

Co-location of research infrastructures – case Finland

Taneli Kolström

AnaEE Day, AgroEco Conference, 3.12.2020

Content

Finnish case – Integrated Atmospheric and Earth System
Research Infrastructure INAR RI

Practical implementation

Results and experiences

Conclusions

The AnaEE - O3HP station at the Haute-Provence Observatory (OHP) (© CNRS).

1. AnaEE – O3HP open-air platform with rainfall regime manipulations in pubescent oak mediterranean forest, featuring ecosystem exchange 'eddyflux', CO₂ & H₂O, trace gases experiment
2. AtmoSud regional air quality monitoring network
3. ICOS – greenhouse gas monitoring at the regional scale
4. ACTRIS - Geophysical station – tropospheric and stratospheric ozone, water, and GHG monitoring

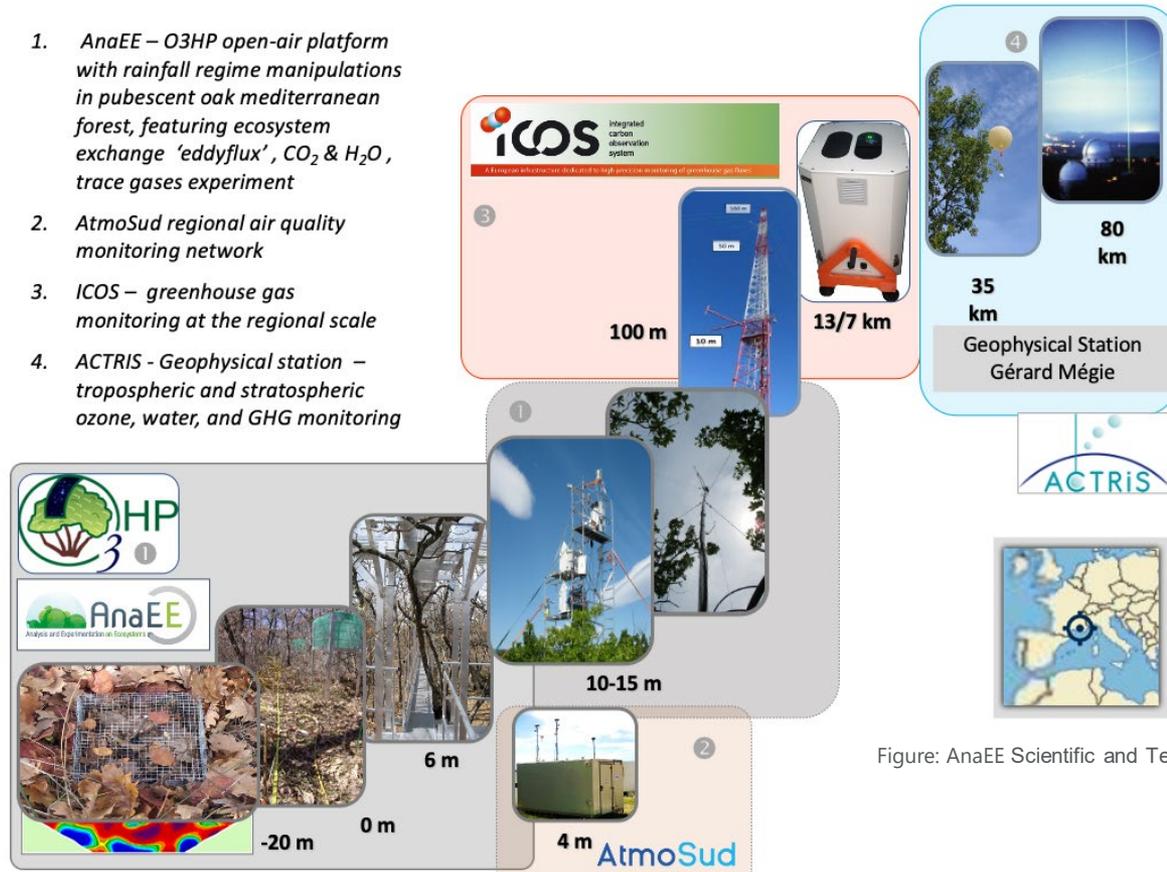


Figure: AnaEE Scientific and Technical Document

Integrated Atmospheric and Earth System Research Infrastructure INAR RI

Acts as an umbrella Research Infrastructure, implementing the distributed national nodes of a group of ESFRI (European Strategy Forum on Research Infrastructures) roadmap infrastructures in the environmental domain in Finland, namely

- ICOS (Integrated Carbon Observation System),
- ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure),
- eLTER (Integrated European Long-Term Ecosystem, Critical Zone & Socio-Ecological Research Infrastructure), and
- AnaEE (Infrastructure for Analysis and Experimentation on Ecosystems).

