EGU2020 Sharing Geoscience Online Meeting, May 4, 2020

Climate Advanced Forecasting of sub-seasonal Extremes: CAFE ITN Project

CAFE-H2020-MSCA-ITN Team:

Álvaro Corral, Marcelo Barreiro, Céline Déandreis, Reik Donner, Hervé Douville, Noémie Ehstand, Eberhard Faust, Laura Ferranti, Shraddha Gupta, Emilio Hernández-García, Xinjia Hu, Amal John, Holger Kantz, Meriem Krouma, Jürgen Kurths, Pedro Herrera, Cristina Masoller, Linus Magnusson, Nikolaos Mastrantonas, Jörg Matschullat, Mónica Minjares, Florian Pappenberger, Iago Pérez, Niclas Rieger, Emmanuel Rouges, Riccardo Silini, Antonio Turiel, Pascal Yiou

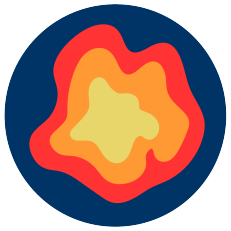
813844 ITN MSCA H2020 EU

CAFE
Climate Advanced Forecasting of sub-seasonal Extremes

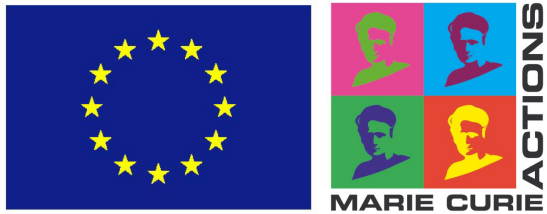
MARIE CURIE ACTIONS

The CAFE ITN Project

813844 ITN MSCA H2020 EU



CAFE
Climate Advanced Forecasting
of sub-seasonal Extremes



- CAFE = Climate Advance Forecasting of sub-seasonal Extremes
  ITN = Innovative Training Network MSCA EU

- Ultimate goal of the CAFE project:

  To contribute to the improvement of sub-seasonal predictability,
  in particular of extreme weather events.

- This will be addressed through a structured and cross-disciplinary program to train 12 early stage researchers (ESRs) while they undertake their PhD theses.

$\Rightarrow$ 12 PhD theses $\Rightarrow$ 12 ESRs

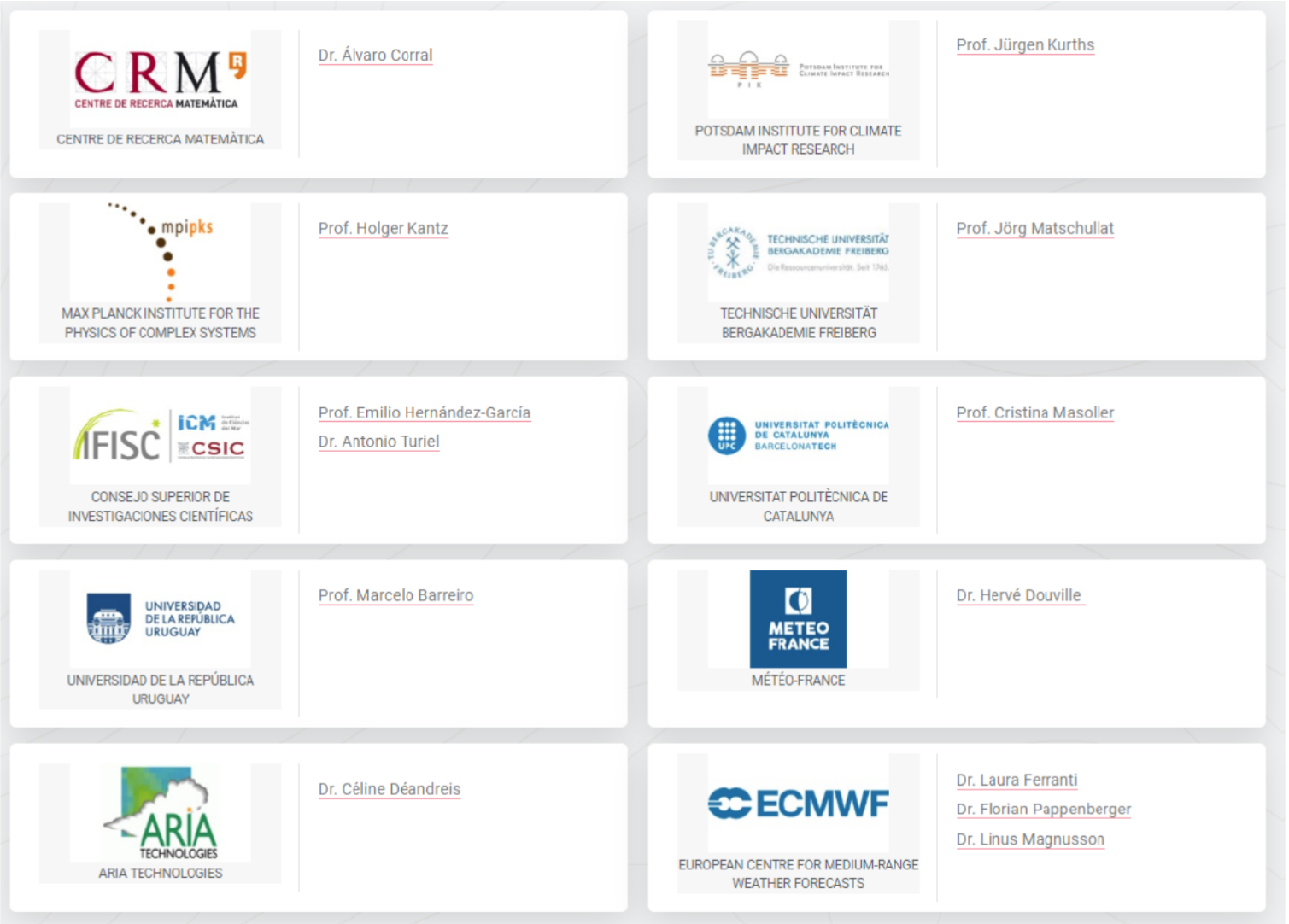
ESRs from 4 continents!

