Critical Zone and Ecosystem Observatories at high latitudes or high altitudes: unravelling geosphere-biosphere interactions

the CZ Collective*

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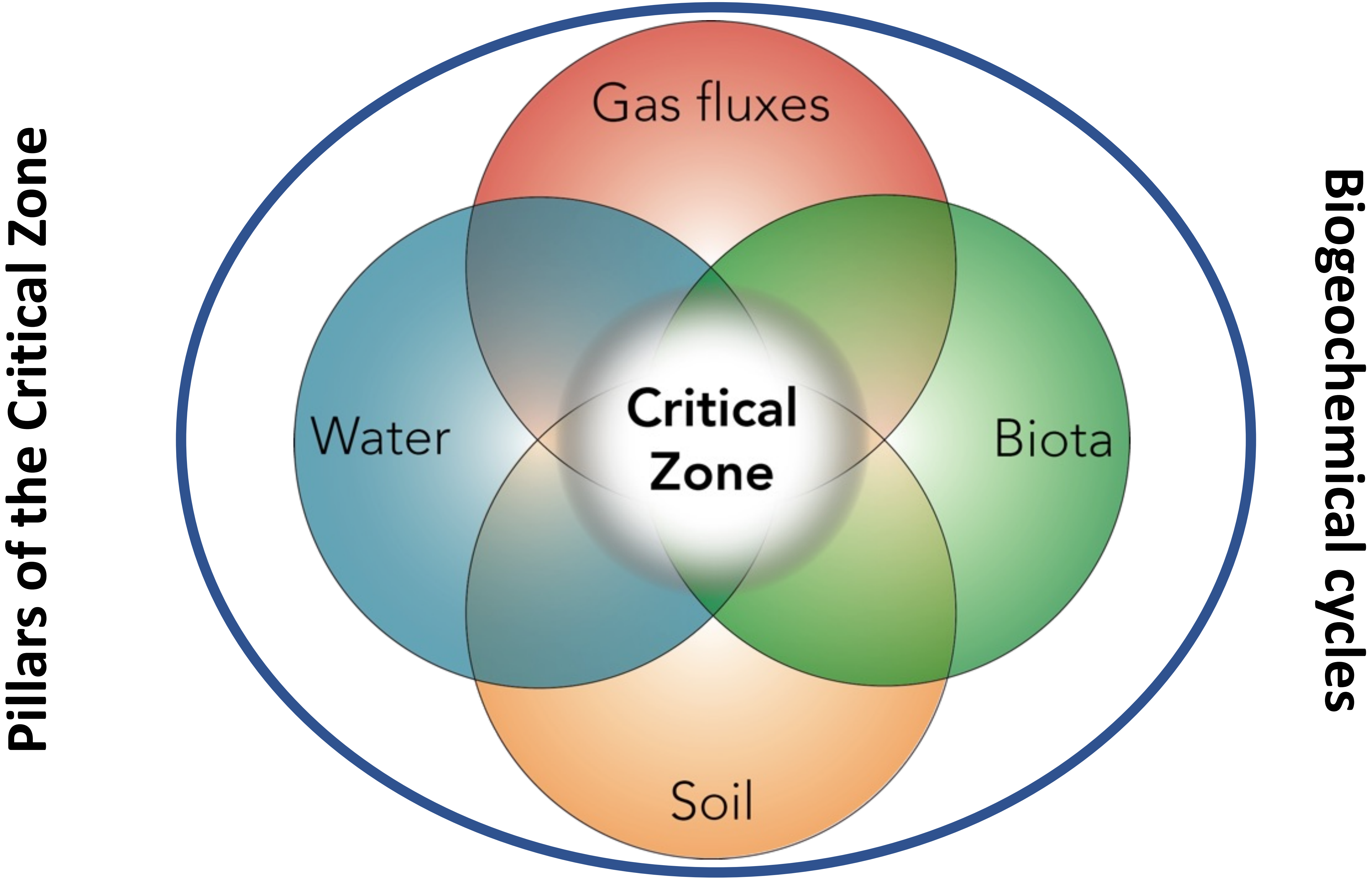
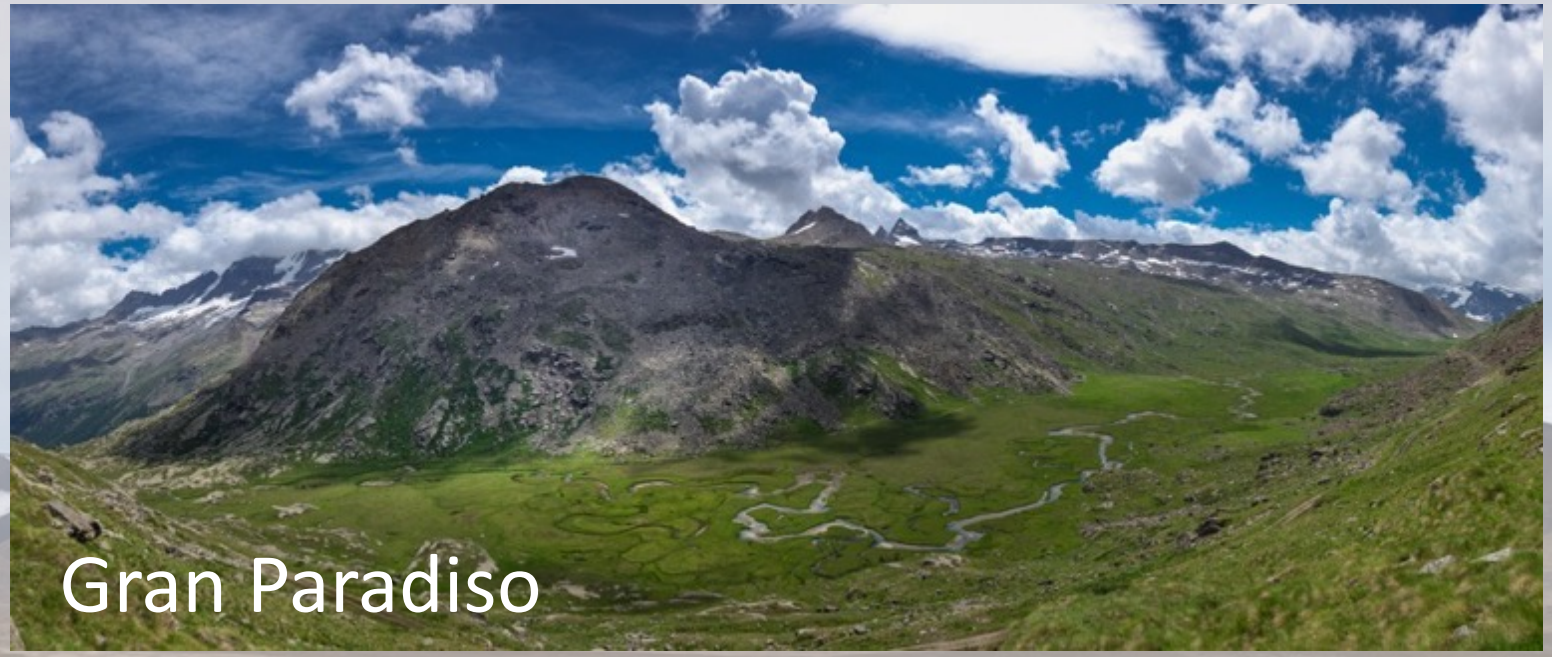
Italiadomani

