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Gis-based assessment of marine oil spill hazard and environmental vulnerability for the coasts of Crete in South Aegean Sea

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Developing effective early warning and coordination systems can save thousands of lives and protect people, property and the environment in the event of natural and man-made disasters. In its document “Towards Better Protection of Citizens against Disaster Risks: Strengthening Early Warning Systems in Europe”, the Commission points out that it seeks to follow a multi-hazard approach, to develop near real time alert systems, to ensure a near real time dissemination of alerts to Participating States, and to improve its rapid analytical capacity. In this context, the EU project DECATASTROPHIZE (http://decatastrophize.eu/project/) co-financed by the EU Humanitarian Aid and Civil Protection aims to develop a Geospatial Early warning Decision Support System (GE-DSS) to assess, prepare for and respond to multiple and/or simultaneous natural and man-made hazards, disasters, and environmental incidents by using existing models/systems in each partner country (Cyprus, France, Greece, Italy and Spain) in a synergistic way on ONE multi-platform, called DECAT. Specifically, project partners will establish appropriate geo-databases for test areas and use existing hazard models to produce hazard and vulnerability geo-spatial information for earthquakes, landslides, tsunamis, floods, forest fires and marine oil spills. The GE-DSS in will consist of one source code with six geodatabases, i.e. one for each partner and risk data in the respective test area. Each partner organization will be able to manage and monitor its own data/database and their results using Multi-Criteria Decision Analysis (MCDA). The GE-DSS will be demonstrated at the local, regional and national levels through a set of Command Post and Table Top Disaster Exercises.

As part of the DECAT GE-DSS, the gis-based geo-database and assessment of marine oil spill hazard and environmental vulnerability for the coasts of Crete in South Aegean Sea are presented here. Environmental Sensitivity Index (ESI) maps are produced comprising shoreline classification – ranked according to a scale relating to sensitivity, natural persistence of oil, and ease of cleanup (Adler and Inbar, 2007; Alves et al., 2014) – biological resources and human-use resources, i.e. specific areas that have added sensitivity and value because of their use, such as beaches, water intakes, and archaeological sites (NOAA, 2002). Seasonal hazard maps (surface oil slick, beached oil) are produced employing a modified version of the open source Lagrangian oil spill fate and transport model MEDSLIK-II (http://medslikii.bo.ingv.it/) coupled with a high-resolution 3D hydrodynamic model. The model predicts the transport and weathering of oil spills following a Lagrangian approach for the solution of the advection-diffusion equation. Transport is governed by the 3D sea currents and wave field. In addition to advective and diffusive displacements, the model simulates several physical and chemical processes that transform the oil (evaporation, emulsification, dispersion in the water column, biodegradation, adhesion to coast). The analysis is carried out under multiple oil spill scenarios accounting for the busiest ship lanes and meteorological conditions using multiple year hydrodynamics. The results highlight the hazard faced by coastal areas of Crete with high ESI.

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