1st CAFE School, Sitges, Barcelona, November 2019

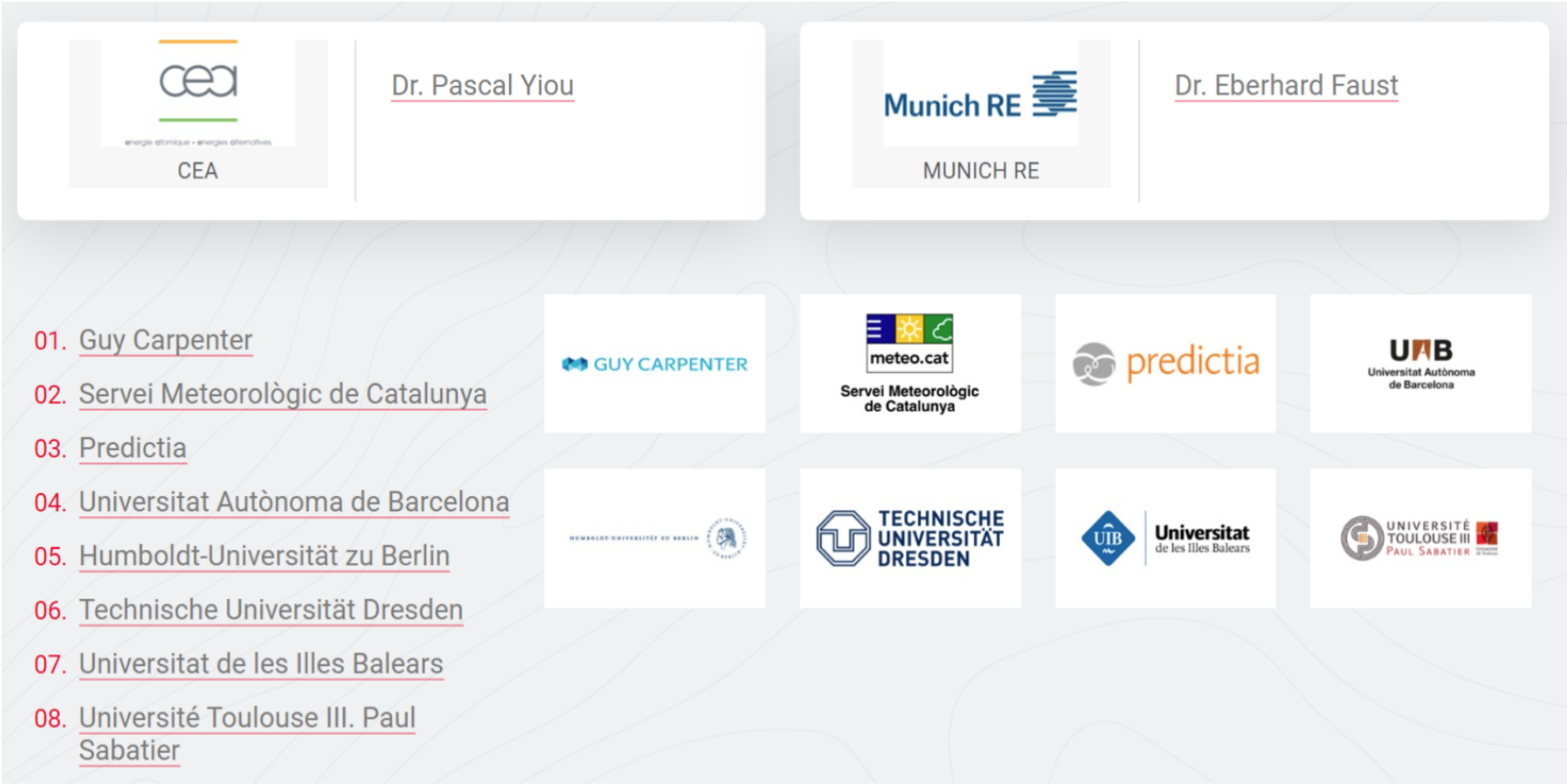
- CAFE brings together a team of co-supervisors with complementary expertise in climate science, meteorology, statistics and nonlinear physics

Kickoff meeting, Mallorca, March 2019

- CAFE (10) beneficiaries (hiring ESRs)



- CAFE (10) associated partners



(Dr. Reik Donner moved from PIK to Magdeburg-Stendal University of Applied Sciences)

CAFE IS A MARIE SKŁODOWSKA-CURIE INNOVATIVE TRAINING NETWORK.
MARIE CURIE ACTIONS
CAFE brings together world-class scientists with complementary expertise in climate science, meteorology, statistics and nonlinear physics. The consortium comprises ten beneficiaries hosting and recruiting researchers in five different countries, complemented by ten partner organizations contributing to the ambitious training programme.
BENEFICIARIES
ECMWF
PARTNERS
GUY CARPENTER
BENEFICIARIES
PARTNERS
Munich RE
TECHNISCHE UNIVERSITÄT DRESDEN
BENEFICIARIES
CRM
CENTRE DE RECERCA MATEMÀTICA
IFISC
ICM CSIC
PARTNERS
meteo.cat
Servei Meteorològic de Catalunya
predictia
UAB
Universitat Autònoma de Barcelona
Universitat de les Illes Balears
BENEFICIARIES
ARIA TECHNOLOGIES
METEO FRANCE
PARTNERS
cea
UNIVERSITÉ TOULOUSE III PAUL SABATIER
BENEFICIARY
UNIVERSIDAD DE LA REPÚBLICA
@CAFE_S2SEXTREM

- CAFE coordinating institution:
  Centre de Recerca Matemàtica (Barcelona, Spain)

  Coordinator: Dr. Álvaro Corral

  Project manager: Dr. Arantxa Sanz

CENTRE DE RECERCA MATEMÀTICA

- Three main research lines:
  - ⋆ Atmospheric and oceanic processes (Work Package 1)
  - ⋆ Analysis of extremes (WP2)
  - ⋆ Tools for predictability (WP3)