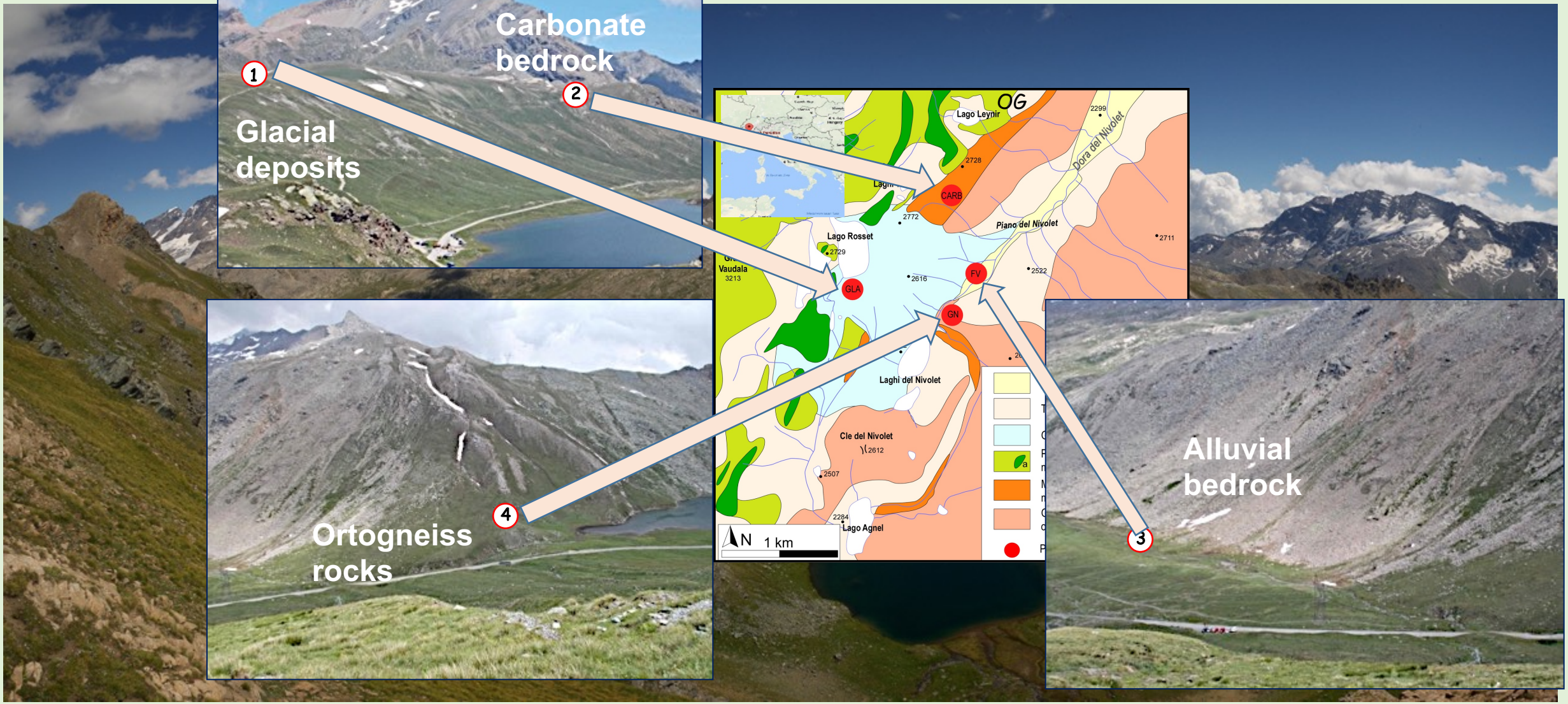

Pillars of the Critical Zone
Gas fluxes
Water
Critical Zone
Biota
Soil
Biogeochemical cycles

1. Active CZ observatories of interest here

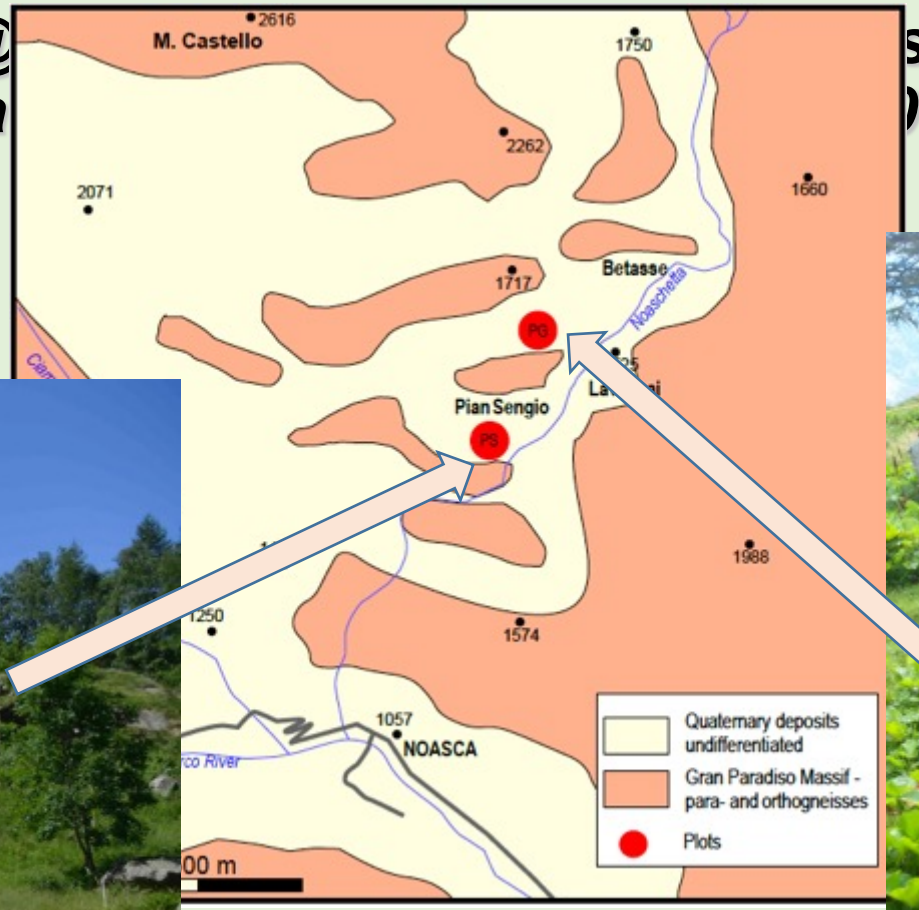


CZO@PNGP: Studies on alpine ecosystems in the Gran Paradiso National Park (since 2017): Nivolet