A proposal to the Academy of Finland National for the roadmap of national infrastructures in Finland 2021–2024.

ICOS The Integrated Carbon Observation System

The Integrated Carbon Observation System (ICOS) is

- a distributed research infrastructure
- operating standardized, high-precision, and long-term observations,
- facilitating research to understand the carbon cycle,
- providing necessary information on greenhouse gases.



ACTRIS The Aerosol, Clouds and Trace Gases Research Infrastructure

The Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) is a pan-European research infrastructure producing high-quality data and information

- on short-lived atmospheric constituents and
- on the processes leading to the variability of these constituents in natural and controlled atmospheres.



LTER Long-Term Ecosystem Research

Long-Term Ecosystem Research (LTER) is an essential component of world-wide efforts to better understand ecosystems. Through **research and monitoring**, LTER seeks

- to improve our knowledge of the structure and functions of ecosystems and
- their long-term response to environmental, societal and economic drivers.



AnaEE Analysis and Experimentation on Ecosystems

AnaEE is a research infrastructure which brings together a series of state-of-the-art **experimental and analytical platforms** for ecosystem research throughout Europe. By linking these platforms to modelling approaches, AnaEE advances

- our understanding of the environmental impacts of ongoing global change, and
- fosters adaptation and mitigation strategies for safeguarding ecosystem services and their economic and societal benefits.



ICOS

ICOS

INTEGRATED
CARBON
OBSERVATION
SYSTEM



ACTRIS



eLTER



AnaEE: a unique position along the observation / experimentation spectrum



Figure: AnaEE Scientific and Technical Document

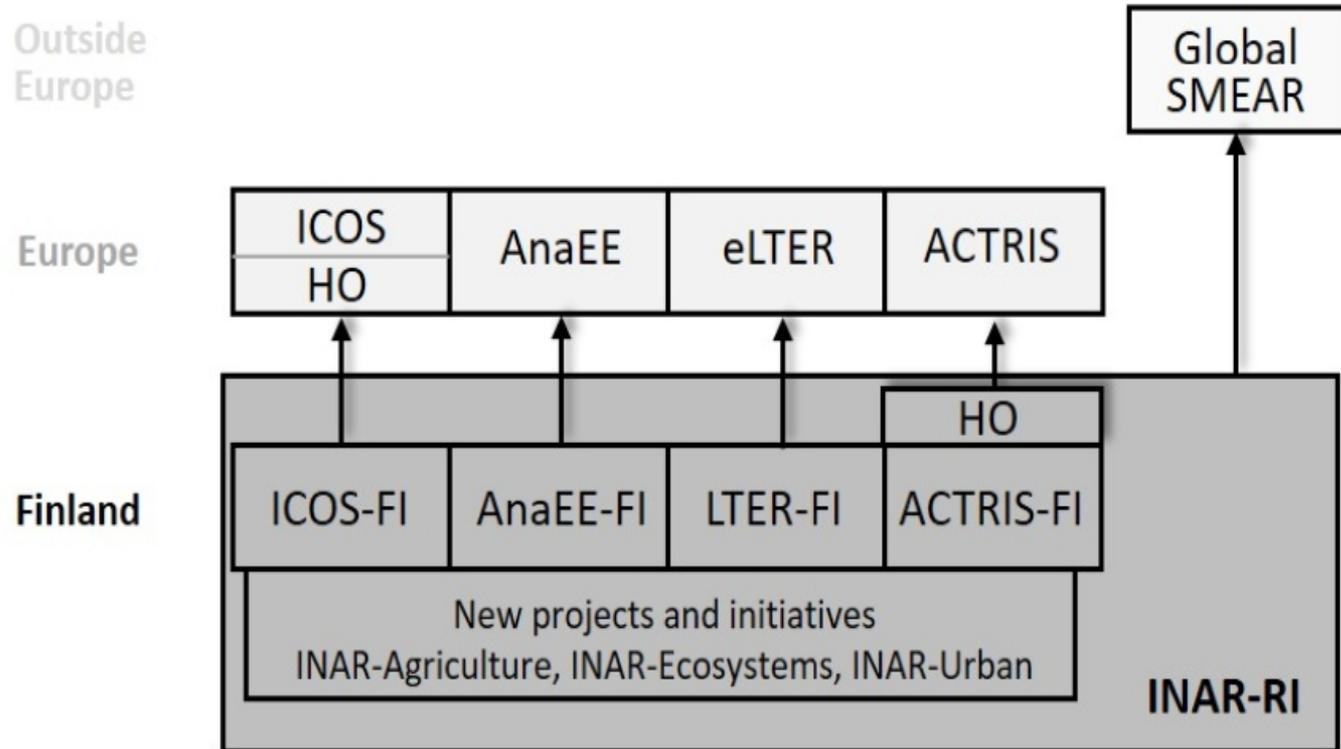
The aims of the INAR RI

To integrate its components into a benchmarking RI in atmosphere–ecosystem domain both nationally and internationally.