  all focused on the sub-seasonal time scale

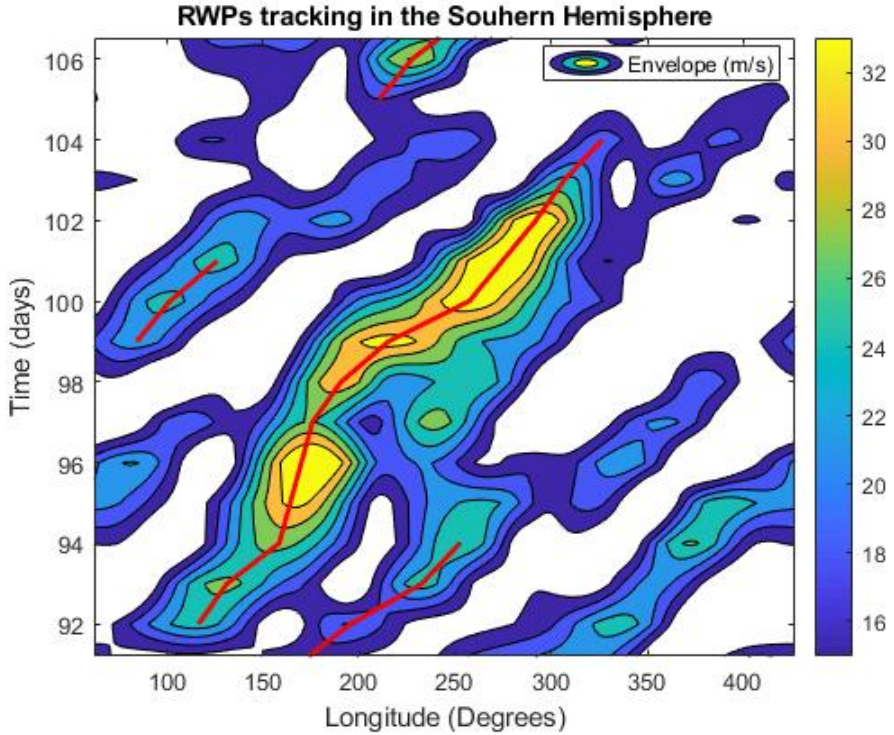
  The research includes the study of

  - ⋆ Rossby wave packets,
  - ⋆ Madden-Julian oscillation,
  - ⋆ Lagrangian coherent structures,
  - ⋆ ENSO-related extreme weather anomalies,
  - ⋆ Cascades of extreme events,
  - ⋆ Extreme precipitation,
  - ⋆ Sea surface salinity,
  - ⋆ Large-scale atmospheric flow patterns,
  - ⋆ Stochastic weather generators, among other topics

PhD thesis projects

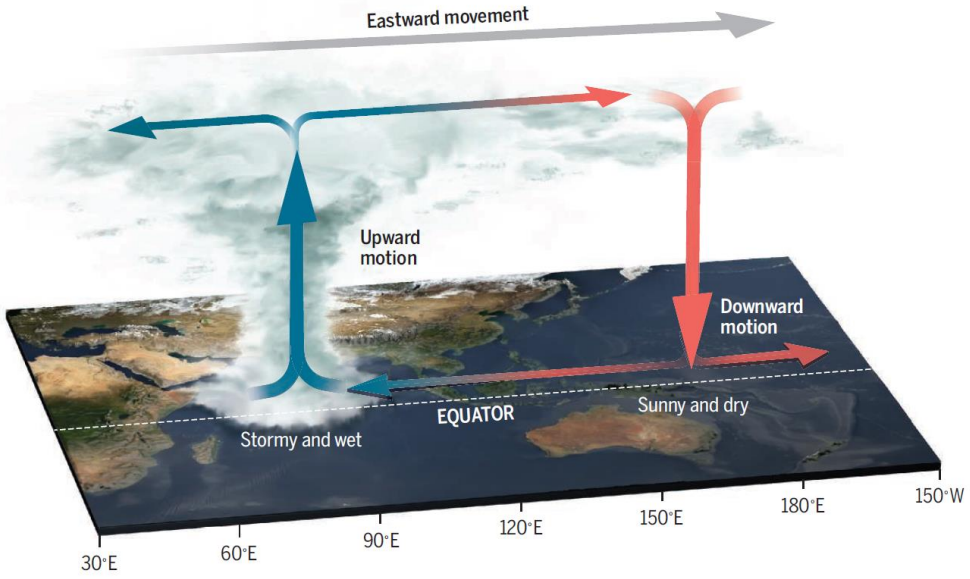
- ESR1 Project:
  Rossby wave packets and their role in atmospheric predictability (WP1)
  ESR: Iago Pérez (UR)
  Supervisors: Marcelo Barreiro (UR) and Cristina Masoller (UPC)

  Objectives: To study how the spatio-temporal coherence, length and duration of Rossby wave packets (RWP) are controlled by the large scale environment. To analyse the limit of predictability that RWPs can provide



- ESR2 Project: **Statistical laws for Madden-Julian events** (WP1)
  ESR: Mónica Minjares (CRM)
  Supervisors: Álvaro Corral (CRM) and Marcelo Barreiro (UR)

  Objectives: To characterize Madden-Julian events in terms of the statistical properties of their lifetime, amplitude, and energy; to quantify the influence of climatic factors on these statistical properties; to develop a simple model of the Madden-Julian oscillation in order to evaluate its predictability

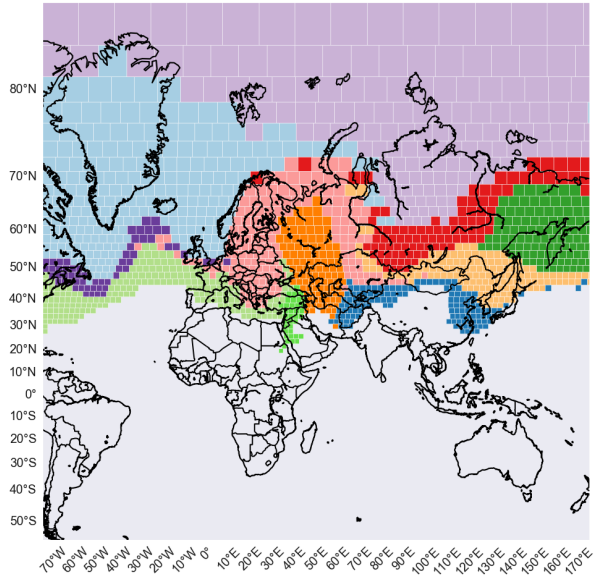


Hand, *Science* (2015)

- ESR3 Project: **Coherent structures in sub-seasonal-scale circulations** (WP1)

  ESR: Noémie Ehstand (CSIC)
  Supervisors: Emilio Hernández-García (CSIC) and Reik Donner (PIK)