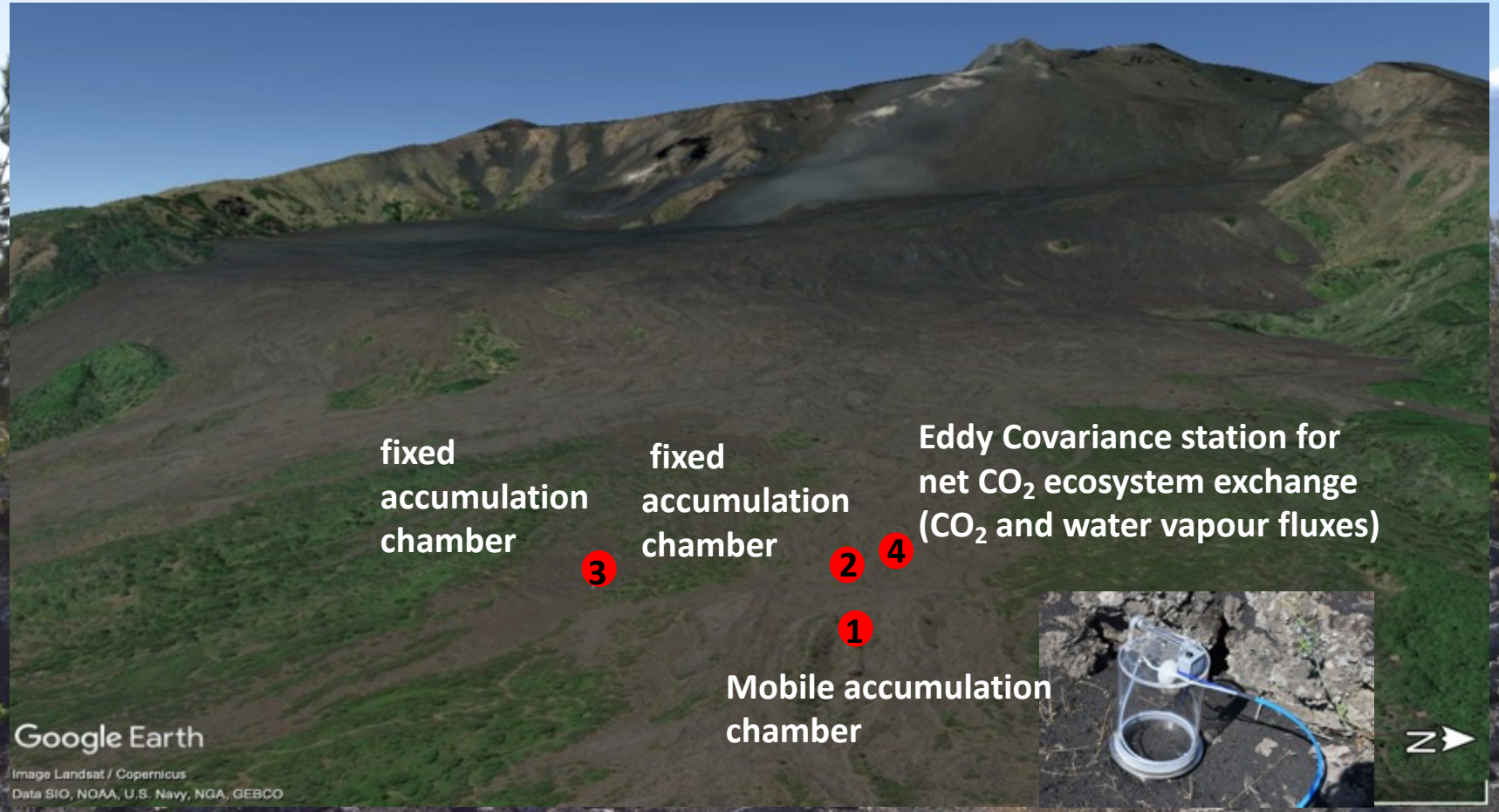
PG



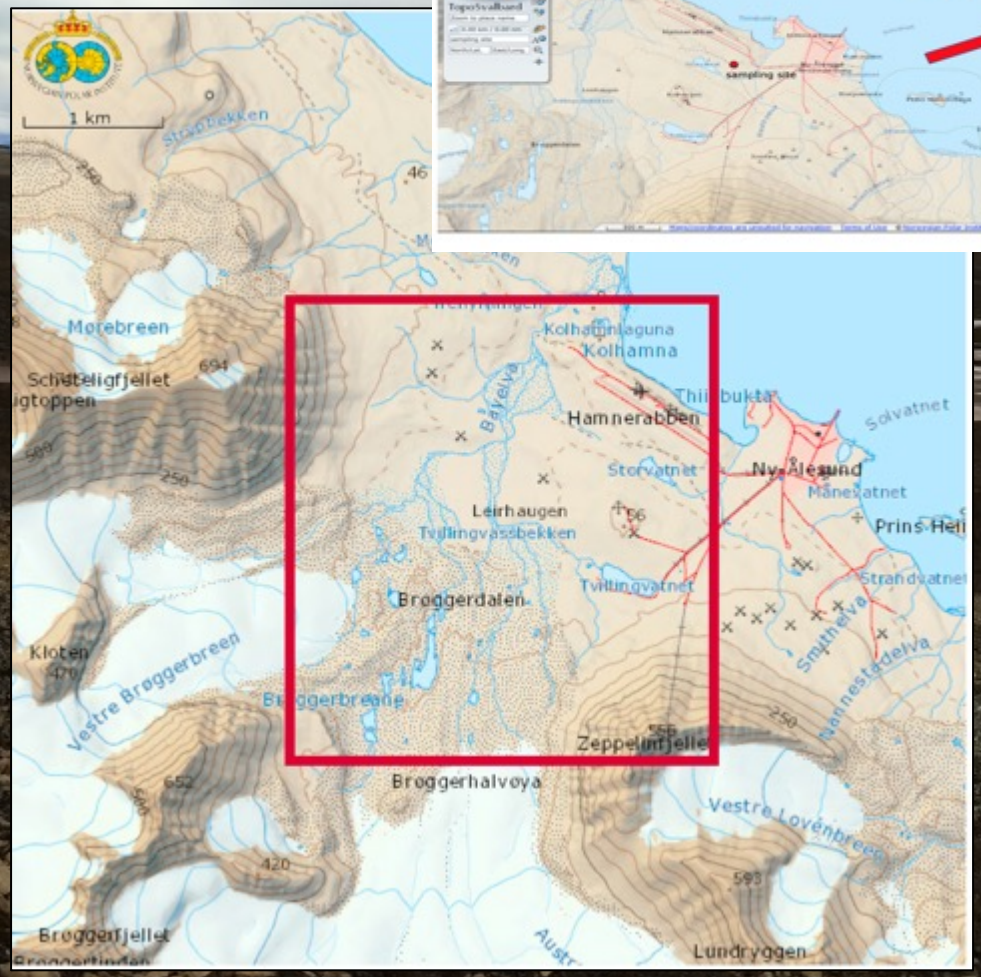
CZO@ systems in the Gran Pa 017): Noaschetta