The key strength of our holistic scientific approach is

- the combination of comprehensive, continuous long-term observations,
- extensive field and laboratory experiments,
- use of satellite data, and
- advanced modeling leading to ground-breaking understanding,
- to quantitative synthesis of different atmosphere–ecosystem processes, and
- to innovative method and instrument development.

Integrated Atmospheric and Earth System Research Infrastructure INAR RI – roadmap proposal to Academy of Finland



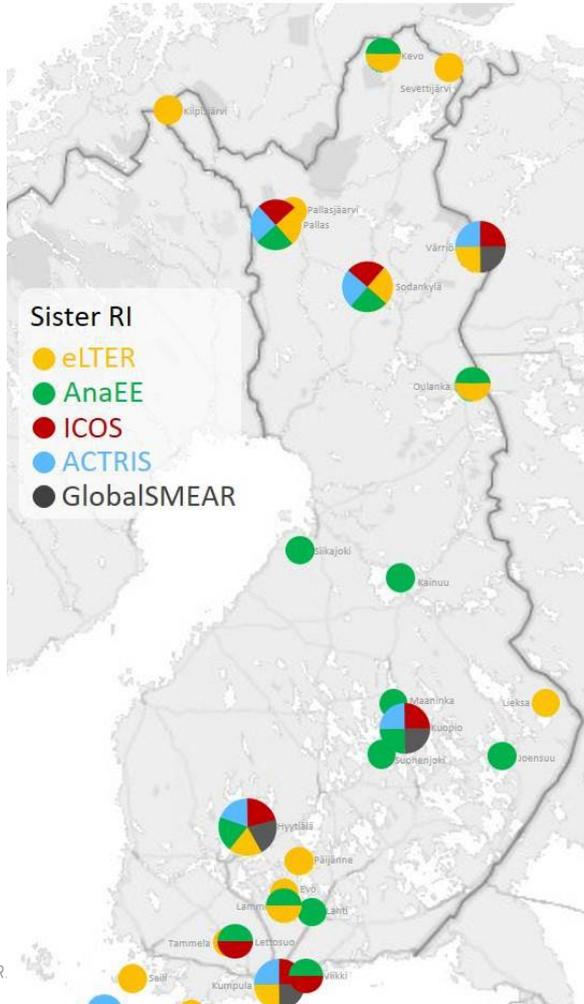
INAR RI organizations involve

- University of Helsinki (UH), coordination
- Finnish Meteorological Institute (FMI),
- University of Eastern Finland (UEF),
- Tampere University (TAU),
- Natural Resource Institute Finland (Luke);
- Finnish Environment Institute (SYKE)
- University of Oulu (UO),
- University of Turku (UTU),
- University of Jyväskylä (JYU),
- Finnish IT Center for Science Ltd. (CSC)

The INAR RI platforms include

- 31 sites and stations (17 of them hosting several co-located infrastructures),
- 11 laboratories and mobile units and
- 2 data infrastructures.

National



- Sister RI**
- eLTER
 - AnaEE
 - ICOS
 - ACTRIS
 - GlobalSMEAR

RESTAT
INTERACT
ICP Forest
ENFIN/NFI

...