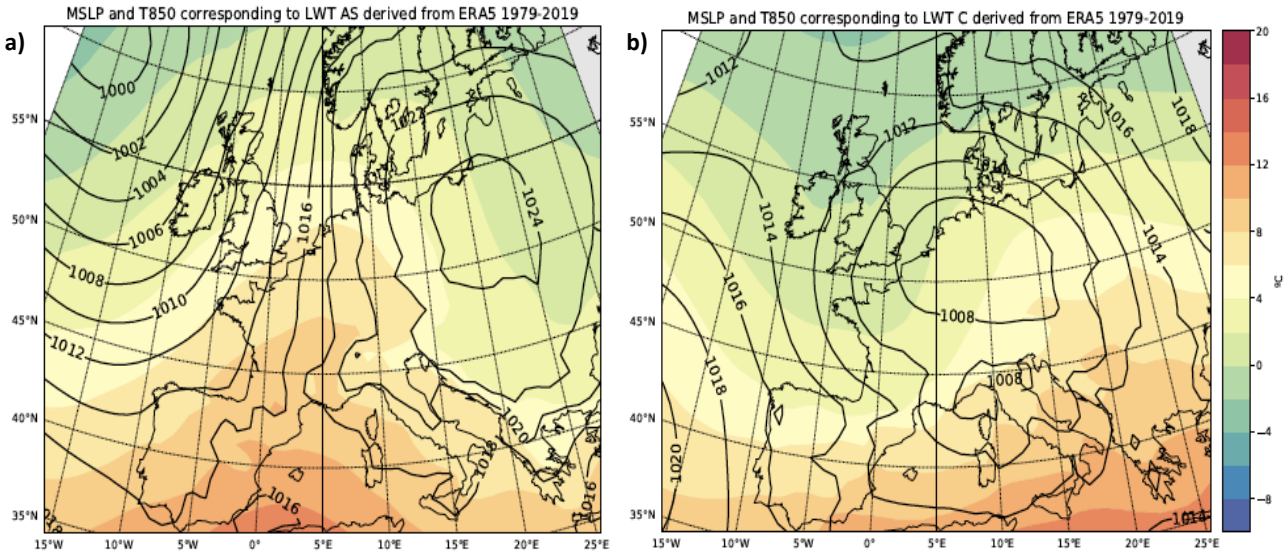
  Objectives: To develop a series of diagnosis tools able to identify and track changes in atmospheric circulation associated with particular events which are known to be relevant for predictability at sub-seasonal scales, specially moving convection structures associated to the Madden-Julian oscillation but also blockings and waves, as well as their oceanic counterparts



Clusters of regions with distinct atmospheric-circulation properties obtained by a flow-network method during a persistent blocking over Eastern Europe in Summer 2010

- ESR4 Project: **Identification of changes in large-scale weather patterns (Grosswetterlagen) in Europe** (WP1)
  ESR: Pedro Herrera (TUBAF)
  Supervisors: Jörg Matschullat (TUBAF) and Hervé Douville (MeteoF)

  Objectives: To analyze weather patterns and their temporal successions to detect variations due to climate change and to identify new climatic phenomena. To study them with respect to their lifetimes and typical sequences. To focus on large-scale weather patterns that trigger weather extremes. To better understand their relationships and effects on sub-seasonal predictability



- ESR5 Project: **Improving data-based forecasts of ENSO-related extreme weather anomalies on lead times of several months** (WP2)

  ESR: Xinjia Hu (MPI)
  Supervisors: Holger Kantz (MPI) and Eberhard Faust (MRe)

  Objectives: To identify atmospheric and oceanic variables and their relevant regions on the globe which show significant correlations with future ENSO phases and relate extreme meteorological anomalies to economic losses.

ESR5 at EGU2020

EGU2020-5119 | Displays | CL4.20/AS1.12/NP2.6/OS1.27

A quantitative comparison of ENSO prediction methods

Xinjia Hu, Holger Kantz, and Eberhard Faust

Thu, 07 May, 14:00-15:45 | D3517

https://meetingorganizer.copernicus.org/EGU2020/EGU2020-5119.html

- ESR6 Project: **Extreme weather situations and cascade effects based on European climate patterns** (WP2)

  ESR: Emmanuel Rouges (ECMWF)
  Supervisors: Laura Ferranti (ECMWF) and Holger Kantz (MPI)

  Objectives: To evaluate links between large scale weather patterns and severe warm events over Europe on the sub-seasonal time scale and to measure current level of predictive skill; to validate the hypothesis that there are follow-up events (cascades, for example, heatwaves preceding droughts); to evaluate the effects of a non-stationary climate on the statistics of extreme weather

  ESR6 at EGU2020

  EGU2020-5619 | Displays | AS1.9

  Heatwaves over Europe: Identification and connection to large-scale circulation

  Emmanuel Rouges, Laura Ferranti, Holger Kantz, and Florian Pappenberger

  Mon, 04 May, 16:15-18:00 | D3208

  https://meetingorganizer.copernicus.org/EGU2020/EGU2020-5619.html

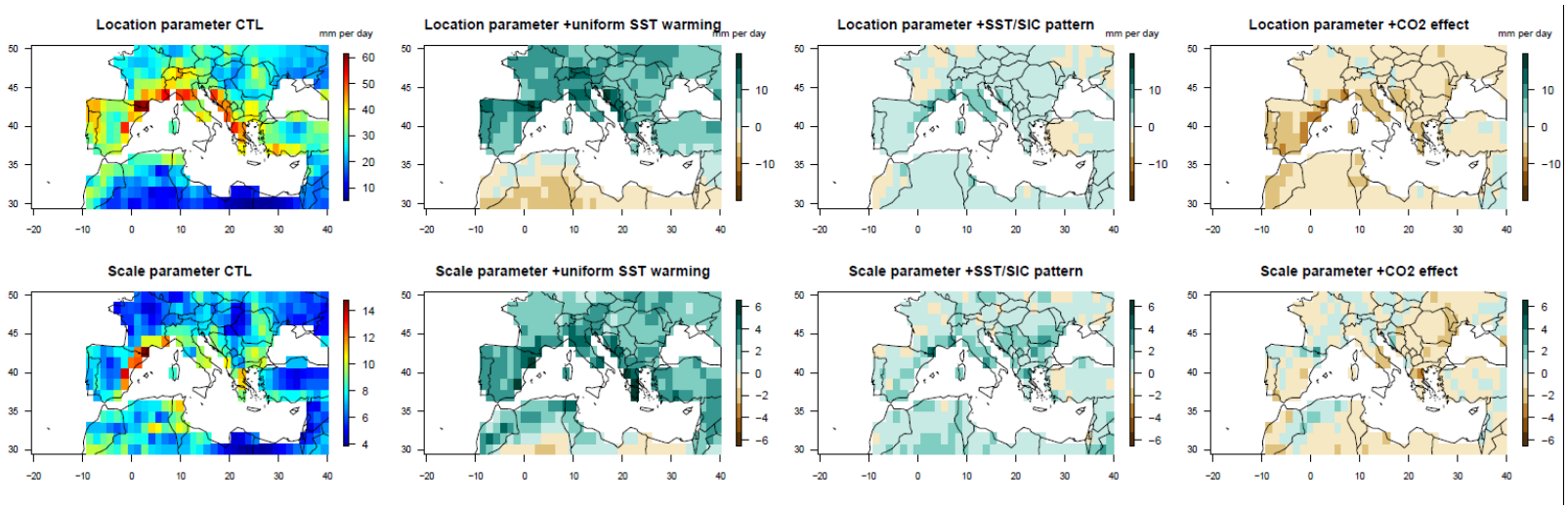
- ESR7 Project: **Assessment of seasonal and sub-seasonal variability of stochastic properties of atmospheric extreme events** (WP2)

