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Exploiting Copernicus Climate Change Service (C3S) to assess ongoing and future soil erosion over Italy

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Soil erosion by water greatly affects Italy impacted by 24% of total soil loss of Europe, 33% of agricultural lands exposed, and costs, e.g. for crop production, up to about 600Meuro. Furthermore, expected increases in severity and magnitude of extreme precipitation events could exacerbate such an issue.

In this regard, rainfall information at very fine spatial and temporal resolution represents a key point; unfortunately, weather stations are not spread uniformly across regions and they uncommonly provide free data at sub-daily scale. Moreover, the reliable projections of how rainfall will change in the coming decades are hard to store and manage for non-experts.

In trying to overcome such a gap, Copernicus Climate Change Service (C3S) provides several tools. The C3S is part of the Copernicus Earth Observation Programme and is implemented by the European Centre for Medium-Range Weather Forecasts (ECMWF) on behalf of the European Commission. In particular, Climate Data Store (CDS) hosts rainfall time series for the historical period and most recent decades from observational (E-OBS) and reanalysis (ERA5, ERA5-Land, UERRA) datasets, at (sub) daily time step and with horizontal resolution ranging from 31 km to 5.5 km. For the future, the simulations' ensemble within EURO-CORDEX (resolution ~12 km, daily time step) are available for robust evaluations, i.e. to consider the uncertainty due to alternative greenhouse gas concentration scenarios and model chain used.

In this context, in the last months, C3S funded the Demo Case SOIL EROSION implemented by the CMCC Foundation and aimed at assessing ongoing and future soil loss by water erosion over Italy. The Demo Case is expected to develop further specific datasets and a web-application by exploiting products and tools also provided by Climate Data Store (CDS) infrastructure.

To assess soil losses, the largely adopted Revised Universal Soil Loss Equation (RUSLE) is selected. Such an empirical equation combines rainfall erosivity (R-factor), evaluated in this case by exploiting datasets in CDS, to soil susceptibility to erosion due to soil intrinsic properties but also to land cover, land management, and topography. Gridded datasets related to R-factor and soil

losses will be then made available within the CDS catalog. Moreover, the web application will permit visualizing and retrieving trends and results for specific areas (e.g. NUTS) in the way of maps and graphs. In addition to the "Basic" mode, the Application is expected to support "what-if" analysis ("Advanced" mode) permitting to understand how variations in land use (C-factor) or management practice (P-factor) can influence soil losses at large scale under current and future conditions.