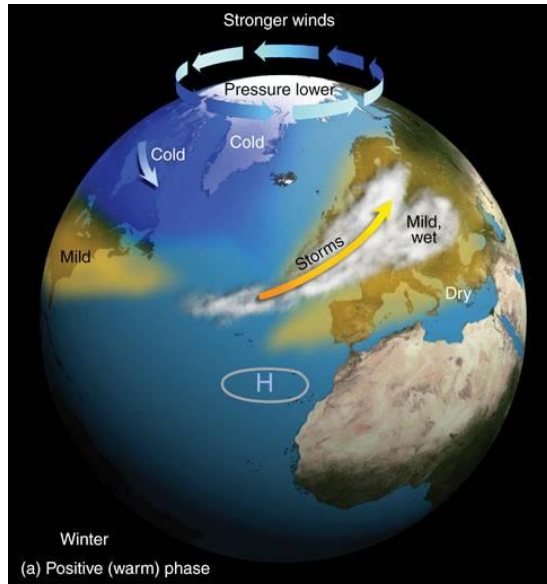
In physics and Mathematic a chaotic system is a dynamical system (which evolve in time and subjected to forces) **highly sensitive to initial conditions**

Chaos: When the present determines the future, but the approximate present does not approximately determine the future.

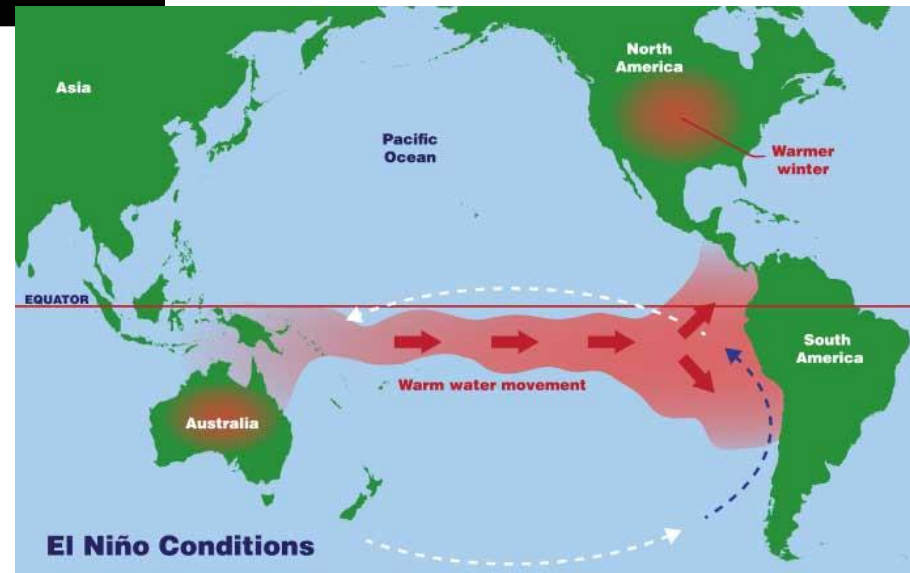
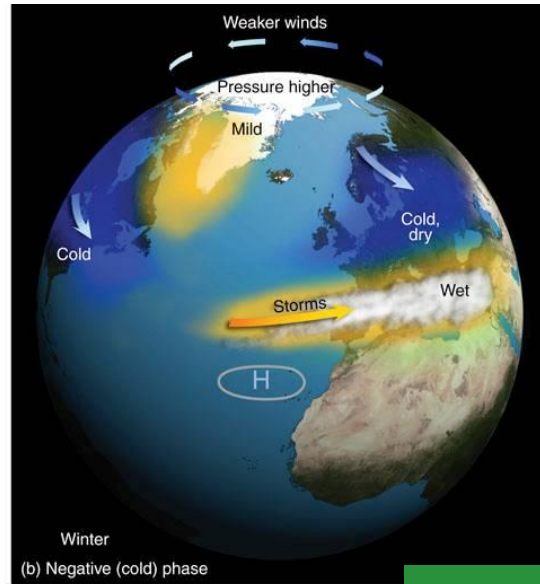
the Butterfly effect