  ESR: Riccardo Silini (UPC)
  Supervisors: Cristina Masoller (UPC) and Marcelo Barreiro (UR)

  Objectives: To determine the key parameters affecting the stochastic properties of severe atmospheric events (winter extratropical cyclones, hurricanes, typhoons...) and to estimate annual exceedance probabilities for various event intensities.

- ESR8 Project:
  Scaling of extreme weather events with stabilized global mean temperature: methodological and modelling uncertainties (WP2)
  ESR: Amal John (MeteoF)
  Supervisors: Hervé Douville (MeteoF) and Pascal Yiou (CEA)

  Objectives: To assess the response of extreme weather events for different levels of stabilized global warming, its sensitivity to the experiment design and its amplitude compared to the influence of ENSO and Madden-Julian-oscillation variability



- ESR9 Project: **Multi-layer networks for sub-seasonal prediction** (WP3)
  ESR: Shraddha Gupta (PIK)
  Supervisors: Jürgen Kurths (PIK) and Florian Pappenberger (ECMWF)

  Objectives: To combine event synchronization and multi-layer networks reconstructed from multivariate observational and model data in order to explore the predictability of climate regime changes on the sub-seasonal scale

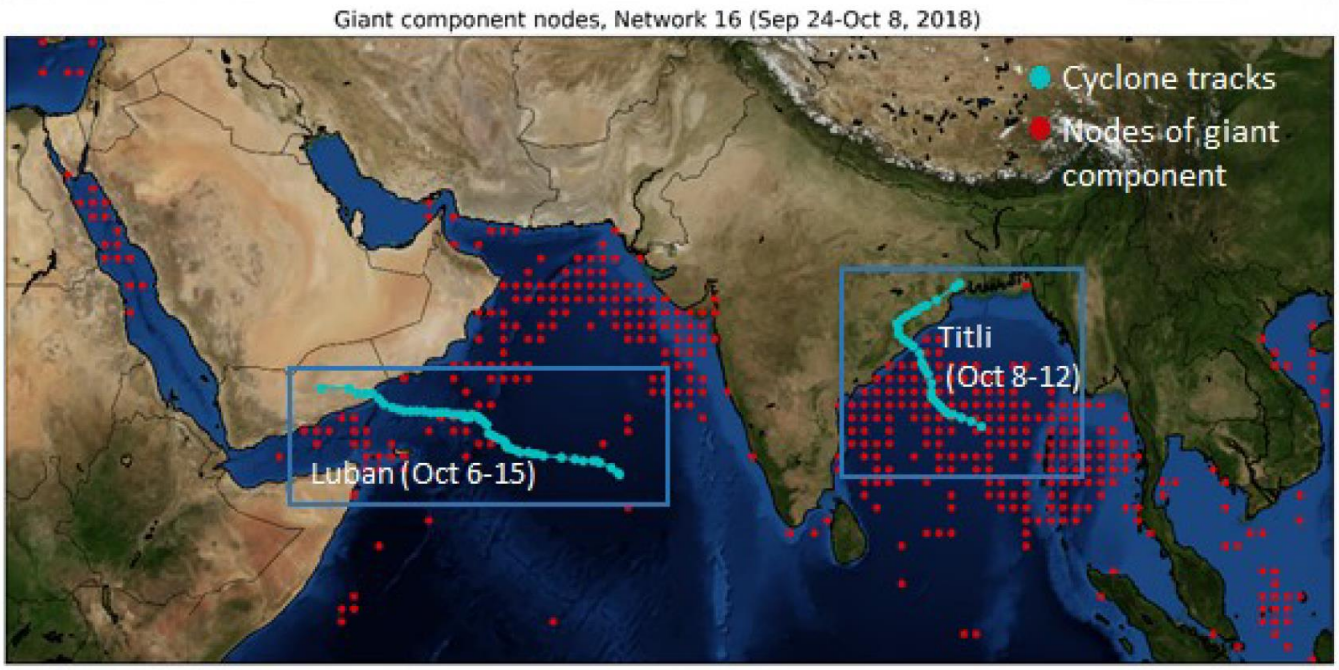
EGU2020-5916 | Displays | NP5.2

Study of Tropical Cyclones in the North Indian Ocean basin using Percolation in Climate Networks

Shraddha Gupta, Jürgen Kurths, and Florian Pappenberger

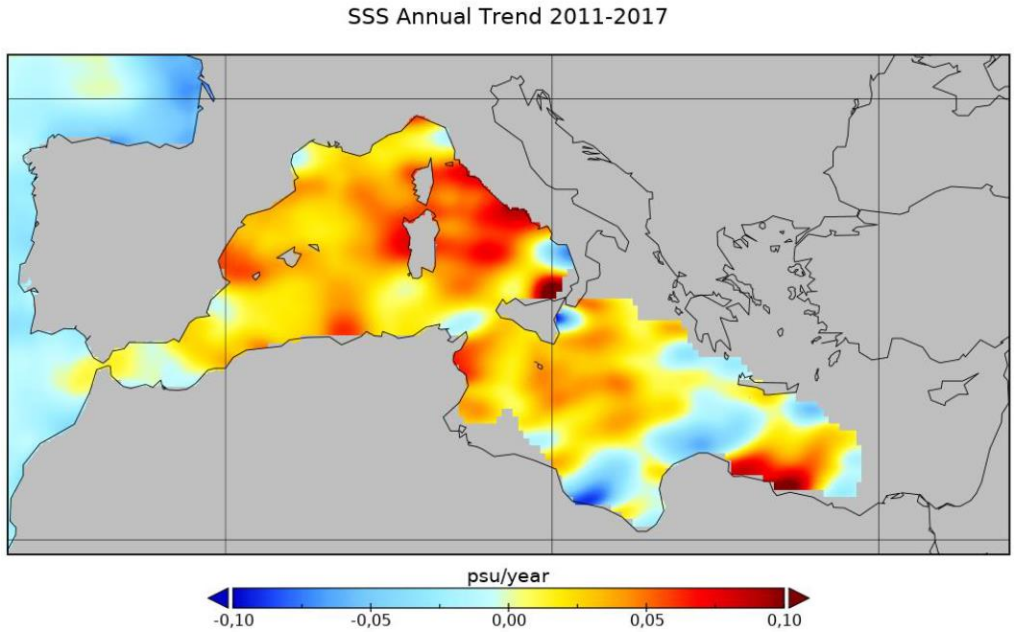
Wed, 06 May, 08:30-10:15 | D2700

(link)



