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## SemantiX: a cross-sensor semantic EO data cube to open and leverage AVHRR time-series and essential climate variables with scientists and the public

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Long time series of essential climate variables (ECVs) derived from satellite data are key to climate research. SemantiX is a research project to establish, complement and expand Advanced Very High Resolution Radiometer (AVHRR) time series using Copernicus Sentinel-3 A/B imagery, making them and derived ECVs accessible using a semantic Earth observation (EO) data cube. The Remote Sensing Research Group at the University of Bern has one of the longest European times series of AVHRR imagery (1981-now). Data cube technologies are a game changer for how EO imagery are stored, accessed, and processed. They also establish reproducible analytical environments for queries and information production and are able to better represent multi-dimensional systems. A semantic EO data cube is a newly coined concept by researchers at the University of Salzburg referring to a spatio-temporal data cube containing EO data, where for each observation at least one nominal (i.e., categorical) interpretation is available and can be queried in the same instance (Augustin et al. 2019). Offering analysis ready data (i.e., calibrated and orthorectified AVHRR Level 1c data) in a data cube along with semantic enrichment reduces barriers to conducting spatial analysis through time based on user-defined AOIs.

This contribution presents a semantic EO data cube containing selected ECV time series (i.e., snow cover extent, lake surface water temperature, vegetation dynamics) derived from AVHRR imagery (1981-2019), a temporal and spatial subset of AVHRR Level 1c imagery (updated after Hüsler et al. 2011) from 2016 until 2019, and, for the later, semantic enrichment derived using the Satellite Image Automatic Mapper (SIAM). SIAM applies a fully automated, spectral rule-based routine based on a physical-model to assign spectral profiles to colour names with known semantic associations; no user parameters are required, and the result is application-independent (Baraldi et al. 2010). Existing probabilistic cloud masks (Musial et al. 2014) generated by the Remote Sensing Research Group at the University of Bern are also included as additional data-derived information to support spatio-temporal semantic queries. This implementation is a foundational step towards the overall objective of combining climate-relevant AVHRR time series with Sentinel-3

imagery for the Austrian-Swiss alpine region, a European region that is currently experiencing serious changes due to climate change that will continue to create challenges well into the future.

Going forward, this semantic EO data cube will be linked to a mobile citizen science smartphone application. For the first time, scientists in disciplines unrelated to remote sensing, students, as well as interested members of the public will have direct and location-based access to these long EO data time series and derived information. SemantiX runs from August 2020-2022 funded by the Austrian Research Promotion Agency (FFG) under the Austrian Space Applications Programme (ASAP 16) (project #878939) in collaboration with the Swiss Space Office (SSO).