



ICOS SWEDEN

Annual Report 2023

SRC short

ICOS | National
Network
Sweden



1. Summary 2023

The Annual Report 2023 was prepared by the ICOS Sweden Coordination Office (CO). The ICOS Sweden Steering Committee endorsed the document on 18 March 2024. The report is complemented by the ICOS Sweden Operational Plan for 2024, the Strategic Plan 2023-2028, and the ICOS Sweden key numbers for 2023. ICOS Sweden operations are going according to plan. The stations fulfill their obligations to ICOS RI. The application for the next funding period 2025-28 was handed in to the SRC in February 2023. In spring, additional requested information on risks for the operations of the RI, consequences of different funding scenarios and corrections to the provided budget table were prepared by the CO. The application got positive response and the funding granted by the SRC allows the continuation of the RI as it has been in the current funding period with one major exception: the marine station Östergarnsholm has to pass the ICOS RI labelling for continued funding by the SRC. Large emphasis was put on the elaboration of the best strategy for future collaboration with the other environmental research infrastructures ACTRIS Sweden and SITES.

2. Popular Science Description

ICOS RI - Integrated Carbon Observation System Research Infrastructure - is a European research infrastructure (www.icos-ri.eu) that produces high-precision data on greenhouse gas concentrations in the atmosphere and information about how carbon circulates between the atmosphere, the earth and the oceans. ICOS RI is prioritized by ESFRI (landmark status). With standardized and open data from measuring stations in 16 European countries ICOS contributes to a better understanding of the drivers of greenhouse gas concentrations in the atmosphere that have a serious impact on our climate.

The Swedish national network ICOS Sweden (www.icos-sweden.se) focuses on typical Swedish terrestrial and marine ecosystems and regions. ICOS Sweden is one key resource for national and international research on climate impacts, earth system modelling and the factual basis for supporting and evaluating climate measures. ICOS Sweden comprises two ocean, six ecosystem, and three atmospheric stations.

3. Description of operations

3.1 Timeplan

With one year left in the current funding phase, ICOS Sweden is running late with some of the planned work – labelling of the Ocean station Östergarnsholm - according to the time plan included in the proposal to the funding period 2021-24 (Table 1a), resp. the proposal for Upgrade and Renewal of the infrastructure (Table 1b) due to continued long delivery times for instrumentation ordered.

3.2 Construction, development and operations of the RI

The new ES mire station Mycklemossen has established the data transfer to the Ecosystem Thematic Centre for the full dataset in early summer 2023; however, the last task for the station certification, the mandatory vegetation sampling is scheduled for spring 2024. The station personnel at the marine station Östergarnsholm is in continued dialogue with the Ocean Thematic Centre on how to best solve the remaining issues with the station certification. In summer 2023, the shipping line changed the schedule of Tavastland from operating in the Baltic to the Mediterranean. However, the ship was scheduled back to the Baltic at the end of 2023. The labelling process of the ICOS measurements on board SOOP Tavastland is ongoing. At the already labelled stations, operations according to the ICOS RI protocols and the [ICOS Sweden operational plan](#) were ongoing. Long term sick leave of technical staff required the use of external workers and re-organization of tasks of the technical and scientific support.

3.3 Cooperation with other RIs

ICOS Sweden together with the two other Swedish Research Infrastructures of national interest SITES and ACTRIS Sweden has been intensively working on designing a strategy for future collaboration between the three environmental RIs SITES, ICOS and ACTRIS in Sweden. The strategy will be sent to the Swedish Research Council in the end of March 2024.

Table 1a: Commented timetable for ICOS Sweden milestones during 2021-2024 according to grant No. 2019-00205. Legend: n/y - n times per year, cont – continuously; accomplished (green), partly accomplished (blue); not yet accomplished (pink)