- ESR10 Project: **Sub-seasonal forecasting of extreme precipitation events using sea surface salinity and other sea surface variables as predictors** (WP3)
  ESR: Niclas Rieder (CRM)
  Supervisors: Álvaro Corral (CRM) and Antonio Turiel (CSIC)

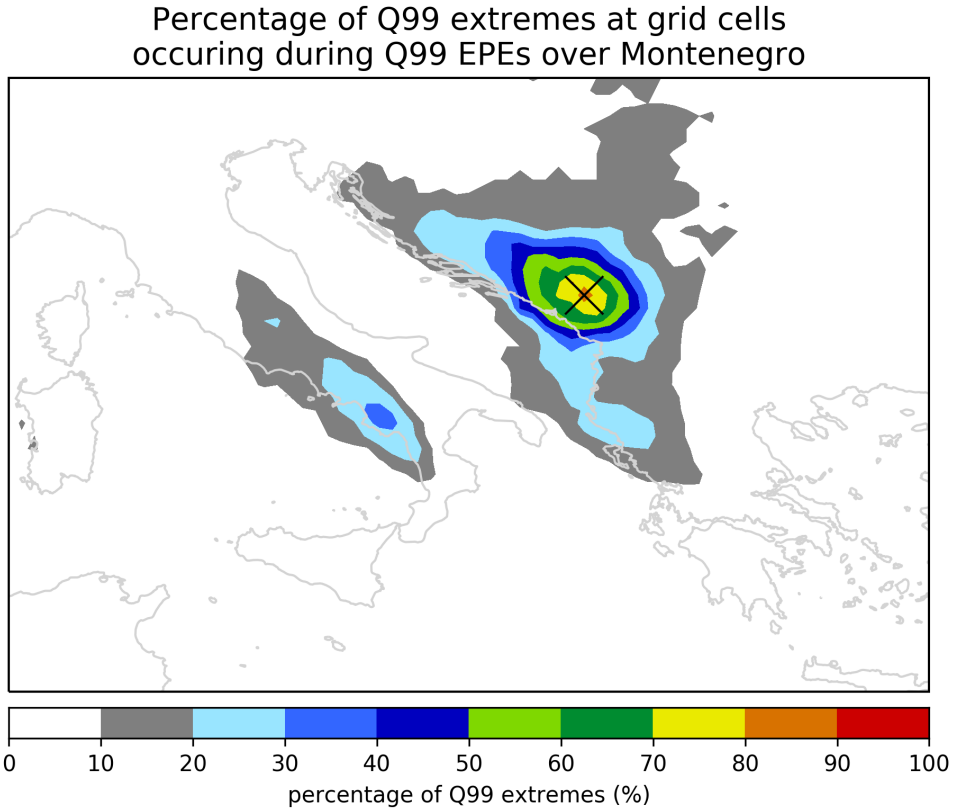
  Objectives: To explore different strategies of statistical analysis, from classical methods such as Empirical Orthogonal Functions to more advanced strategies as multilinear regression and multifractal analysis, in order to derive dynamic associations among key variables of the hydrological cycle from ocean to land, especially for extreme events



- ESR11 Project: **Predictability of large-scale atmospheric flow patterns over the Mediterranean connected to extreme weather** (WP3)

  ESR: Nikolaos Mastrantonas (ECMWF)
  Supervisors: Linus Magnusson (ECMWF) and Jörg Matschullat (TUBAF)

  Objectives: To reach a better understanding of the predictability of large-scale flow patterns over the Mediterranean in sub-seasonal (monthly) forecasts, and its connection to extreme weather



EGU2020-8593 | Displays | HS7.10/NH1.12

Extreme precipitation events in the Mediterranean...

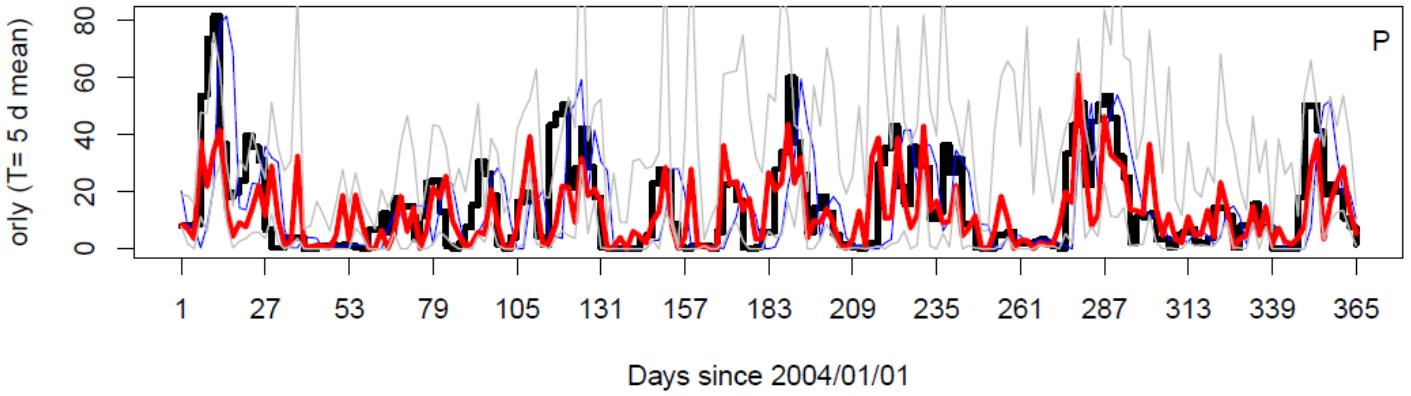
N. Mastrantonas, L. Magnusson, F. Pappenberger,

and J. Matschullat; Tue, 05 May, 16:15-18:00 | D336 (link)