El Nino, NAO



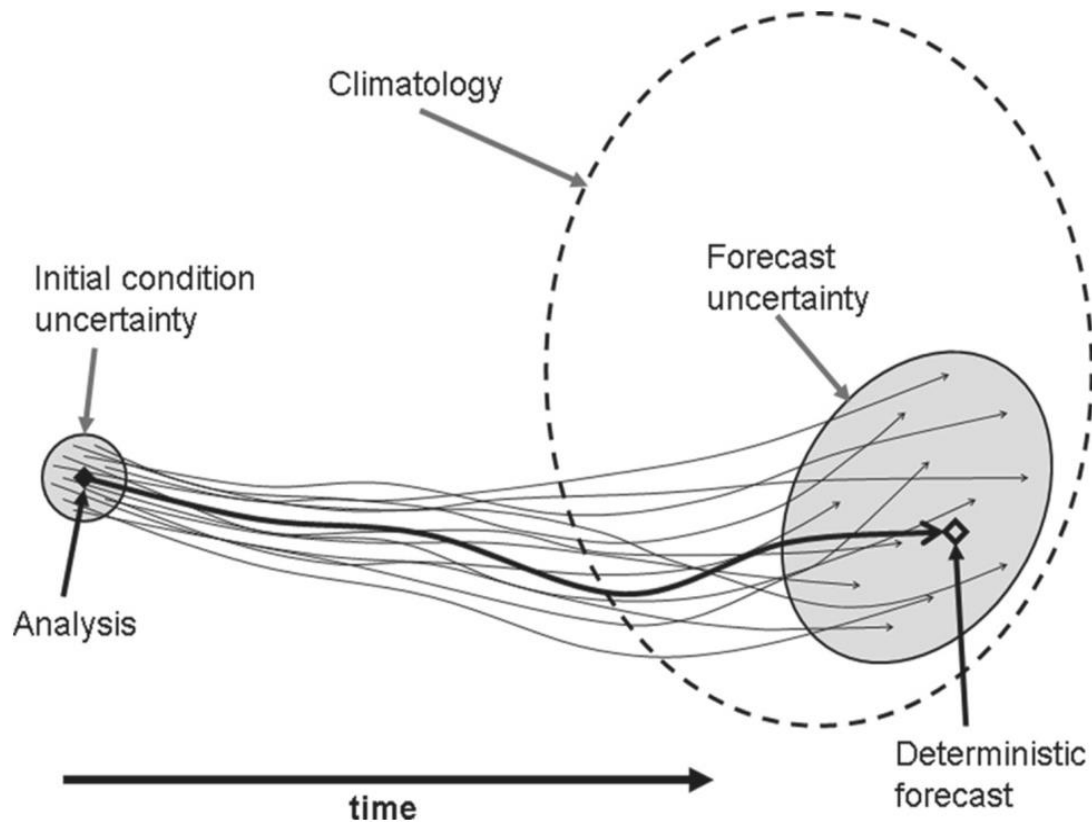
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What is a seasonal forecast?

