Scientific contact: francesco.brardinoni@unibo.it

Titolo di Progetto / Project Title: "PARACELSO – Predictive Analysis, monitoRing and mAnagement of Climate change Effects Leveraging Satellite Observations"

CUP: F93C23000290001

Titolo dell'assegno di ricerca / Project Component Title:

Mappatura e caratterizzazione cinematica dei rock glaciers in Val d'Aosta (ITA)

Geomorphologic mapping and kinematic characterization of rock glaciers in the Aosta Valley (ENG)

Starting from a morphological rock glacier inventory compiled by ARPA Valle D'Aosta, WP4 of PARACELSO aims to: (1) characterize rock glacier distribution and kinematics in selected drainage basins of Valle d'Aosta through integration of interferograms derived from Sentinel-1, CosmoSkyMed and SAOCOM constellations; (2) analyze climatic, lithologic and topographic controls on rock glacier's spatial distribution and kinematics, as characterized at point 1 (e.g., Bertone et al., 2024). For selected case studies, InSAR-based findings will be validated against independent kinematic measurements derived by multitemporal UAV and GNSS surveys previously acquired by ARPA.

Kinematic characterization will follow the specifics outlined in Bertone et al. (2022). The project is innovative in that it integrates three satellite platforms: (1) Sentinel-1, particularly suited for characterizing destabilized rock glaciers, which may display up to metric rates of annual downslope deformation; (2) Cosmo-SkyMed, which allows detecting mm- to cm-scale deformations, and as such useful for characterizing transitional rock glaciers undergoing slow subsidence associated with permafrost degradation; and (3) the more recent SAOCOM constellation, whose L-band of acquisition promises high versatility and spatial resolution.

The project will last for a minimum of 18 months, and therefore the present 12-month contract will be extended upon evaluation, for a minimum of additional 6 months. During this period, the postdoctoral fellow will actively take part to the coordination of the upcoming **IPA Standing Committee** on rock glacier inventories and kinematics (RGIK).

To pursue the foregoing objectives the postdoctoral fellow will interact with:

(i) ARPA Valle d'Aosta (Umberto Morra di Cella, Paolo Pogliotti and Federico Grosso);

(ii) Italian Space Agency, for access to CosmoSkyMed and SAOCOM data;

(iii) Dr. Tazio Strozzi of GAMMA Remote Sensing AG in Gümligen (CH), for analysis of SAR interferometry;

(iv) Dr. Thomas Echelard, expert in the InSAR-based characterization of rock glaciers;

(v) Dr. Sebastian Vivero, expert in the multi-sensor/multi-source kinematic characterization of rock glaciers.

Bertone, A, Barboux, C, Bodin, X, Bolch, T, Brardinoni, F, Caduff, R, Christiansen, H H, Darrow, M, Delaloye, R, Etzelmüller, B, Humlum, O, Lambiel, C, Lilleøren, K S, Mair, V, Pellegrinon, G, Rouyet, L, Ruiz, L, and Strozzi, T. 2022. Incorporating InSAR kinematics into rock glacier inventories: insights from eleven regions worldwide. The Cryosphere, 16, 2769-2792. https://doi.org/10.5194/tc-16-2769-2022.

Bertone A, Jones N, Mair V, Scotti R, Strozzi T, Brardinoni F**.** 2024. A climate-driven, altitudinal transition in rock glacier dynamics detected through integration of geomorphologic mapping and InSAR-based kinematic information. *The Cryosphere,* 18, 2335–2356. https://doi.org/10.5194/tc-18-2335-2024.

PRACTICAL SUMMARY (ENG)

Scientific contact: francesco.brardinoni@unibo.it

Duration: 12 months

Start date: 01 February 2025 (or no later than 01 April 2025)

Study sites: Selected drainage basin of Valle d'Aosta, Western Italian Alps

Desired skills (one or more among the following)

Independence and interest in the topic

GIS-based mapping (→ for mapping rock glacier outlines on optical imagery and moving areas (MA) on interferograms)

Radar Interferometry (→ ability to read interferograms and derive velocity)

Quantitative skills to analyze LiDAR digital topography, gridded climatic data, and the vector databases (the RG inventory and the MA inventory)

Opportunity:

we are not starting from scratch, manual mapping on optical imagery and on interferograms has started since early 2024, and currently covers about 20% of the entire Val d'Aosta extent.

As the RG kinematic and morphologic inventory is being built, there will be opportunity to analyse and compare the database against an existing analogue in western South Tyrol (Bertone et al., 2024; Scotti et al., 2024).

Requirement: Master of Science degree, although a PhD will be given preference.

Flexibility: Possibility to work remotely, especially if the candidate is already familiar with interferograms and fringe pattern interpretation.

No teaching duties are foreseen.

Net salary is about €1750 per month.

Scotti R, Mair V, Costantini D, Brardinoni F. 2024. A high-resolution rock glacier inventory of South Tyrol: Evaluating lithologic, topographic, and climatic effects. In: Beddoe, R.A. and Karunaratne, K.C. (Eds.). 12th International Conference on Permafrost. 16-20 June 2024, Whitehorse, Canada: International Permafrost Association, pp. 382-389. https://doi.org/10.52381/ICOP2024.176.1