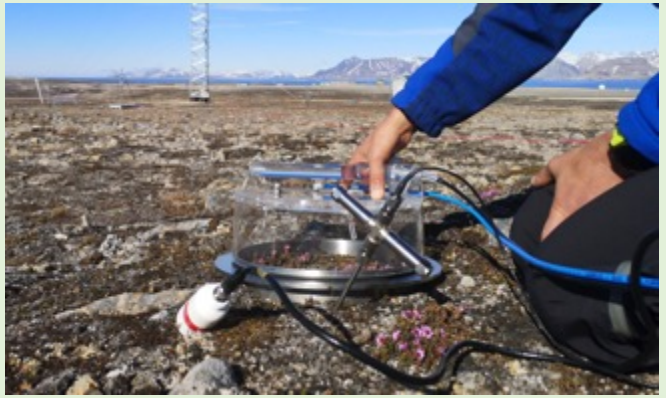
CZO@Mt.ETNA: assessing the balance between CO_2 of volcanic and biogenic origin at Mt. Etna (since 2021)



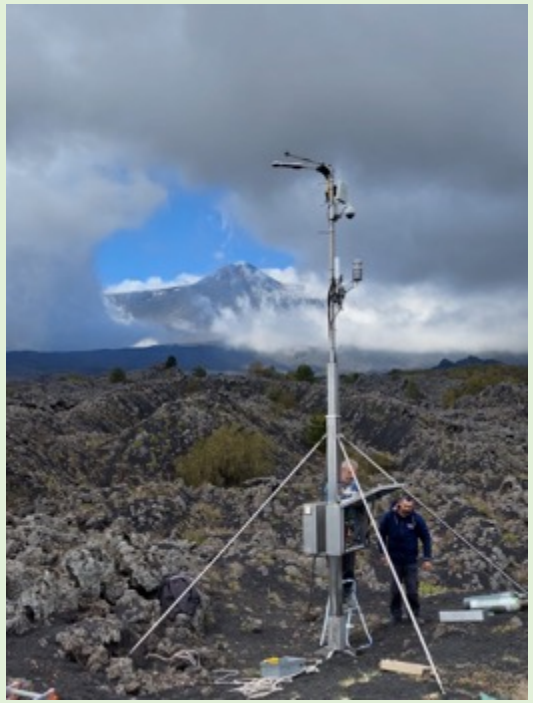
CZO@Bayelva: Observing Critical Zone processes in the Bayelva basin
ce 2019)



1. CO_2 fluxes by a portable flux chamber



2. CO_2 fluxes by Eddy Covariance



3. CO_2 fluxes by automated flux chamber

Remote sensing by drones (RGB, thermal, multispectral, hyperspectral, LIDAR)

Mobile laboratory

Multiple drivers: empirical multivariate models

$$ER = (a_0 + a_1 GFC + a_2 VWC)\exp(b_0\, Ta) + \varepsilon\,,$$

$$GPP = \frac{F\,\alpha_0\, rs}{F + \alpha_0 rs}\,(A_0 + A_1 GFC + A_2 VWC) + \varepsilon\,,$$

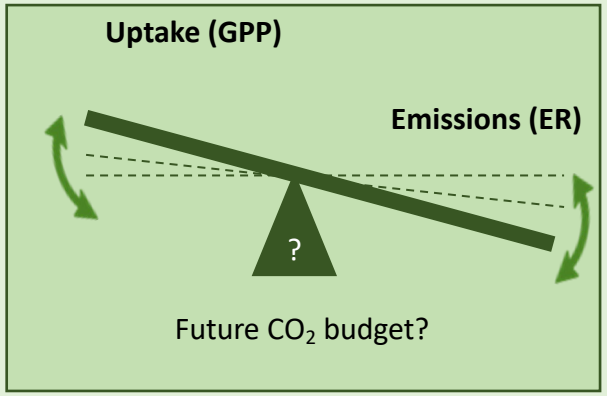
Water-carbon process-based models

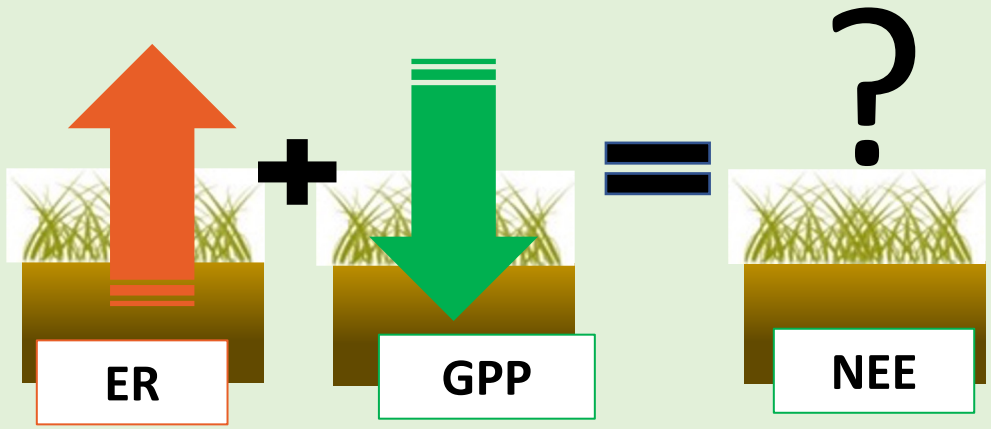
$$\frac{ds}{dt} = I(s,r) - [\,f_v\, X_v(s) + (1 - f_v)\, X_b(s)] - K$$

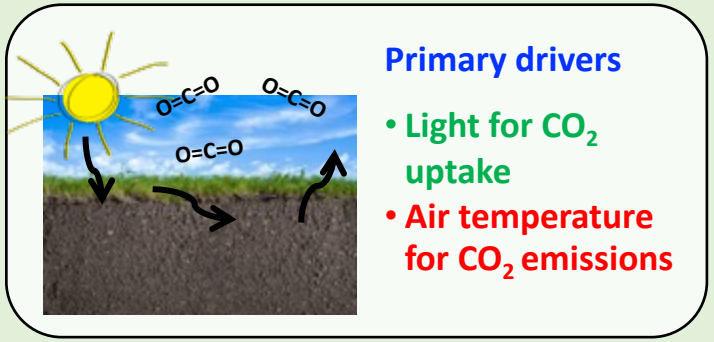
$$\frac{dC_v}{dt} = P - R_V - L$$

$$\frac{dC_s}{dt} = R_s - L$$

Magnani et al., (2020). Drivers of carbon fluxes in Alpine tundra: a comparison of three empirical model approaches







Primary drivers

- Light for CO_2 uptake
- Air temperature for CO_2 emissions

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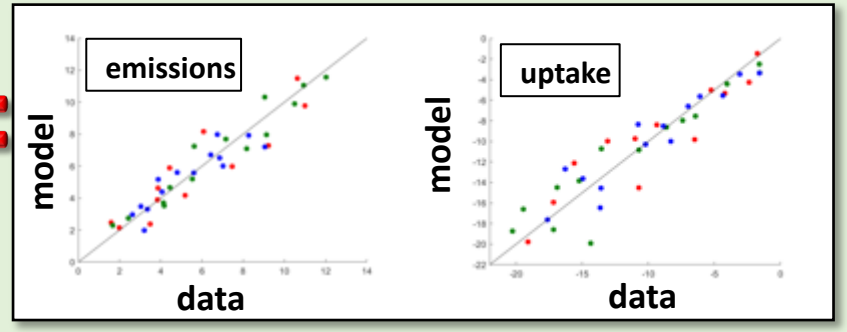
Additional drivers