		2021	2022	2023	2024
Milestones	1. Management of the organization (module 1)				
	Management				
	Production and revision of steering documents	1 / y	1 / y	1 / y	1 / y
	Board meetings, revisions and endorsements	3 / y	3 / y	3 / y	3 / y
	Collaboration with other RIs	cont	cont	cont	cont
	Joint SAC and Board meetings	1 / y	1 / y	1 / y	1 / y
	Management team meetings	2-4 /y	2-4 /y	2-4 /y	2-4 /y
	Preparation of reports				
	Annual reporting, incl. financial status and key numbers	1 / y	1 / y	1 / y	1 / y
	Self-evaluation	1 / y		1 / y	1 / y
	Conduction of outreach activities and dissemination				
	Homepage, media activities, reports, info material, papers	cont	cont	cont	cont
	Courses and field visits	cont	cont	cont	cont
	Activities to stimulate scientific use of the RI	cont	cont	cont	cont
	2. Management of sites, systems and measurements (modules 2-6)				
	Operate measurement sites	cont	cont	cont	cont
	Station labelling: SE-Sto	x			
	Station labelling: SE-MFT-Östergarnsholm	x			
	Station labelling: SE-SOOP Tavastland				x
	Station labelling: SE-Myc				x
	Quality check data from thematic centres	cont	cont	cont	cont
	Service, system maintenance and update, work routines and protocols	cont	cont	cont	cont
	Staff training and station safety routines	1 / y	1 / y	1 / y	1 / y
	Service to ancillary project and data users	cont	cont	cont	cont
	Research engineer meetings (distant and face-2-face)	monthly	monthly	monthly	monthly
	3. Evaluation and renewal application (module 1)				
	Preparation of midterm evaluation	cont			
Preparation for application for next period		cont	cont		
Deliverables	4. Reports (module 1)				
	Annual and financial reports incl. key numbers, operational plan, revision of strategic plan	1 / y	1 / y	1 / y	1 / y
	5. Dissemination (module 1-6)				
	ICOS conferences (ICOS RI, Nordic ICOS Symposium)	1 / y	1 / y	1 / y	1 / y
	6. Data (module 2-6)				
Delivering data to ICOS RI	cont	cont	cont	cont	
Open data available in Carbon Portal	cont	cont	cont	cont	

Table 1b: Commented timetable for ICOS Sweden milestones during 2021-2024 according to grant No. 2021-00244. Legend: n/y - n times per year, cont – continuously; accomplished (green), partly accomplished (blue); not yet accomplished (pink)

		2021	2022	2023	2024	2025
Milestones	Procurement					
	1 N ₂ O analysers atmosphere stations		06/22			
	2 CH ₄ analysers wetland ecosystem stations		06/22			
	3 buoy fixed ocean station	12/21				
	4 CH ₄ upgrade ferrybox	12/21				
	5 CO ₂ flux system for northern flux systems	12/21				
	6 below canopy PAR sensors	12/21				
	7 Replacement sensors for old equipment	12/21				
	Purchase					
	8 N ₂ O analysers atmosphere stations		09/22			
	9 CH ₄ analysers wetland ecosystem stations		09/22			
	10 buoy fixed ocean station		06/22			
	11 CH ₄ upgrade ferrybox		06/22			
	12 CO ₂ flux system for northern flux systems		02/22			
	13 below canopy PAR sensors		02/22			
	14 replacement sensors for old equipment		06/22			
	15 replacement for basic infrastructure (boardwalks, elevator)	12/21				
	Installation					
	16 N ₂ O analysers atmosphere stations		12/22			
	17 CH ₄ analysers wetland ecosystem stations		12/22			
	18 buoy fixed ocean station					
	19 CH ₄ upgrade ferrybox			03/23		
	20 CO ₂ flux system for northern flux systems		10/22			
21 below canopy PAR sensors		10/22				
22 Replacement sensors for old equipment		09/22				
23 replacement for basic infrastructure		08/22				
Deliverables	Data flow established					
	1 N ₂ O analysers atmosphere stations		10/22			
	2 CH ₄ analysers wetland ecosystem stations		10/22			
	3 buoy fixed ocean station					
	4 CH ₄ upgrade ferrybox			03/23		
	5 CO ₂ flux system for northern flux systems		12/22			
	6 below canopy PAR sensors		12/22			
	7 reporting			03/23		

3.4 Datahandling and e-infrastructure use

The main data repository for ICOS Sweden data is the [ICOS Carbon Portal](#). Data from the Ocean stations have been submitted to the Surface Ocean CO₂ Atlas ([SOCAT](#)) from where they will be available for FAIR use after thorough quality control. An overview over the available data on the data repositories is available on the [RI's webpage](#).

4. Changes in organisation of the RI

The mandate period of Jutta Holst as Director of ICOS Sweden which was prolonged until December, 31 2024.

Table 2: Deviations from the special terms from ICOS Sweden granted in 2023.