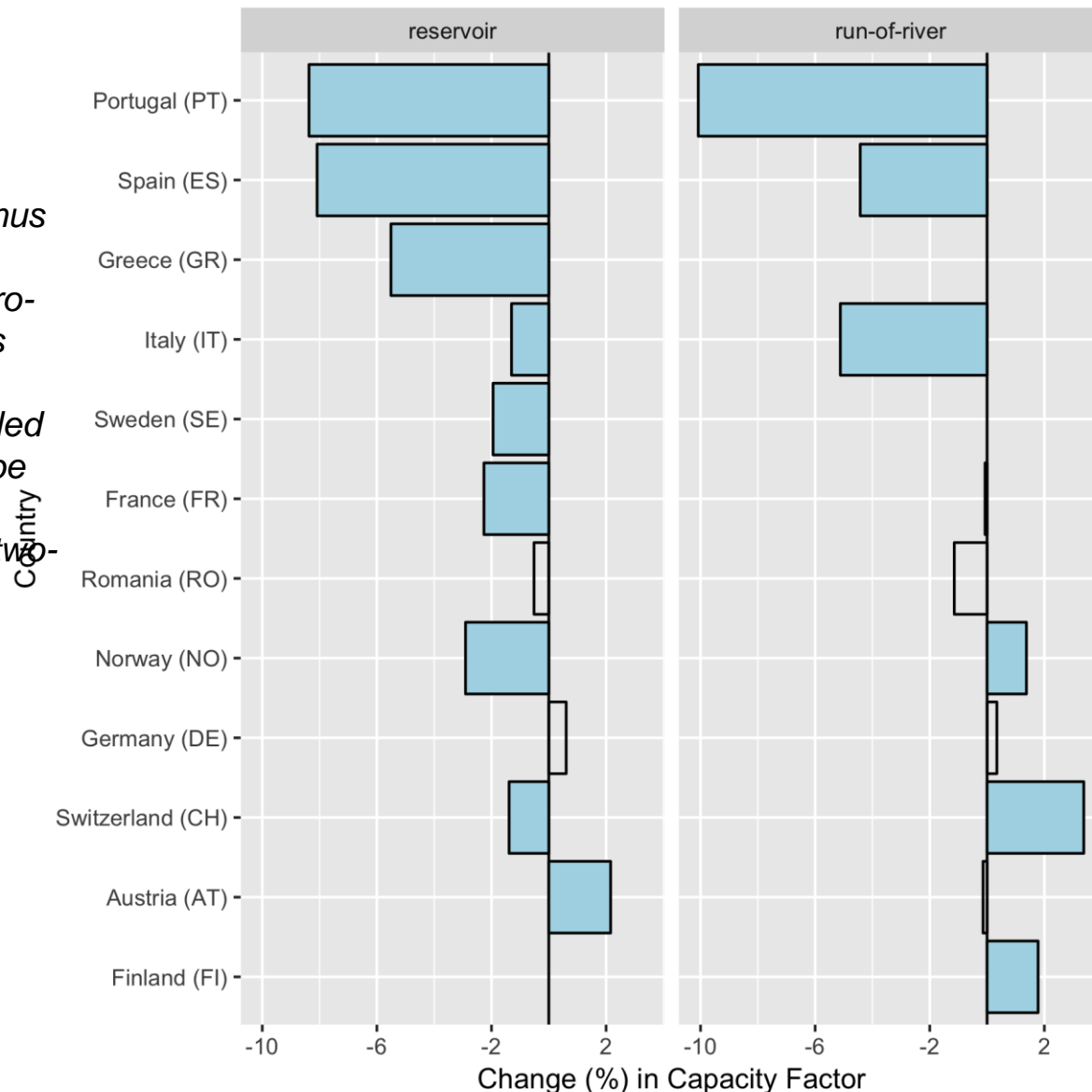
Seasonal forecast

What is a seasonal forecast?