- ESR12 Project: **Ensemble weather predictability with a stochastic weather generator based on analogues of circulation** (WP3)

  ESR: Meriem Krouma (ARIA)
  Supervisors: Céline Déandreis (ARIA) and Pascal Yiou (CEA)

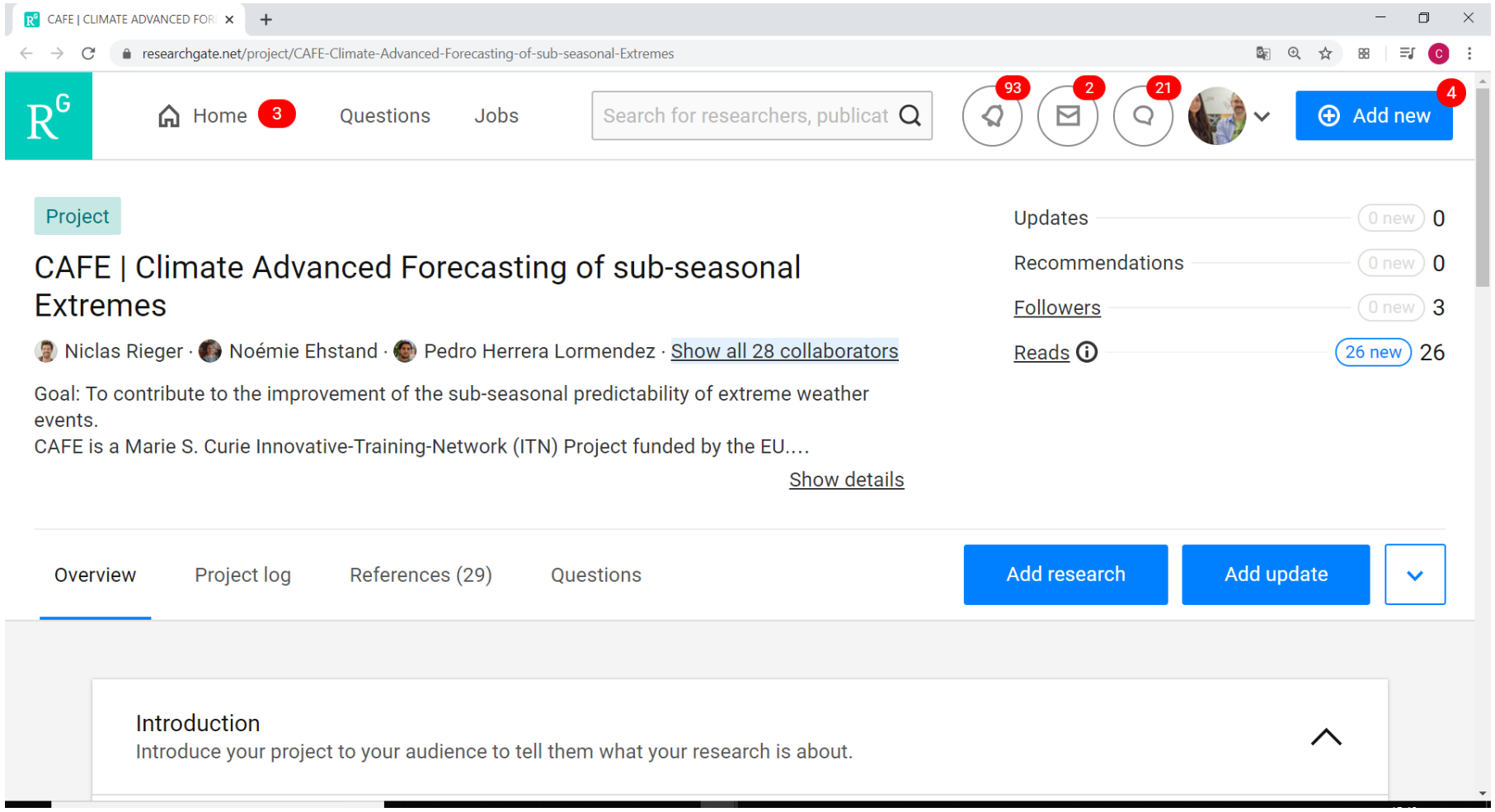
  Objectives: To explore the conditions of predictability of regional surface meteorological variables (temperature, precipitation) with a stochastic weather generator of analogues of atmospheric circulation