Granted 2023-03-16	ICOS Sweden Upgrade and Renewal (DNo. 2021-00244): Winter flux system/renewal of basic infrastructure
Granted 2023-05-11	Förfrågan om avsteg från budget för GU/ICOS Sweden
FI-2023-46	Ansökan om förlängd tid för inköp samt förlängd frist för slutredovisning av inköp (DNr 2019-00205)
FI-2023-47	Ansökan om förlängd tid för inköp (DNr 2021-00244)

Granted 2023-12-13	Ansökan om godkännande för ändring av användning av anslag/Svartberget elevator (DNr 2021-00244)
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5. Steering Committee (SC)

The ICOS SC (Eija Juurola (Chair; ACTRIS ERIC), Lars Arneborg, (SMHI), Hjalmar Laudon (SLU), Heather Reese (GU), Isaac Rodrigues Dos Santos (GU), Linda Marie Kanders (IVL), Marko Scholze (LU), Lars Tranvik (UU)) met twice to approve the steering documents (annual report, key numbers, operational plan, budget and financial outcome, update of decommissioning plan) and was also involved in strategic discussions concerning to the funding scenarios related to the proposal for the next funding period and developing the strategy for the cooperation with SITES and ACTRIS and discussing strategies to attract users to the RI. The mandate period of the current SC members ends at the end of 2024.

6. Financial outcome 2023

According to the summary of the financial outcome (Table 2) at the end of 2023 for the grant ICOS Sweden Operations 2021-24 (DNo. 2019-00205), the RI is well in line with the budget. Adjustments will be made in the co-funding in 2024 to adjust the negative remaining balance of the SRC funding to the RI. Overall, the co-funding share of the partner institutions is 54.7% according to the preliminary budget for 2024. The remaining balance prognoses a relatively large surplus at the end of 2024 especially for investments and other operating costs. Since some of the instrument purchases have still not been delivered in spring 2024 the total costs for these (including freight) are still unclear; an additional request to prolong the deadline for spending the grant and the final reporting has been sent to the SRC in February 2024. Furthermore, the budget prognosis for 2024 provided by the partner institutions included strong limitations in spending funding on other operational costs, since the final financial outcome for 2023 was not ready until now and 2024 is the last year of the funding period.

Table 2. ICOS Sweden Operations 2021-24 grant (DNo. 2019-00205) financial outcomes per year until the end of 2023, preliminary budget for 2024 and preliminary remaining balance at the end of 2024 (kSEK).

	1	2	3	4	5	6	7	8
		total 2021-2024	Outcome 2021	Outcome 2022	Outcome 2023	Budget 2024	Total outcome 2021-2024	Remaining balance 2024
in	partner	53 240.0	9 741.8	14 052.1	11 787.8	12 744.3	48 326.0	4 914.0
	SRC	40 000.0	10 000.5	10 000.0	10 000.0	10 000.2	40 000.7	-0.7
	total income	93 240.0	19 742.3	24 052.1	21 787.9	22 744.5	88 326.8	4 913.2
costs	Staff/salaries	38 080.1	13 100.7	8 506.2	8 944.7	10 019.7	40 571.3	-2 491.1
	Premises	2 105.5	651.0	768.8	730.4	857.0	3 007.2	-901.7
	Operating other costs	28 707.3	2 688.4	6 766.7	4 986.5	5 741.3	20 182.8	8 524.5
	Overhead	17 123.3	4 748.8	3 872.9	4 083.6	4 846.5	17 551.8	-428.5
	Investments	7 223.8	1 735.2	831.0	1 662.7	1 875.0	6 103.9	1 119.9
	total costs	93 240.0	22 924.1	20 745.6	20 407.9	23 339.5	87 417.0	5 823.0
	in-out			-3 181.8	3 306.5	1 380.0	-595.0	909.7

Table 3. ICOS Sweden Upgrade and Renewal grant (DNo. 2021-00244) financial outcomes until the end of 2023, preliminary budget for 2024 and preliminary remaining balance at the end of 2024 (kSEK).