CO_2 emissions
- Soil humidity
- Air pressure
- Day Of the Year

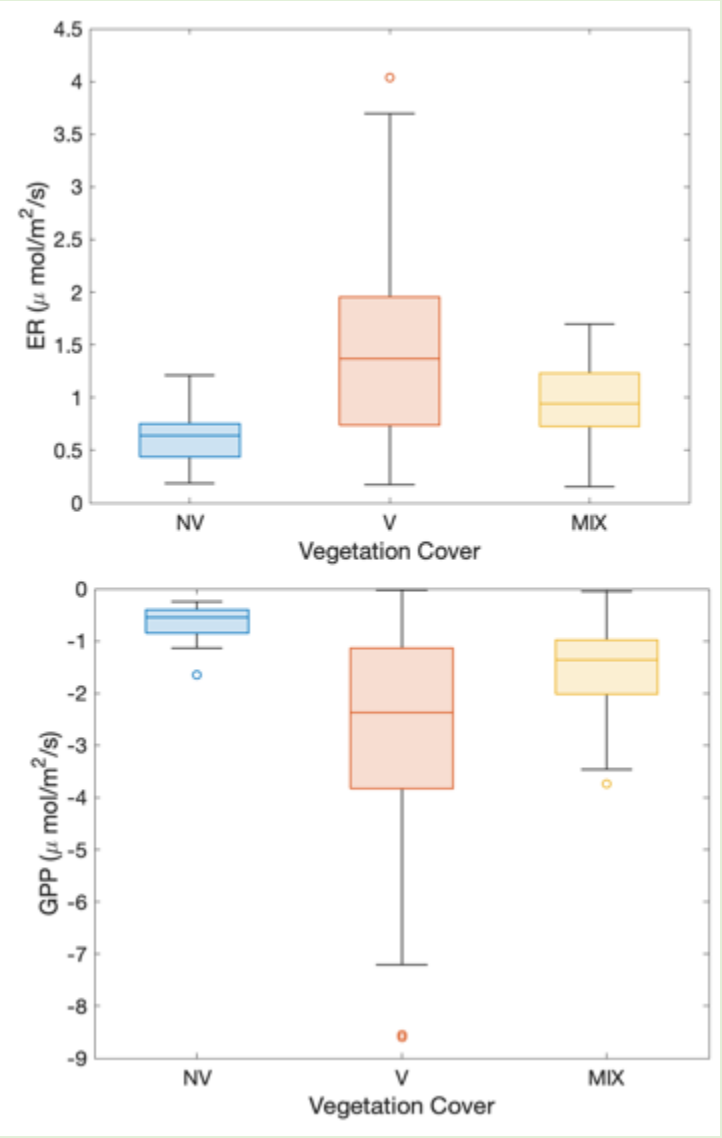
CO_2 uptake
- Soil humidity
- Day Of the Year

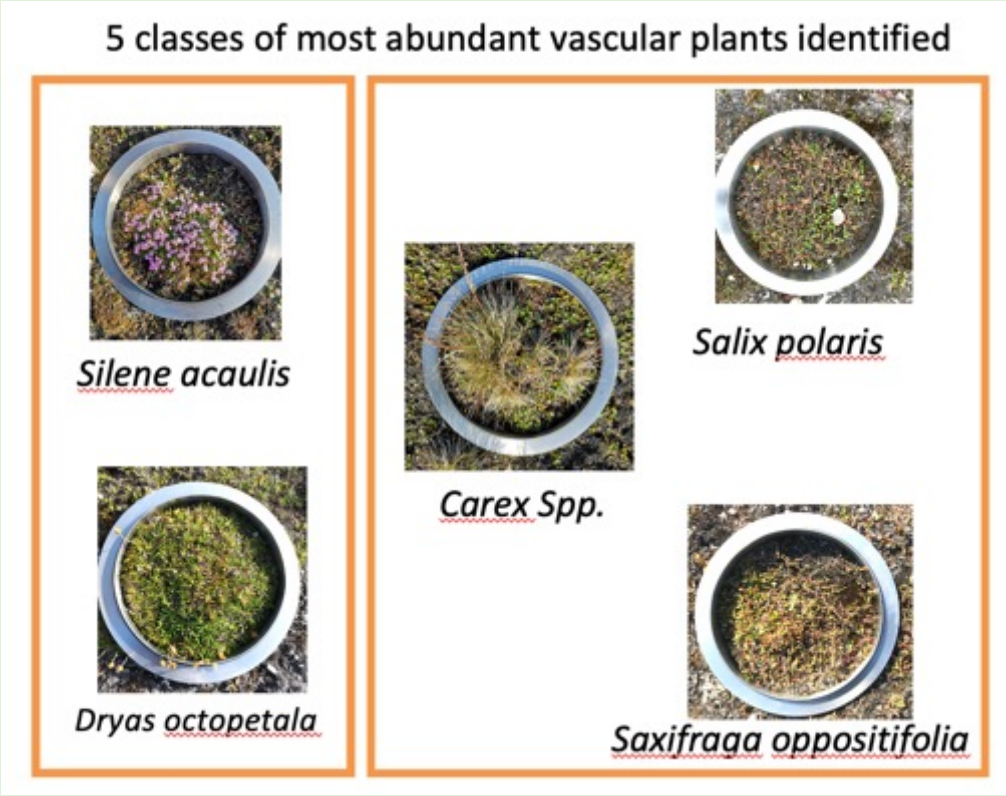
=



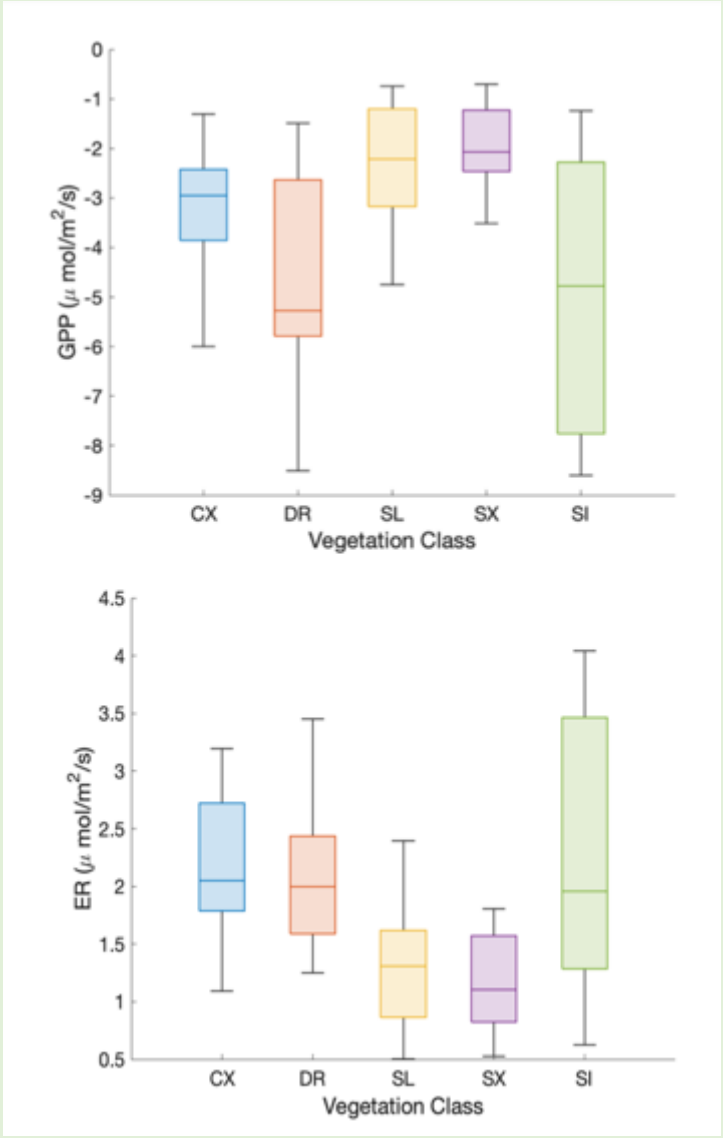
Lloyd & Tylor (1994) *Ruimy et al. (1995)*

