

## **Title: Sea level rise and other indicators of coastal vulnerability**

### **Project description:**

The project will be developed in the framework of the “RETURN” project, aiming at the individuation of key-indicators for coastal hazard, exposure and vulnerability assessment. It should tackle natural and anthropogenic hazards through a comprehensive approach, based on the collection, compilation and harmonization of impact-oriented variables (indicators) relevant to coastal vulnerability. The individuation of these indicators will be of key importance for creating reliable quantitative future scenarios, supporting site-specific impact/risk studies and driving coastal management and adaptation strategies. Specific focus will be given to sea-level variations, since sea level rise is one of the most evident climate-related effects, increasing exposure and vulnerability of coastal areas and communities all over the world. Enhanced flooding during extreme meteorological events, permanent floodings, enhanced shoreline retreat, salt intrusion in coastal aquifers and estuaries, damage on coastal defenses, and loss of coastal and marine ecosystem services are just some of the several relevant impacts. There is a general need for regional- to local-scale assessments of sea-level rise and related hydrogeological effects, since global projections are often not suitable to be applied to specific coastal areas due to the space-time variability of the processes involved.

The project focuses on the Emilia-Romagna coastal area as a case study. This area has undergone severe anthropogenic pressure in the last decades: increased subsidence due to underground fluid exploitation, river regulation and the widespread use of coastal defense structures caused the coastal plain of the Emilia-Romagna to become more and more vulnerable to the impacts of sea-level rise, including flooding, coastal erosion, saltwater encroachment along rivers, soil and groundwater salinization, decrease in freshwater availability overall causing significant long-term concern for ground and surface water users in the low-lying coastal basins.

### **Plan of activities:**

- identify existing databases of indicators relevant to coastal vulnerability and hazard through the collection, compilation and harmonization of impact-oriented variables, climate-related and not. A comprehensive, multi-hazard approach, considering natural and anthropogenic contributions at the recent and the historical scale, will be carried out at the basin scale;
- collect and analyze data on relative sea-level changes at the regional scale over the historical and the “satellite era” and evaluate related uncertainties. Data on the local vertical movements will be also considered, being an important factor influencing the local sea level along the E-R coasts, as recorded by tide gauges. Annual to decadal climate-driven variability of the sea level will be analyzed at the sub-basin and basin scale (Northern Adriatic and Mediterranean, respectively).
- Statistical analyses of drainage, subsidence, climate, and land use change datasets will be performed to constrain the relative weight of each single factor in affecting coastal evolution and exposure to different hazards (coastal flooding, aquifer salinization, degradation of dune area and of coastal vegetation, etc.).

The expected results and advancement in process understanding will be crucial for supporting regional/local hazard assessment, in providing key-role climate-related indicators (such as sea level rise and groundwater salinization), and in planning protection, adaptation and mitigation strategies on the most vulnerable coastal areas within the studied region.