	1	2	3	4	5	6	7	8
		Total Budget 2021-2025	Outcome 2021	Outcome 2022	Outcome 2023	Budget 2024	Total outcome 2021-2024	Remaining balance 2024
in	SRC	16 833.0	5 892.0	5 892.0	1 683.3	1 683.0	15 150.3	1 682.8
	total income	16 833.0	5 892.0	5 892.0	1 683.3	1 683.0	15 150.3	1 682.8
cost	Investments	16 833.0	485.9	3 528.5	3 397.2	3 845.4	11 257.0	5 576.1
	total costs	16 833.0	485.9	3 528.5	3 397.2	3 845.4	11 257.0	5 576.1
in-out			5 406.1	2 363.5	-1 713.9	-2 162.4	3 893.3	-3 893.3

7. Key numbers

Academic projects are evenly distributed between all sites, except the measurements on board the ship of opportunity Tavastland. Projects and visitors at the Swedish ICOS stations were mainly

connected to the host of the respective stations. However, data products from the stations were downloaded from the ICOS Carbon Portal data repository from 45 countries outside Sweden. Downloads from users within Sweden increased to >6% of the total downloads compared to earlier years. The number of research projects at the stations increased. Note, that the number of research projects purely using data are not part of this statistic. Even if researchers are asked to inform the station PIs about the usage of data the number is highly unsure due to the open data policy following.

As in previous years, data downloads from the Atmosphere Stations are higher than from the Ecosystem stations due to the structure of the data products (single variables in Atmosphere station data vs. collection of parameters in Ecosystem station data) and due to the user behaviour within the different communities: whereas the Atmosphere station community often accesses the data by demand during model runs which results in multiple downloads for multiple model runs, the typical Ecosystem station data user downloads a dataset and works offline with the data (single data download).

8. Comment on publication list

The number of peer-reviewed publications using ICOS Sweden data increased slightly compared to 2022, but still did not reach the levels of 2020/21. The publications are mainly based on data from the labelled stations.

9. Equality

Gender equality was balanced in 2023 for competence building projects. However, for research projects, females were underrepresented.

10. Risk analysis

A risk analysis has been performed and included in the [strategic plan](#). Additional risks: ordered instruments will not arrive in time which will have influence on the complexity of data available from the stations. Ordinary staff employed within the RI does not pass the medical health checks for climbing the towers (external workers have to be hired for tower work).

11. Training efforts, outreach and user support

SPIs and station team members took actively part in the MSA meetings of all three domains, Atmosphere, Ecosystem and Ocean which were partly held online during 2023 to reduce travel needs and travel connected emissions. ICOS Sweden Ocean station staff attended the OTC organized a workshop on data quality assurance for data from the Ocean stations in Paris (Dec 2023). ICOS Sweden scientists and research engineers ICOS Sweden attended the 4th Nordic ICOS Symposium which was held in Bergen (21-22 November 2023). Data from the ICOS Sweden stations were subject of several presentations at this conference, but also at other conferences (e.g. EGU, AGU, Baltic Earth Conference). User support is given at the stations and from the central support functions (data support). ICOS Sweden was present at several occasions targeted to the general public and schools (e.g. Lund University NMT dagarna, Open house at Hyltemossa Research station at World Environmental Day). A list of selected appearances of [ICOS Sweden in media](#) is listed on the RI's webpage. The RI is active on social media platforms (LinkedIn, X) and actively contributes to the ICOS RI communication team outreach activities with Sweden related inputs (e.g. for the ICOS RI newsletter). In summer 2023, the 2nd ICOS Bulletin "Fluxes" was published. The publication with the subtitle "Nature based solutions for net zero" is targeted at stakeholders and researchers outside the core ICOS science area.

12. Other

Reduced surface roughness **at the combined ICOS Atmosphere and forest Ecosystem Station Norunda after the clear-cutting** in November 2022 caused that the area seen by the system for measuring ecosystem fluxes increased over the borders of the clear-cut area. The measurement design was adjusted to the new environmental conditions in agreement with the ICOS Central Facilities. The main flux system for measuring carbon exchange remained at the 100 m tower, but its measurement height was reduced to ensure that the measurement area covered with the system is within the target area. However, the area around the high tower became

very wet after the clear cut. A second tower for ecosystem flux measurements was installed in the drier area of the clear cut before the summer.

The itinerary of **SOOP Tavastland** was changed by the shipping company during 2023. After several months in the port the ship was finally scheduled on a route to the Mediterranean. In the beginning of 2024, the ship was transferred back to the Baltic area, travelling between the Baltic Sea in northern Germany and the Gulf of Bothnia.