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Digital geomorphological mapping with GOGIRA (Ground Operative-system for GIS Input Raw-data Acquisition) – An innovative system to numerical cartography.

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In recent years, digital mapping systems have gained interest among geomorphologists thanks to the fast evolution of technology. However, a mapmaker still uses traditional cartographic supports as printed topographic maps, which need to be subsequently digitalized. Every step adds an additional level of cartographic error, often difficult to quantify. A solution can be to map the landforms directly in digital format during the fieldwork through an ad hoc system.

With the purpose of making a “native” numerical cartography, GOGIRA (Ground Operative-system for GIS Input Row-data Acquisition) has been realized. GOGIRA consists of a set of hardware and software tools to digitalize real-world geomorphological elements and obtain georeferenced shapefiles. It is currently composed by two devices for data acquisition: an Android App for data collection and a Python-based software for coordinate computation. The technologies have been chosen to be enough accurate but cheaper than already available topographic tools. Each device uses an “Arduino Nano” board and low expensive sensors like MPU6000 (3 axis accelerometer + 3 axis gyroscope) or BNO055 (3 axis accelerometer + 3 axis gyroscope + 3 axis magnetometer).

GOGIRA has been tested in Aosta and Tanaro Valley, in North-Western Alps of Piedmont Region (Italy). The first case study was chosen in the context of the active monitoring of a complex landslide system close to an important highway that connects Italy, France and Swiss. It was possible to remotely (distance from 0.5 to 2.7 km from targets) map an area of limited access due to steep slopes, high scarps and rockfall hazard. Small single elements were mapped, as rockfall scarps not detectable from topographic support. The time for the survey has revealed to be short (a couple of hours included the search of a good observation point). The second case study was picked during the preliminary fieldwork for the realization of rolling tanks to mitigate the hydrologic hazard in the anthropized Tanaro Plain. The area has been investigated both with traditional methods and GOGIRA system, if morphometry allowed. Scarps, karst springs and debris/rock flow tracks were mapped.

The results obtained from both the tests highlight complications in mapping polygonal elements regarding visibility and overlaying but show a particularly high reliability in collecting data on linear and punctual geomorphic elements.