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Advancing exposure and risk assessment in the EU by modeling population distribution in daily and seasonal cycles

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Population exposure is a major component of disaster risk, and for many hazard events, especially those extreme or above a certain magnitude, can be a major determinant of impacts. Human activities (work, study, leisure) result in large fluctuations in population distribution at a range of spatio-temporal scales. These population dynamics can greatly modify the patterns and assessment of population exposure, particularly for rapid onset hazard events such as earthquakes, tsunamis, and floods. However, due mostly to lack of data on population spatio-temporal dynamics, these implications have been largely overlooked in risk analyses or considered only for small areas and in case studies.
In the frame of the project ENACT (ENhancing ACTivity and population mapping), we produced for Europe (EU28) a set of seamless nighttime and daytime population density grids for each month of the year, taking into account human activities and induced major daily and monthly variations. We created these new spatio-temporal grids by mining and combining official statistical data at regional level with geo-spatial data from conventional and non-conventional data sources. These population data sets are validated and will be freely available to the public.
Availability of such data sets opens the way for a consistent and detailed analysis of the daily and seasonal variations of population exposure and risk across 28 countries inhabited by more than 500 million people. By combining these population grids with the most recent hazard data on seismic and flood hazard, we are able to map and quantify variations of population exposure, to study their spatio-temporal patterns, and to eventually identify potential daily and seasonal exposure hot spots. Although most useful for baseline risk assessment, such population grids can benefit all stages of the Disaster Management cycle and promise to substantially contribute to advancements in natural hazard risk assessment models.