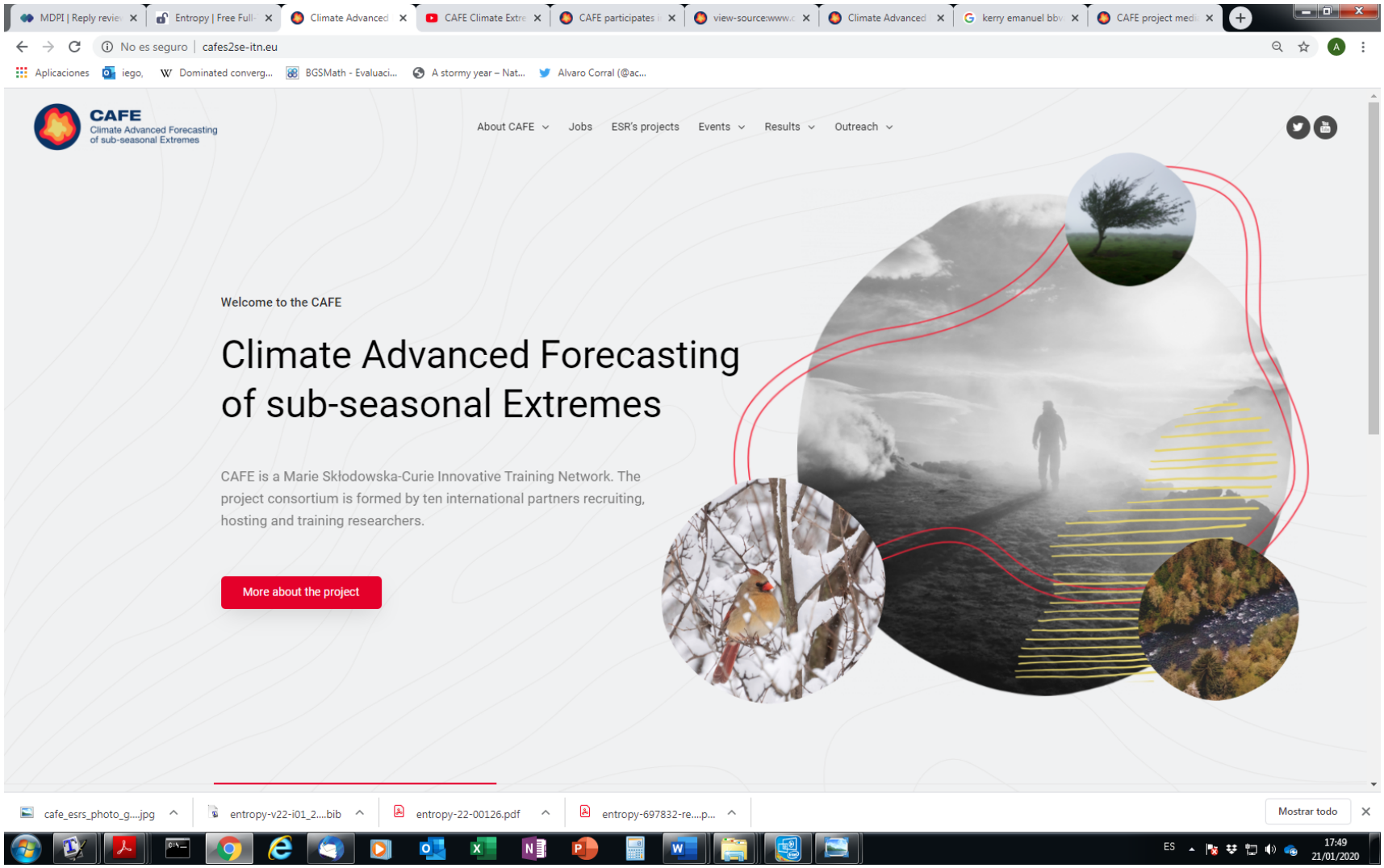
EGU2020-4705 | AS1.3; **Ensemble weather forecast of precipitation with a stochastic weather generator based on analogues circulation**; **M. Krouma**, P. Yiou, C. Déandreis, and S. Thao; Mon, 04 May, 08:30-10:15 | D3173 (link)

CAFE at ResearchGate:

https://www.researchgate.net/project/CAFE-Climate-Advanced-Forecasting-of-sub-seasonal-Extremes

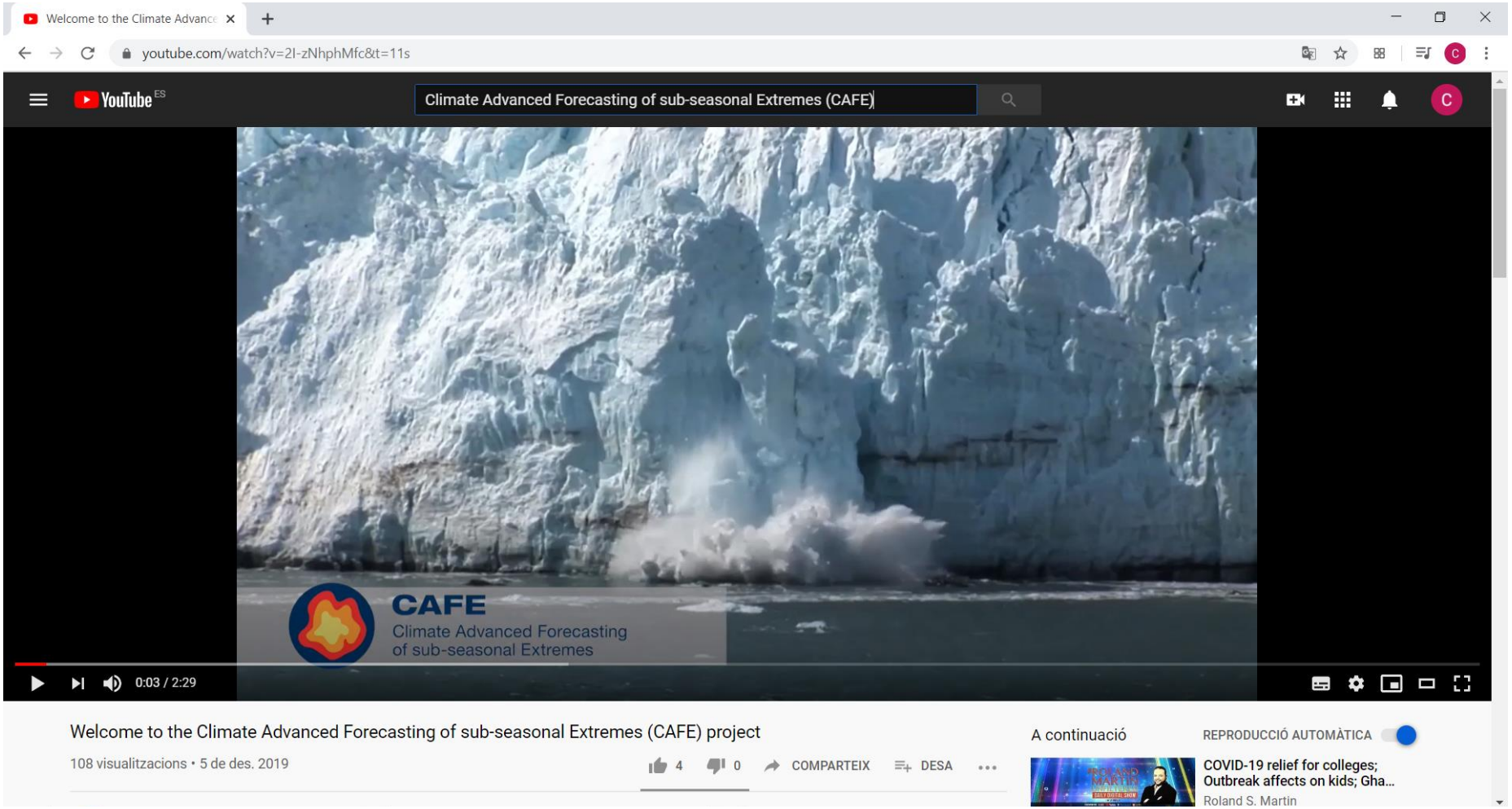


CAFE Web: http://www.cafes2se-itn.eu



CAFE twitter: @CAFE_S2SExtrem

CAFE at youtube: https://www.youtube.com/watch?v=2I-zNhphMfc&t=0s



Acknowledgements

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www.cafes2se-itn.eu

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