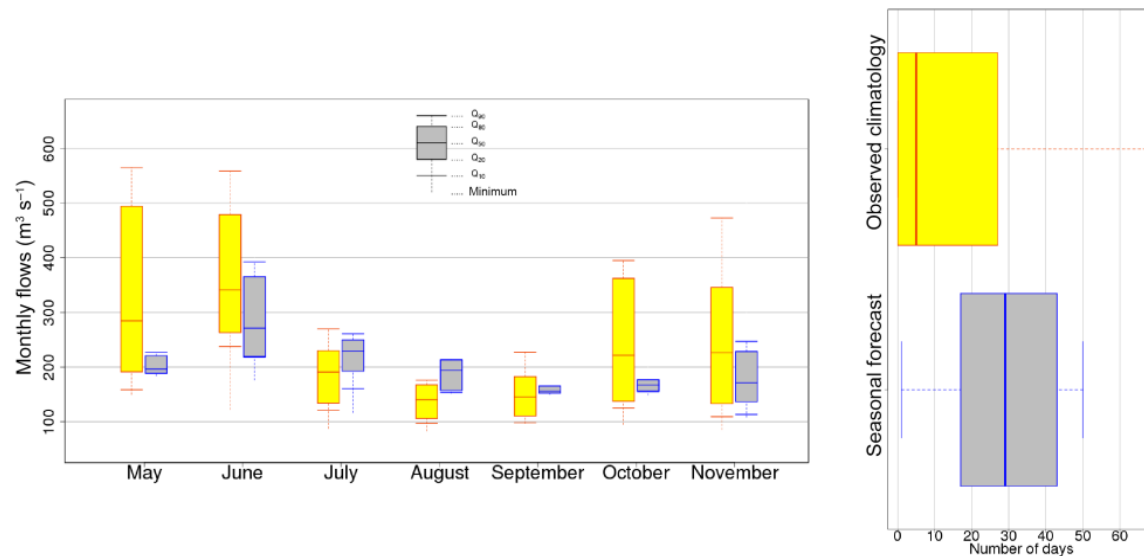
Seasonal forecast

percentage change (NAO positive minus NAO negative) in annual capacity factors for both the typologies of hydro-power between the hydrological years with positive and negative winter NAO phases. Filled bars represent the changes that can be considered statistically significant using a Welch two-sample t-test with a p-value of 0.05.



Seasonal forecast

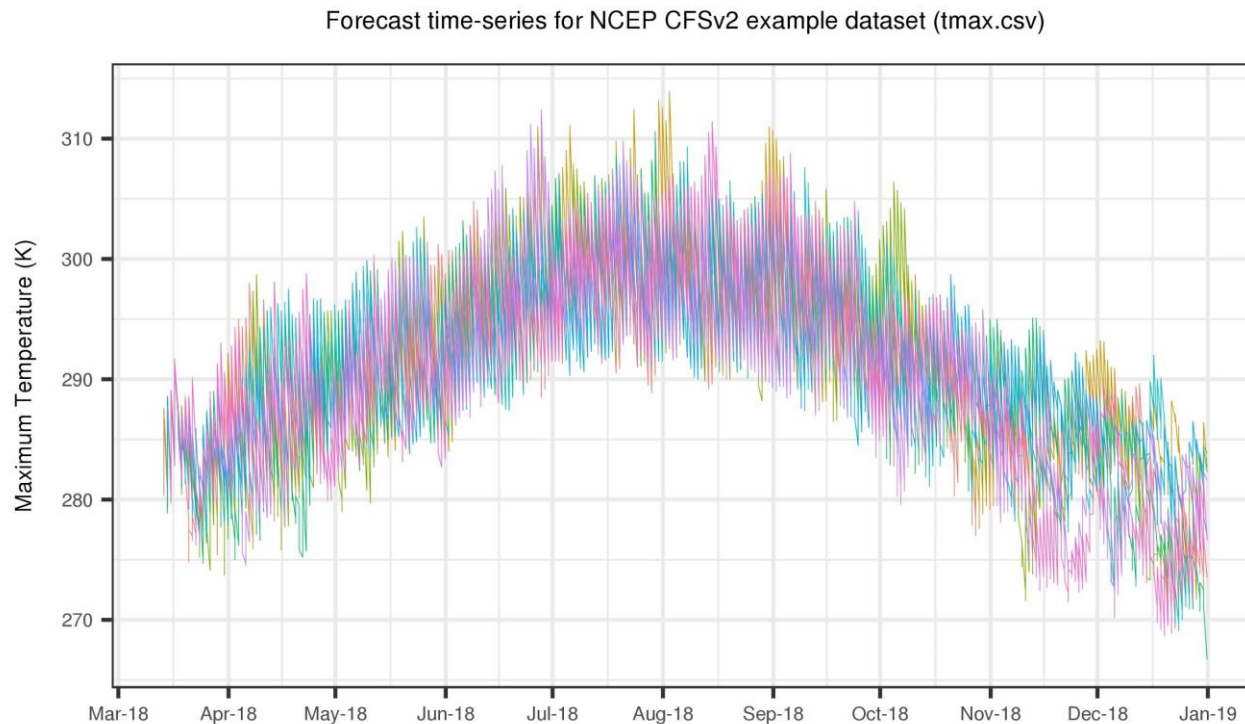
What is a seasonal forecast?



Examples of prediction products deriving from impact models. On the left, monthly mean river flow based on seasonal forecasts (grey boxplot) compared to climatology (yellow boxplot) for the next seven months. On the right, number of days of low flow (grey boxplot) based on seasonal forecasts compared to climatology (yellow boxplot), integrated over the whole dry season (from Viel et al., 2016).

Seasonal forecast

What is a seasonal forecast?



