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Early stress detection in grapevine – can remotely-sensed sun-induced chlorophyll fluorescence do the job?

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Ongoing changes in climate (both in the means and the extremes) are increasingly challenging grapevine production in the province of South Tyrol (Italy). Here we ask the question whether sun-induced chlorophyll fluorescence (SIF) observed remotely from space can detect early warning signs of stress in grapevine and thus help guide mitigation measures.

Chlorophyll fluorescence refers to light absorbed by chlorophyll molecules that is re-emitted in the red to far-red wavelength region. Previous research at leaf and canopy scale indicated that SIF correlates with the plant photosynthetic uptake of carbon dioxide as it competes for the same energy pool.

To address this question, we use time series of two down-scaled SIF products (GOME-2 and OCO-2, 2007/14-2018) as well as the original OCO-2 data (2014-2019). As a benchmark, we use several vegetation indices related to canopy greenness, as well as a novel near-infrared radiation-based vegetation index (2000-2019). Meteorological data fields are used to explore possible weather-related causes for observed deviations in remote sensing data. Regional DOC grapevine census data (2000-2019) are used as a reference for the analyses.