



ICOS SWEDEN - user statistics 2020

ICOS |  National
Network
Sweden



Key numbers for the annual reporting of the infrastructure activities

“Special conditions for contributions to the national infrastructure - ICOS Sweden”, The Swedish Research Council’s (SRC’s) Director General, March 21, 2016.

The Integrated Carbon Observation System Sweden, ICOS Sweden¹ is a part of the pan-European distributed research infrastructure ICOS² that promotes fundamental understanding of carbon cycle, greenhouse gas (GHG) budgets and perturbations and their underlying processes by providing consistent and persistent measurement data from *in situ* networks. The overall aim of ICOS Sweden is to produce harmonized, high quality data on GHG exchanges, atmospheric concentrations and their defining state variables within typical Swedish ecosystems (both terrestrial and marine) and regions. These activities are critical to enable quantification of the Swedish GHG balance and the feedbacks of these ecosystems to a changing climate. Swedish ICOS stations contribute data that are critical for a continental scale understanding of the GHG balance of Europe. This document contains a description of how infrastructure and its activities are organized in order to achieve these aims.

ICOS Sweden and its data products is an infrastructure which is open to everyone. As research infrastructure, it is meant to be used by scientists to address different research questions. By organizing open door events or preparing easy to understand teaching material, it can even reach out to the general public to arouse interest and enlarge knowledge on ecosystem related climate issues. Elaborated products will be available for all the interested social stakeholders such as citizens, decision makers and media.

ICOS Sweden stations usually are used as destination of excursions and field courses at different levels. During 2020, the access to the stations was restricted to avoid spreading of the covid-19 virus. However, field work was supported wherever possible.

Scientific users of the infrastructure are researchers using the data produced by the measurement stations to address their research question. More than 35000 datasets of near real time (level 1) or final quality-controlled data sets (level 2) have been downloaded via the Carbon Portal or other trackable data portals (e.g. SITES data portal).

Scientific users of the ICOS Sweden infrastructure are also researchers coming to the stations for field experiments to answer their specific research question. During 2020, around 51 projects were active at the ICOS Sweden stations, many of them using several stations for their studies.

The users of ICOS infrastructure divide into two partially overlapping classes, data users and users of the physical station infrastructure. Again the data and the sites will be available to all.

The academic users of ICOS data can be divided into three main groups. 1) Modelers working with both bottom-up and top-down type models from different disciplines, e.g., soil science, ecophysiology, biogeochemistry, hydrology, meteorology, climate science, atmospheric science. 2) Remote sensing (RS) community that is interested in ground truth data for validation of different RS

¹ www.icos-sweden.se

² www.icos-ri.eu

products. 3) Researchers synthesizing empirical data from different types of ecosystems and climatic regions to understand the processes regulating exchange of matter and energy between ecosystems and the climate system.

Users taking advantage of the physical access to the measurement stations benefit from station infrastructure, including laboratory space, technical support, power supply, internet and other services, and high-quality auxiliary data provided by ICOS Sweden. These users perform on site research consisting of measurement programs that are in addition to the ongoing ICOS measurement program. They, in turn, benefit directly from the context of the long term ICOS measurements.

Today, the ICOS Sweden community consists of more than 2200 scientists from all over the globe (since 2016), who participate in ICOS Sweden related work and operations. They design, build, and operate ICOS stations and use and process ICOS data while integrating it into their own scientific research topics. The ICOS RI can thus be regarded as being co-designed by its users. They publish scientific papers in high-impact journals, make presentations at international workshops and conferences, and develop novel measurement methods that may become operational within ICOS in future. During 2020, due to the covid-19 restrictions, mainly users from the consortium member institutions visited the sites. However, data from the station was widely used and downloads from the repositories (mainly ICOS Carbon Portal) increased compared to previous years.

ICOS Sweden data and stations are also used in education at all levels from high school to research training. This and public information days follow the aim to increase the public awareness, interest, and knowledge of climate change issues. Large numbers of the general public (non-scientific users) have been and will be reached. Table 1 comprises the summary of the key numbers since the start of the 2nd ICOS Sweden funding period 2016. The results are analyzed in more detail below. Note that numbers for the downloads from the Carbon Portal for earlier years have changed due to a change in metadata storage at the Carbon Portal. Since the statistics of data repository downloads include even level 0 data (raw data), a large number is due to the daily processing at the ICOS Thematic Centers. Data downloads including only level 1 to 3 (near real time to elaborated products) amounted to 35t10 datasets.

