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Research brief: Integrating AI and climate scenarios to assess multi-risk in Veneto's coastal areas



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Integrating AI and climate scenarios to assess multi-risk in Veneto's coastal areas.

Highlights

- A novel two-tier Machine Learning (ML) approach was developed to determine the daily risk score and estimate the annual frequency of climate-related impacts in Veneto coastal municipalities.
- The model, tested and validated using recent-day data (2009-2019), was applied to mid-term (until 2045) and long-term (until 2100) climate change scenarios.
- Results emphasise the importance of multi-hazard analysis, particularly the interplay between sea-level rise and precipitation, while wind significantly influences impacts only when combined with other hazards.
- The expected annual frequency of climate-related impacts increases across all scenarios, with RCP8.5 showing a tenfold rise by 2100, where sea-level rise drives long-term risk escalation and precipitation affects seasonal variations.
- Findings highlight the urgency of proactive risk management strategies for Veneto's coastal municipalities, advocating their integration in the Regional Strategy for Climate Change Adaptation.

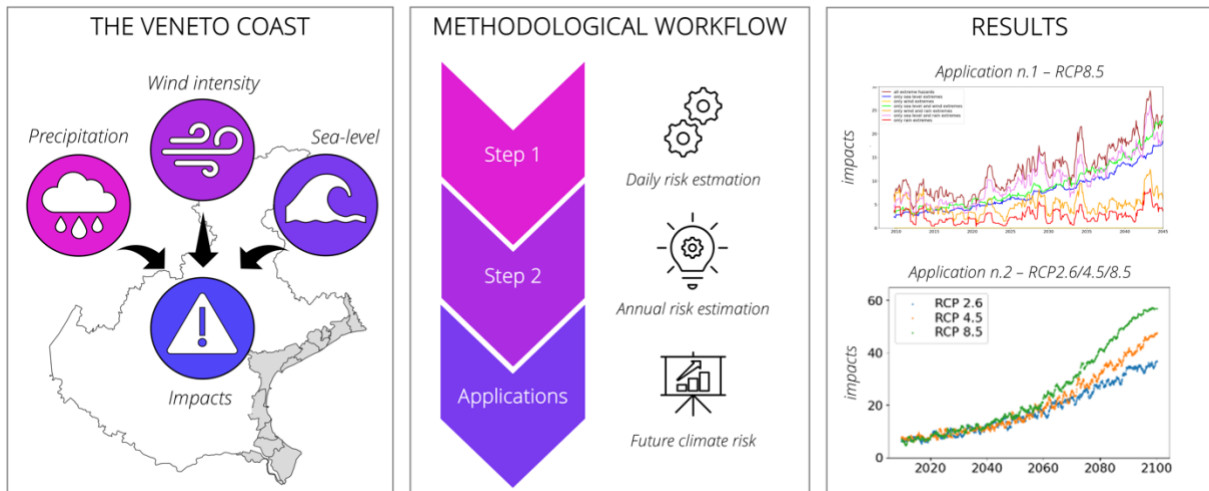
Recommendations

The integration of the proposed two-tier ML approach into adaptive management strategies could help prioritize coastal risk reduction and resilience efforts in vulnerable areas. This study shows that multi-risk modelling would benefit from the incorporation of additional hazard indicators, improving impact data quality, and advanced AI techniques. Cross-sector collaboration among local governments, environmental agencies, and researchers should be strengthened to develop comprehensive climate adaptation policies that address multi-hazard risks. Greater awareness of climate risks could be fostered by supporting protection measures and encouraging community-driven adaptation initiatives.

Context

Climate change is causing an increase in extreme weather events, posing significant risks to coastal regions due to rising sea levels, heavy precipitation, and storm surges. These areas, like the Veneto coast, facing the North Adriatic Sea, are particularly vulnerable because of their dense populations, economic importance, and fragile ecosystems. Traditional risk assessment methods struggle to capture the complex interactions between multiple hazards. To address this, the study introduces an innovative two-tier Machine Learning approach that estimates the frequency of climate-related impacts based on daily hazard indicators.

Illustration/Graph/Picture



(Source: Dal Barco et al., 2025)

Want to know more?

- **Article:**



- **Full reference:** Dal Barco, M.K., Maraschini, M., Nguyen, N.D., Ferrario, D.M., Rufo, O., Fonseca, H.L., Vascon, S., Torresan, S., & Critto, A. (2025). Integrating AI and climate change scenarios for multi-risk assessment in the coastal municipalities of the Veneto region. *Science of The Total Environment*, 965 (15 February 2025), 178586.
- **Link to paper:** <https://doi.org/10.1016/j.scitotenv.2025.178586>
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