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Italian network of four permanent observatories: implementation of background data selection (BaDSfit) and 5-year analysis of the atmospheric CO2 mixing ratio.

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The Mediterranean basin is considered a global hot-spot region for climate change and air-quality. CO_2 is the single most-important anthropogenic greenhouse gas (GHG) in the atmosphere, accounting approximatively for 63% of the anthropogenic radiative forcing by long-lived GHG. According to Le Quérée et al. (2018), the increasing of the atmospheric CO_2 mixing ratios in the global atmosphere is driven by fossil fuel and cement production.
In order to reduce GHG emissions and taking into account the needs for economy and society development, schemes of regulation and emission trading have been adopted at international, national, and city levels. The implementation of these regulation, to achieve the goal successfully, needs scientific evidence and information provided on consistent datasets. In the last year, efforts are dedicated to set up harmonized reference networks at difference scales (WMO/GAW, AGAGE, ICOS).
In this work, we analysed a set of continuous long-term measurements of CO_2 carried out at 4 atmospheric observatories in Italy belonging to the WMO/GAW network and spanning from the Alpine region to central Mediterranean Sea: Plateau Rosa (western Italian Alps, 3480 m a.s.l.), Mt. Cimone (northern Apennines, 2165 m a.s.l.), Capo Granitola (southern Sicily coastline) and Lampedusa Island. Mt. Cimone is also a “class-2” ICOS station, while Plateau Rosa and Lampedusa are in the labelling process. Starting time of GHG observations range from 1979 for Mt. Cimone to 2015 for Capo Granitola. Due to their different locations and ecosystems, they provide useful hints to investigate CO_2 variability on different latitudinal and altitudinal ranges in the Mediterranean basin and to study of natural and anthropogenic-related processes able to affect the observed variability.
The study addresses primarily differences in daily and seasonal cycles at the different sites, and implemented a procedure to identify background conditions called BaDSfit (Background Data Selection for Italian stations; Trisolino et al., submitted). This methodology was originally used at

Plateau Rosa station (Apadula, 2019) and it is based on the Mauna Loa data selection method (Tans and Thoning, 2008). BaDSfit consist of three steps and an optimization of the procedure was carried out with a sensitivity study. Marked differences among the daily cycles at the various sites exist. The effect of the data selection on the seasonal and diurnal cycle and long-term evolution is investigated. The BaDSfit lead to a more coherent diurnal and seasonal evolution of the different datasets, is able to identify background condition and allows the separation of local/regional scale from large scale phenomena in the CO_2 time series.