Extreme Events Monitoring: a climate service for interactive classification of events in Italy

Alessandro Pugliese*, Giuseppe Giugliano, Giuliana Barbato, Paola Mercogliano

REgional Models and geo-Hydrological Impacts, Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy

*corresponding author: Alessandro.pugliese@cmcc.it

Introduction

The climate service called **Extreme Events Monitoring (EEM), developed by Fondazione CMCC**, provides an interactive classification of extreme events in Italy. This service focuses on major meteorological events that have significant socio-economic impacts.

The initial selection of events includes warm and cold anomalies, heavy rainfall, drought, and storms. These events are identified using specific indicators commonly used in the scientific literature to assess their occurrence.

The EEM climate service, developed by Fondazione CMCC, is accessible through the Dataclime platform (www.dataclime.com).

Data and Methods

For the classification, the event types, are compared in terms of *percentile* defining three following classes (**Rare**, **Extreme** and **Exceptional)**, with the exception of droughts where classification has been applied (McKee et al., 1993 e WMO, 2012).These values represent respectively the **90th**, **95th** and **99th** percentile and are obtained by comparing the daily value of the indicator with the reference value over the period 1991-2020.

The service is based on the use of model reanalysis, which are a very powerful tool, that, by consistently combining numerical modelling with observations, can provide a consistent and robust representation of the current climate. Actually, two datasets are used: **ERA5** (Hersbach et al., 2018) and **ERA5@2km** (Raffa et al; 2021), a dynamical downscaling of ERA5 developed by CMCC and the analysis covers the entire refered period.
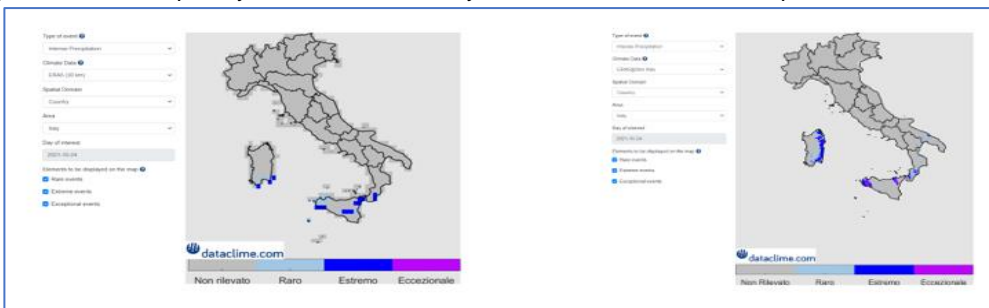

ERA5 vs ERA5@2km 24/10/2021

Results

Evaluation of **EEM** service, for the detection of extreme events, was carried out by using information from European Severe Weather Database (Dotzek, 2009), based on voluntary observers-networks, weather enthusiasts, news and media and national hydro-meteorological services which are then confirmed and given a certain degree of accuracy.

For the validation (over the period 1991-2021) of our climate service only report **QC1** (Report confirmed by reliable source) and **QC2** (The events and their reports are confirmed and have been the subject of scientific case studies) were used.
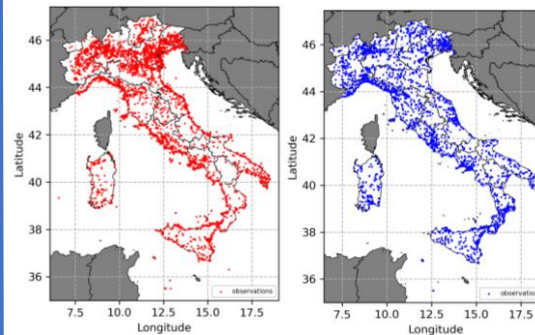
ESWD: Extreme wind and heavy precipitation reports 1991-2021

Extreme wind and heavy precipitation report over Italy are collected by **ESWD** (European Severe Weather Database) and the performance of **EEM** service has been statistically evaluated.

Over the period 1991-2021 there are 4282 segnalation for extreme wind and 2923 for extreme precipitation in the Italian peninsula. The plots below shows the performance of our service
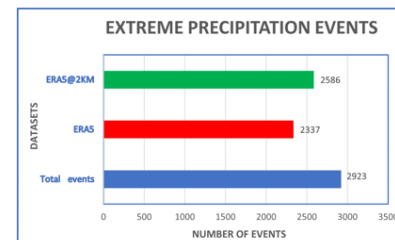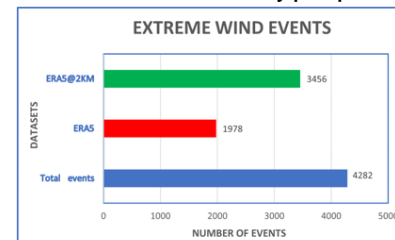
	RMSE	MAE	COVARIANCE	ERROR RATE
ESWD vs ERA5	0,45	0,2	0,50	21 %
ESWD vs ERA5@2km	0,30	0,12	0,36	10 %

	RMSE	MAE	COVARIANCE	ERROR RATE
ESWD vs ERA5	0,73	0,5	1,08	54 %
ESWD vs ERA5@2km	0,19	0,2	0,49	20 %

For both variables we note that the use of higher resolution for this type of analysis allows to catch a greater number of events.
This result is also evidenced by the statistical indices considered: RMSE (Root-Mean-Square deviation), MAE (Mean Absolute Error) and percentage of error, that show a better performance of **ERA5@2km** than **ERA5** especially on such difficult areas like mountain region or sea-land border