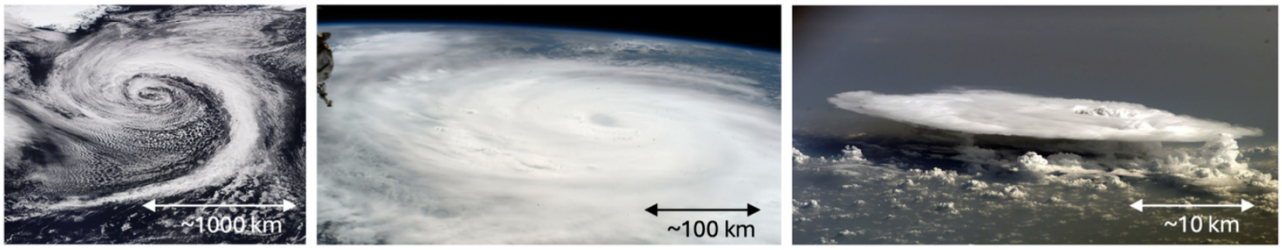
Global classification of historical storms according to the underlying physical processes

(Proposer: Francesco Marra)

Summary: This PhD position is part of the HYPES project "Rethinking statistical HYdrology: introducing Physics in Extreme rainfall Statistics" funded by the FIS3 program, in which we aim at producing a statistical description of extreme rainfall probability informed by physics, and therefore explainable, physically consistent, and invariant in space and time. Developing such a model is critical for providing physically-sound projections of future very-rare precipitation extremes.

Predicting the probability of occurrence of extreme events is at the backbone of risk management, hydrological and hydraulic design, and insurance/reinsurance business. Despite its importance, the practical approach to estimating the probability of extremes mostly relies on statistical extrapolations from small samples of empirical data. Explicit inclusion of the available physical knowledge in these statistical models is still at an embryonal stage and requires a multidisciplinary approach at the intersection of atmospheric physics, statistics and hydrology.



This PhD project aims at producing a storm-centred database including virtually all storms occurred since the satellite era. Storms spanning different ranges of spatial scales, from convective storms to extratropical cyclones, will be isolated and segmented using satellite precipitation estimates and satellite geostationary imagery. They will be then classified into different types according to the underlying physical processes relevant for the scale of interest using unsupervised or semi-supervised clustering algorithms. The obtained clusters will be refined and validated against available databases from synoptic climatology.

Collaborations: Prof. Moshe Armon (Hebrew University of Jerusalemt, Israel), Prof. Antonio Canale (University of Padova, Italy), Dr. Giuseppe Zappa (Institute of Atmospheric Sciences and Climate, CNR, Italy)

Related funding: FIS3, DOR