Table 1. Summary of the key numbers for the annual reporting of the infrastructure activities. Data downloads include all levels of data products (Level 0: raw data to level 3: elaborated products); deviations from earlier years appear due to changes in the metadata structure at the Carbon Portal.

year	general key numbers	Site visitors and project Pis					Data repository downloads	
		international		national		unknown	international	national
	number of peer-reviewed publications	male	female	male	female			
2016	44	140	129	337	270	0	--	--
2017	64	48	12	100	197	56	202	647
2018	60	15	13	72	69	2	11408	1181
2019	26	75	36	166	97	0	73725	1781
2020	87	35	15	143	84	0	92 340	1805

Physical Users of the infrastructure

The motivation for users that come in person to the ICOS Sweden RI facilities is broad. It starts from the general public that is attracted by e.g. open-door days or programs for school children. ICOS

Sweden facilities are also used for education at university level during excursions and field courses. Last but not least, national and international scientists use ICOS Sweden stations for their own research project related field work. Table 2 includes the updated numbers for each group of physical users.

Table 2. User numbers for project PIs, Scientific visitors (site visitors through field courses and excursions) and General public visitors (general public and school children).

year	Project PIs		Scientific visitors		General public visitors
	male	female	male	female	not divided by gender
2016	50	19	355	277	245
2017	40	14	166	227	21
2018	42	12	72	67	32
2019	63	25	163	94	14
2020	49	35	129	64	10

The number of research projects at the stations was comparable to the previous years. Note, that the number of research projects purely using data are not part of this statistic due to the FAIR data policy. The distribution of origin for project PIs during 2020 as far as known is shown in Fig. 1a (national users) and 1b (international users).

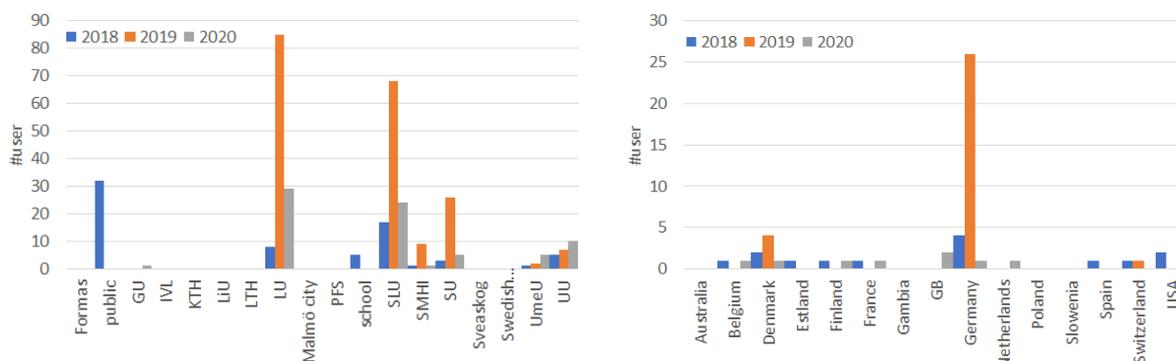


Fig. 1: Origin of (a) national and (b) international project PIs at the ICOS Sweden facilities from 2018 to 2020 as far as known.

For the statistics on the number of physical users on subject area, only the research projects related to ICOS Sweden stations have been analyzed. During 2020, the background of the majority of the physical users was within Geo- and Environmental sciences (SCB code 105), but related also to SCB code 103 (atmospheric sciences, aerosol measurements) and Agricultural Science and Forestry (SCB code 401).

Users of the data produced by the infrastructure

Data produced at ICOS Sweden facilities is of interest for scientists nationally and internationally. During 2020, the amount of data requests from the ICOS Carbon portal, where all data are available under a Creative Commons Attribution 4.0 International License, as well as data requests from compiled data products like the NOAA Observation package (ObsPack) increased to more than 35000. No personal data is gathered from users downloading data via the Carbon Portal, however,

the country of origin is derived from the users IP number (Fig 3). No statistics on gender distribution was evaluated for 2020.