Magnani et al., (2022). Microscale drivers of summer CO_2 fluxes in the Svalbard High Arctic tundra

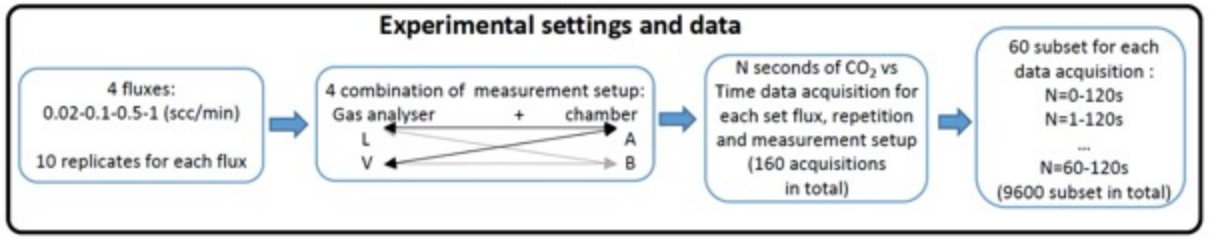


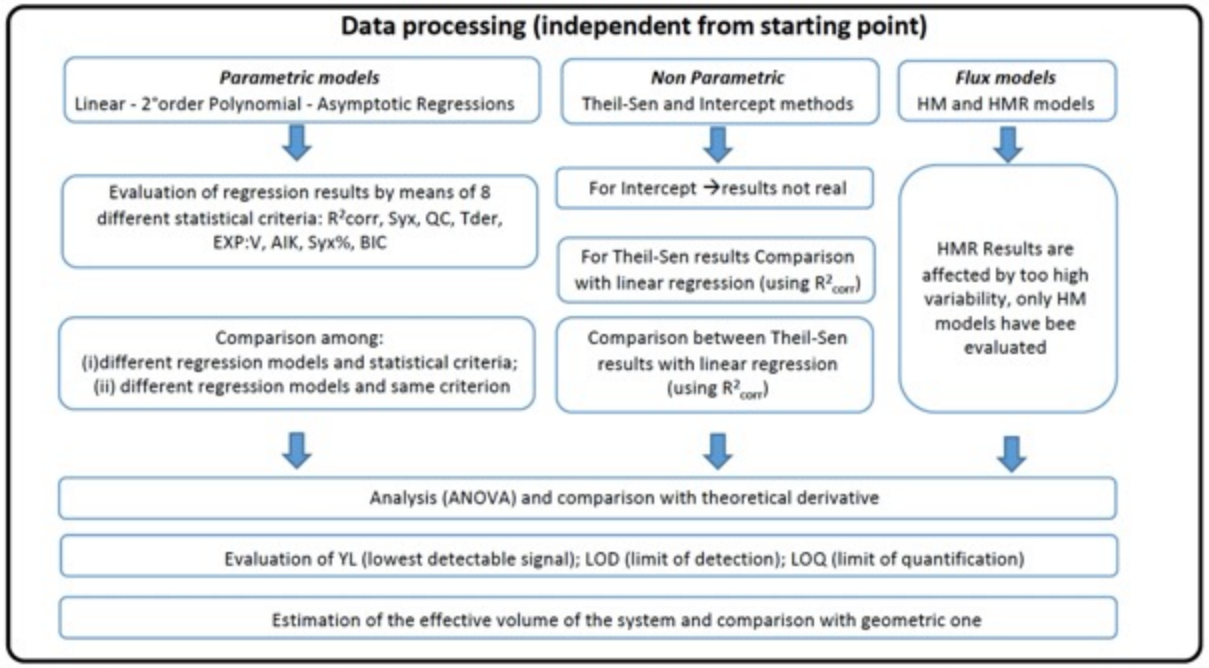


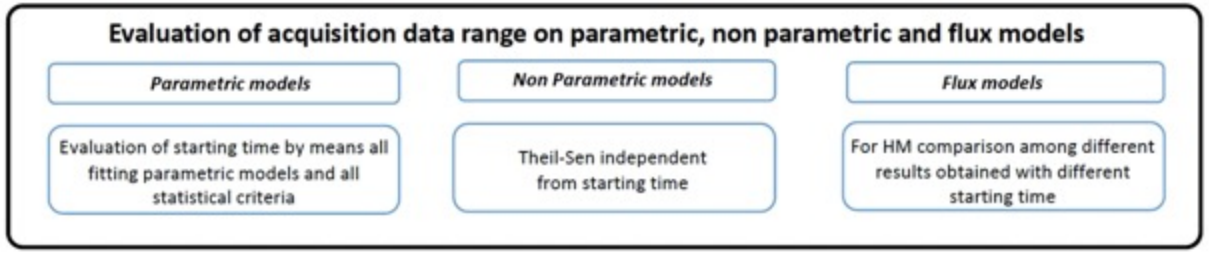
CX=Carex spp., DR=Dryas octopetala, SL=Salix polaris, SX=Saxifraga oppostifolia and SI=Silene acaulis

