EGU23-8120, updated on 05 Dec 2023
https://doi.org/10.5194/egusphere-egu23-8120
EGU General Assembly 2023


# A Machine Learning approach to support multi-risk assessment and climate adaptation planning in the Veneto region

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The analysis of extreme events that occurred in the last decades shows that these are often generated by multiple hazards, whose interactions are still to be fully understood. Moreover, the observation of their temporal trend suggests that their frequency and entity may be related to climate change. The growing impact that natural disasters and climate change have on people and ecosystems makes the ability to model and predict the relationships between multiple risks and their evolution over time a critical expertise.

The use of Artificial Intelligence for climate change adaptation can leverage advanced understanding of multi-risk dynamics, in order to support forward looking disaster risk management and system resilience thinking. Specifically, Machine Learning (ML) algorithms offer a new path to address the analysis of multiple risks due to their ability to model complex and non-linear interactions between different factors, without the need for an explicit modelling.

Here we present the design and development of a ML approach called *INTELLIGENT multi-risk* (i.e., InNovaTive machinE Learning methodoLogy to assess multi-rIsk dynamics under climate chanGe futurE coNdiTions), aimed at evaluating the impacts of multi-risk events at the regional (sub-national) scale, and predicting risk scenarios based on future climate change projections.

Taking as input hazard, exposure and vulnerability features from both historical observations and future projections, the *INTELLIGENT multi-risk* allows to: analyse the multi-hazard footprint at different spatio-temporal scales; identify the most influencing factors triggering multiple risks; estimate the effect of climate change on risks scenarios.

An initial application was developed in the frame of the Interreg ITA-CRO AdriaClim project to assess the risks of extreme weather events along the coastal municipalities of the Veneto region. The ML algorithm was trained, validated and tested with local impact records over the 2009-2020 baseline timeframe, and then used to project future climate risk for the timeframe 2021-2050,

under the high-emission RCP8.5 climate change scenario. The results of the analysis for the training dataset show a F1-score value of 74% on balanced data, identifying sea surface height, temperature, precipitation, and wind parameters as the most important factors triggering risks in the Veneto coastal area. Nevertheless, the model has the potential to identify which are the coastal municipalities more exposed to multi-hazard events, both in the baseline and future scenarios, in order to support the definition of coastal adaptation strategies.

Future developments of the *INTELLIGENT multi-risk* approach are foreseen within the H2020 MYRIAD-EU project, where the analysis will be extended to the whole Veneto region, in order to consider additional hazards (e.g., heat waves, drought, wildfires), and analyze multi-risk dynamics across different landscapes (mountains, plains and coastal area), and sectors (finance, tourism, natural ecosystems). At the same time, the ML-based methodology will be used to better identify spatial and temporal footprints of the multi-hazard events and to model the impact of natural hazards and climate change on environmental quality indicators (i.e., water, air, and soil quality).