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CLIMATE DATA FOR YOUR DECISION CHAIN

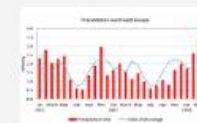
IN FOCUS



MONTHLY MAPS & CHARTS

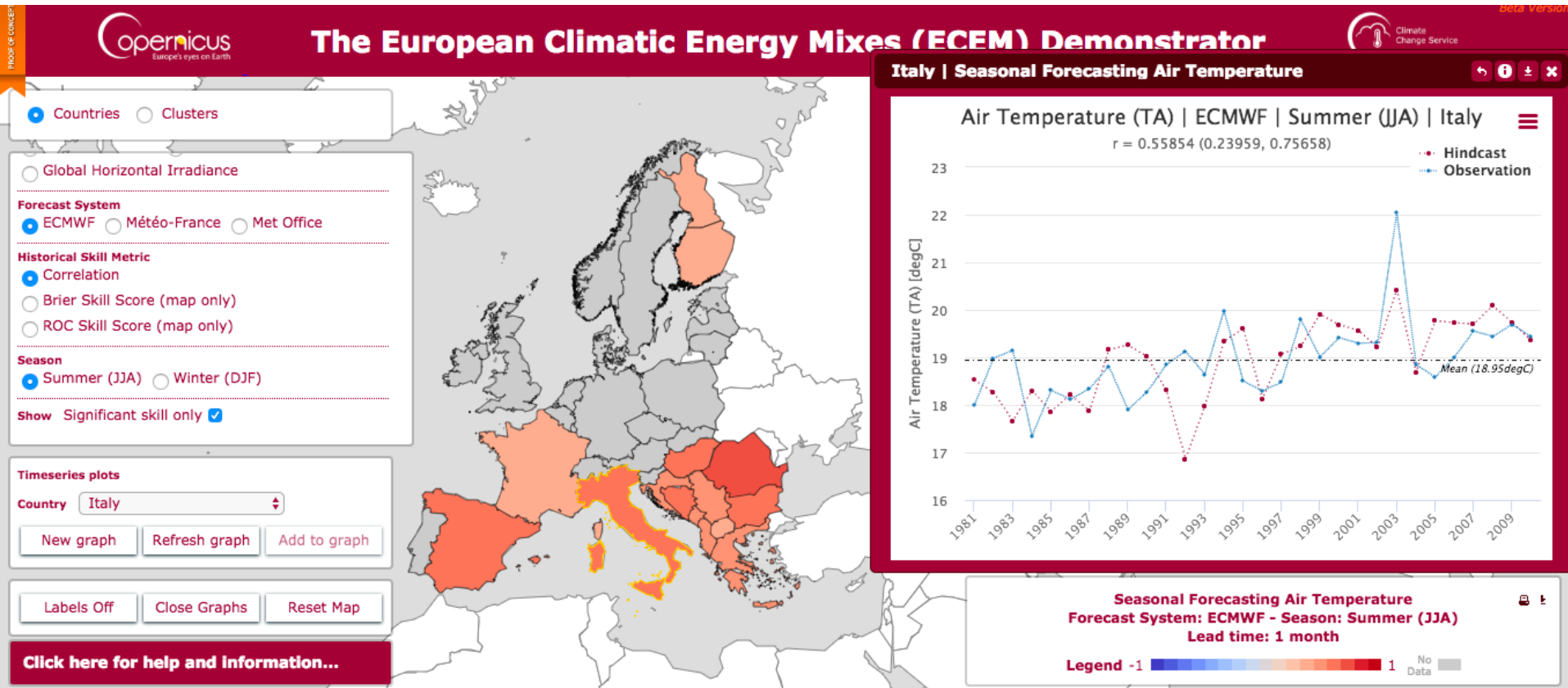


NEWS



22 May 2018
Rain returns in force to
Spain and Portugal

ECEM project



Some project on seasonal forecast

- SECLI-FIRM: The added value of seasonal climate forecasting for integrated risk management
- MED-GOLD: Turning climate-related information into added value for traditional MEDiterranean Grape, OLive and Durum wheat food systems
- S2S4E: Climate services for clean energy
- Euporias

Is it possible to forecast the weather for the next season?

**Is it possible to forecast the weather for
the next season?**

May

Is it possible to forecast the weather for the next 3 months?

**Is it possible to forecast the weather for
the next 3 months?**

Yes

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0101 0010 1101
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1111 1010 0000