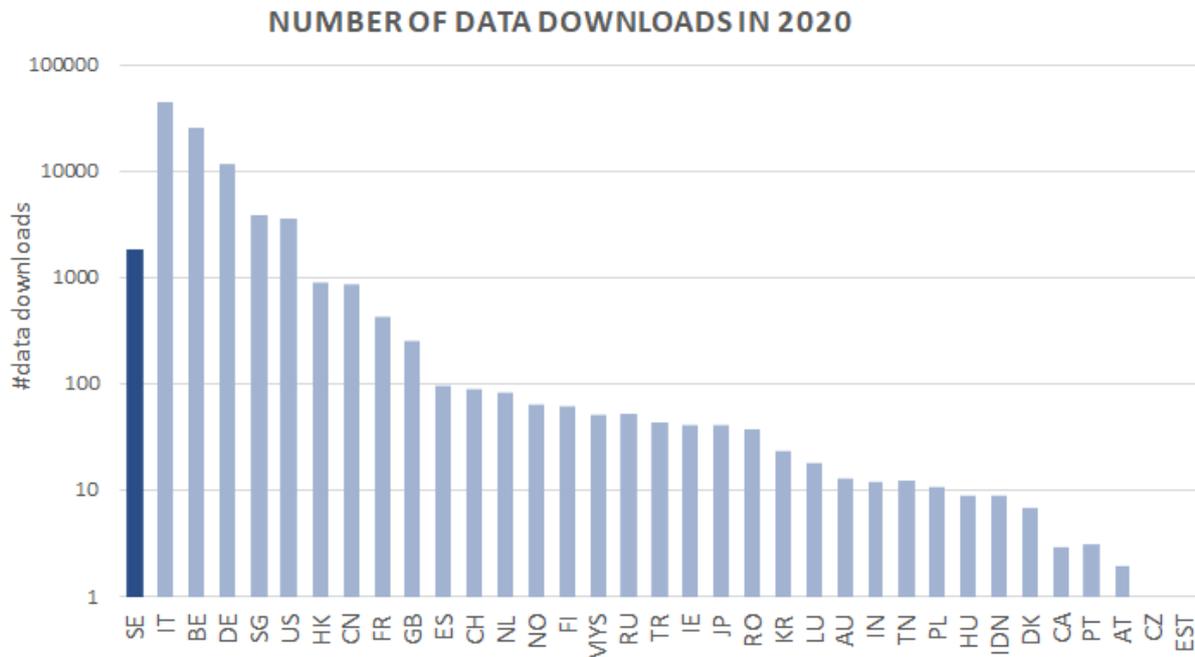


Fig. 3: Origin of international data users of the ICOS Sweden data products in 2020 (level 0 to 3); data downloads from the ICOS Carbon Portal.

The data flow from the stations through the ICOS Thematic Centres and to the Carbon portal been fully established for the Atmosphere Thematic Centre. The data flow from the stations to the Ecosystem Thematic Centre has been fully established for the labelled Ecosystem stations. For follow-up analyses of the 2018 Drought, as well as for analysing consequences from the first covid-19 shutdown and the warm winter season 2019/2020, data from the stations have been collected by the Thematic Centres and will be made available through the ICOS Carbon Portal in the FLUXNET format; the gap-filling has been done by the Ecosystem Thematic Centre based on PI calculated fluxes; the FLUXNET data format was often requested by users in the past. Data products which are not part of the published datasets at the Carbon Portal can be received through direct contact with the station Scientific Principle Investigators or the ICOS Sweden data manager.

Most of the data requests via direct contact came from Swedish institutions. Data products from ICOS Sweden stations are also used for educational purposes at undergraduate and graduate level, reaching out to a number of students in environmental sciences, forestry and physical geography.

Citation statistics for peer-reviewed publications related ICOS Sweden stations

The full list of peer-reviewed scientific publications published in 2020 that the ICOS Sweden infrastructure has contributed to through data measured at the stations or support of field research at the stations is included in Appendix A. Google scholar was used to compile the citations related to publications since 2016 (Table 3). The full publication list of included papers is available on www.icos-sweden.se.

Table 3. Citation statistics on publications related to ICOS Sweden stations and ICOS Sweden activities (2020-02-24). The full publication list of included papers is available on www.icos-sweden.se.

	Since 2016
Total number of publications	286
Citations	7748
h-index	45
I10-index	184