Organization	Research Infrastructure Platforms	INAR RI sister RI	
UH	SMEAR I (Värriö)	ICOS, ACTRIS, eLTER, GlobalSMEAR	
	SMEAR II (Hyytiälä, 3 sites)	ICOS, ACTRIS, eLTER, AnaEE, GlobalSMEAR	
	SMEAR III (Kumpula)	ICOS, ACTRIS, eLTER, GlobalSMEAR	
	SMEAR Agri (Viikki)	AnaEE, ICOS	
	Tvärminne	eLTER	
	Lammi	eLTER, AnaEE	
	Viikki ecophysiology platform	AnaEE	
	Kumpula aerosol laboratory	ACTRIS	
	Kilpisjärvi	eLTER	
	Algolab (Lahti)	AnaEE	
	Aerosol, cluster and trace gas laboratory	ACTRIS	
	FMI	Pallas-Sodankylä (3 sites)	ICOS, ACTRIS, eLTER
		Utö	ICOS, ACTRIS
Lettosuo		ICOS	
Marambio, Antarctica		ACTRIS	
Tiksi, Russia		ACTRIS	
Multiwavelength Raman Lidar		ACTRIS	
Doppler Cloud Radar		ACTRIS	
Doppler Lidar		ACTRIS	
Unmanned Aerial vehicle (UAV)		ACTRIS	
SMEAR IV (Puijo)		ICOS, ACTRIS, GlobalSMEAR	
UEF	SMEAR IV (Puijo)	ICOS, ACTRIS, GlobalSMEAR	
	Atmospheric simulation chambers	ACTRIS	
	Growth chamber and laboratory facilities	AnaEE	
TAU	Mobile Aerosol Laboratory	ACTRIS	
Luke	Joensuu	AnaEE	
	Kainuu	AnaEE	
	Maaninka	AnaEE	
	Siikajoki	AnaEE	
	Suonenjoki	AnaEE	
	Pallas-Sodankylä	eLTER, AnaEE	
	ICP Forests Level II sites	eLTER	
	Lettosuo	AnaEE	
	Data infrastructure FEO	eLTER	
	SYKE	Pallas-Sodankylä	eLTER
Lammi		eLTER	
Tvärminne		eLTER	
Lake Päijänne		eLTER	
ICP Integrated Monitoring sites		eLTER	
UO		Oulanka	eLTER, AnaEE
UTU		Kevo	eLTER, AnaEE
JYU	Seili	eLTER	
	Lake Päijänne	eLTER	
CSC	Data infrastructure	eLTER, GlobalSMEAR	
Other organizations	SMEAR Estonia (Järvselja)	GlobalSMEAR	
	SORPES Nanjing	GlobalSMEAR	
	BUCT Beijing	GlobalSMEAR	

INAR RI acts

The activities in these national research infrastructures are aligned by INAR RI towards common targets and integration of environmental infrastructures in European RI landscape.

INAR RI integrates the activities and coordinates the Finnish national nodes in these ESFRIs to study atmosphere, ecosystems, their interactions and how they contribute to the Earth system.

- upgrading the infrastructures – joint applications

Practical issues of the INAR RI

Strategy

- The research and collaboration in INAR RI is tied up excellently with the strategies of the partners and fits perfectly to the strategies of the other participating organization.
- INAR RI supports the governmental strategy to deepen cooperation between the universities and the sectoral research institutes.

Management

- INAR RI sister RIs have their own national **management boards**:
 - ICOS-FI, ACTRIS-FI, and
 - a joint board for LTER-FI and AnaEE-FI (INAR RI Ecosystems board).

Added value of INAR RI

- Many INAR RI sites are rooted to and continuously used for national and international high-level education which has close links to the top-level research.
 - University research stations
- In methodological/technical development INAR RI researchers and technicians have a significant role in standardization of various observations.
 - For example, a standard for eddy covariance measurements has been submitted to the World Meteorological Organization.
- INAR RI aims to produce open data with the highest quality in a harmonized manner.

Data policy

INAR RI data policy

- is a compilation of INAR RI sister RI data policies and
- aims at optimal sharing of data and information within a professional and highly ethical legal framework
 - FAIR principles: data is Findable, Accessible, Interoperable and Reusable.

This will increase the usage and visibility of the data, and access to sites.

Role of the Finnish IT Center for Science Ltd. (CSC)

Speciality of INAR RI

Being mainly located in the **boreal biome**, INAR RI includes

- all major types of boreal ecosystems,
- unmanaged or managed,
- agro-ecosystems, forests, grasslands, shrublands, wetlands, rivers and lakes and coastal ecosystems as well as urban areas.

INAR RI also operates several arctic/subarctic sites, where the impacts of climate change are most pronounced.

Some results

Between 2014-19, INAR RI

- has produced in total 2 560 peer reviewed publications and 160 PhD theses,
- the data has been downloaded for 21 000 measurement years (including SmartSMEAR, ICOS Carbon Portal, ACTRIS Data Center, Fluxnet, NOAA and EuropeanFluxes databases), and
- the sites and data storages have been visited by 3756 visitors from 72 different countries.

The active role of INAR RI in improving the capacity of stations and other platforms to be able contribute to ESFRIs.

Conclusions

With integration of national nodes of several ESFRIs, INAR RI is a benchmark RI in Europe, where such integration is still not so actively yet implemented.

INAR RI promotes the holistic scientific approach.

Thank you!

taneli.kolstrom@luke.fi