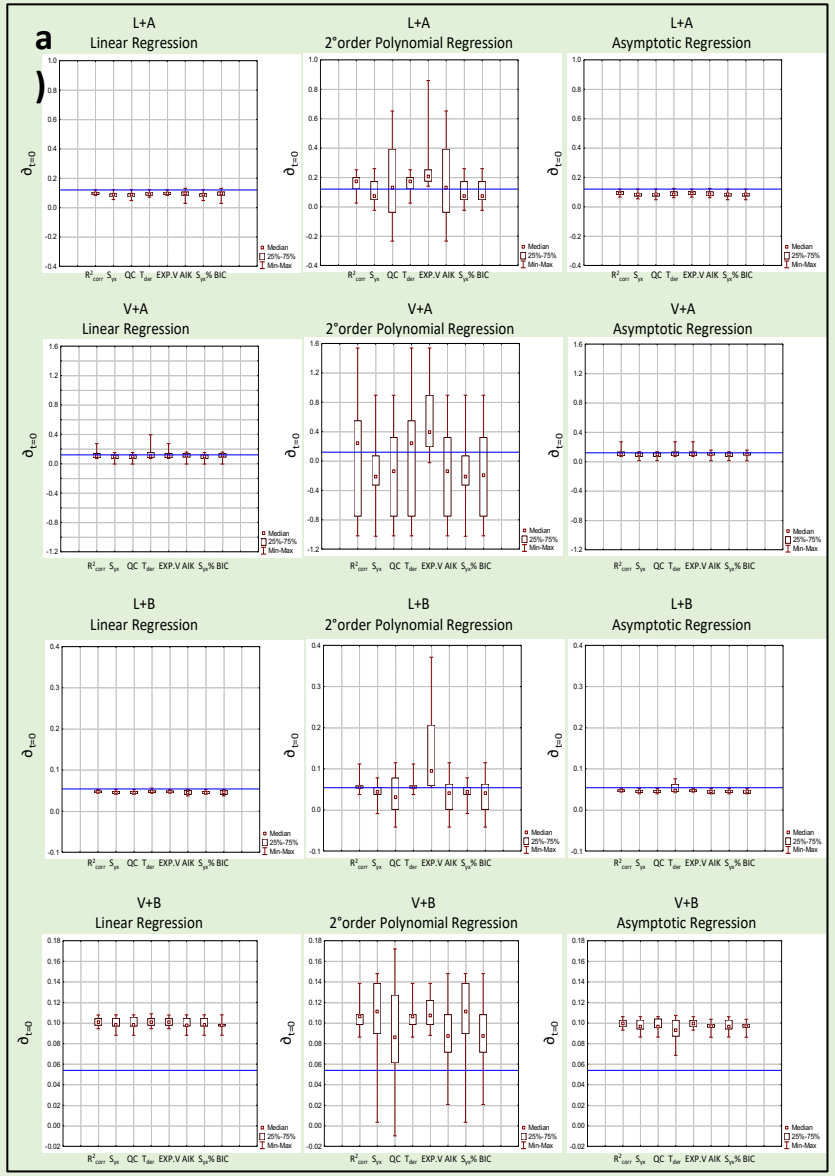


Baneschi et al., (2022). Non steady-state closed dynamic chamber to measure soil CO_2 respiration: a protocol to reduce uncertainty.

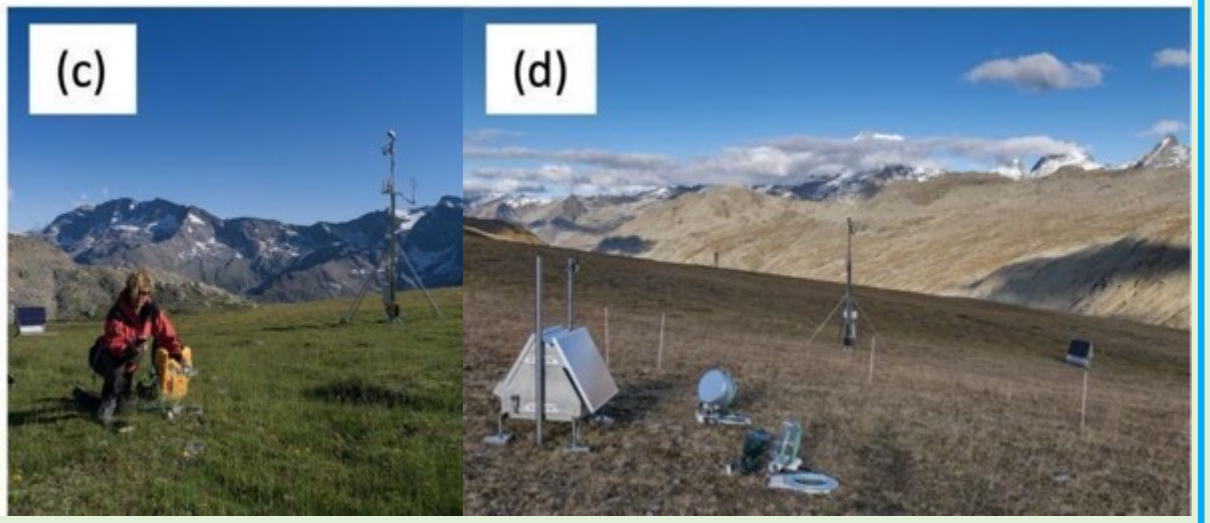


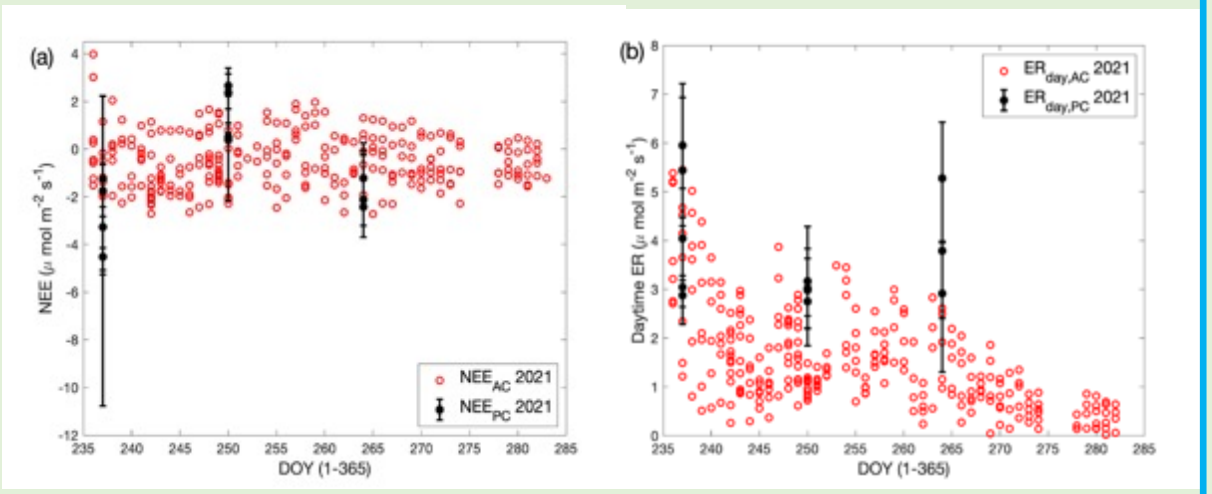


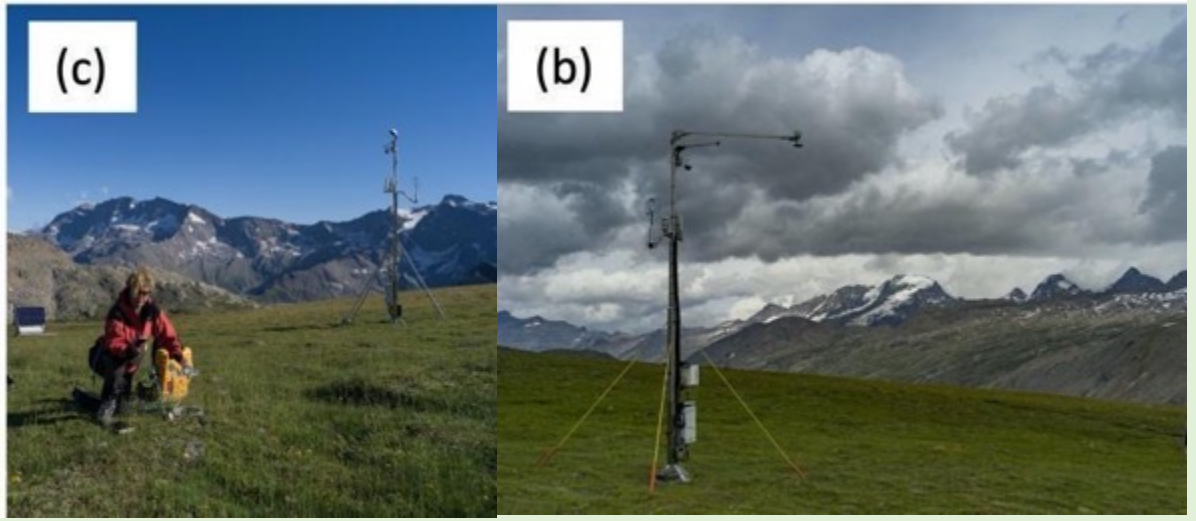


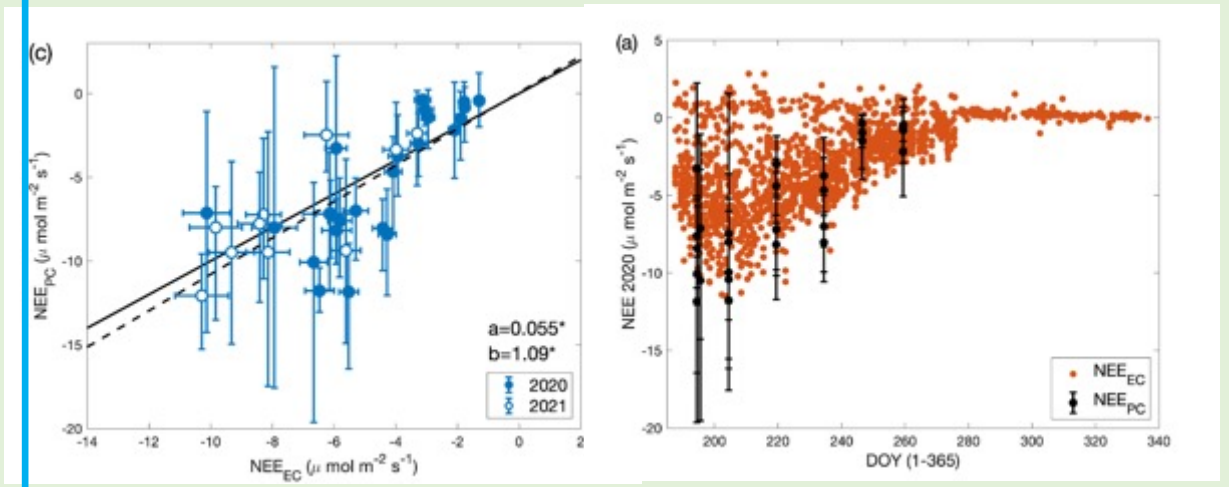


Vivaldo et al., (2022).Carbon dioxide fluxes: gaps between three different instrument and modelling method in the Alpine tundra (Gran Paradiso National Park, Italy) ***(revision submitted)***

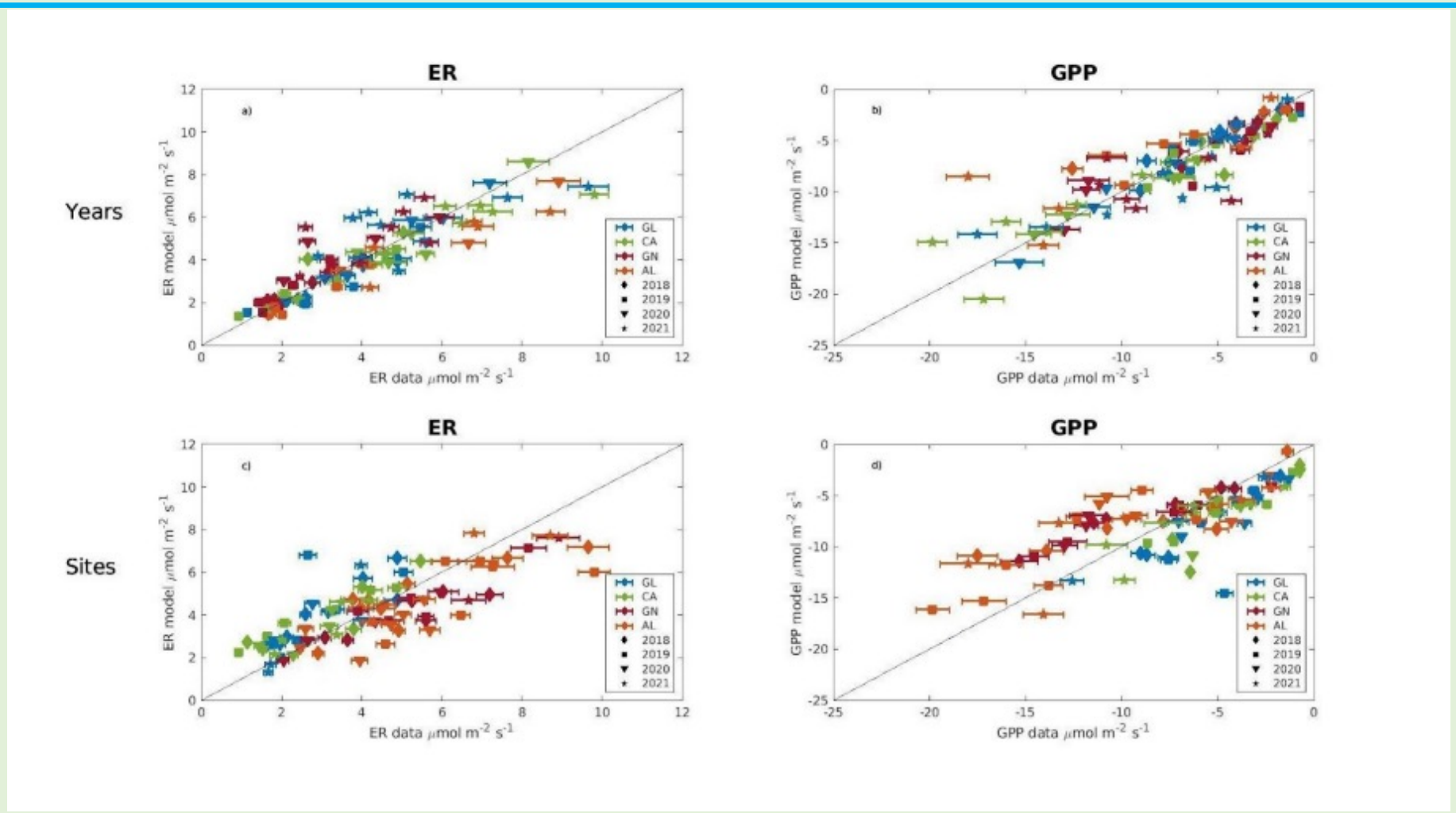








Lenzi et al., (2022).Spatial and temporal variability of carbon dioxide fluxes in the Alpine Critical Zone: the case of the Nivolet plain , Gran Paradiso National Park, Italy. ***(submitted)***



Colors indicate the areas, symbols the years


Thank you for your attention