

Proposal from JSI for relocation of the MSC-E activities

Agenda item #3.
Geneva, 11.09.2023

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Jožef Stefan Institute - JSI

Jožef Stefan Institute, Ljubljana, Slovenia

- 1949 – Institute of Physics
- 1959 – Jožef Stefan Nuclear Institute
- 1969 – Jožef Stefan Institute



Jožef Stefan 1835 – 1893

The Jožef Stefan Institute is named after the distinguished 19th century physicist Jožef Stefan, most famous for his work on the Stefan-Boltzmann law of black-body radiation

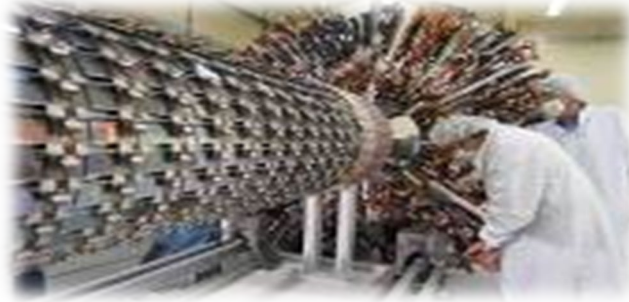


The Mission of the Jožef Stefan Institute:
Creation, spread and transfer of knowledge in the fields of natural, life and engineering sciences to the benefit of the society

Research departments of the Jožef Stefan Institute

Human resources :

- 600 researchers
- 250 support staff and administration
- 200 PhD students



Jožef Stefan
International
Postgraduate
School



CHEMISTRY, BIOCHEMISTRY, NEW MATERIALS

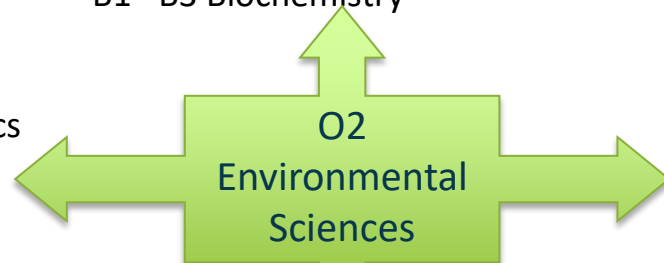
- K1 Inorganic Chemistry and Technology
- K3 Physical and Organic Chemistry
- K5 Electronic Ceramics
- K6 Engineering Ceramics
- K7 Nanostructured Materials
- K8 Synthesis of Materials
- K9 Advanced Materials
- B1 –B3 Biochemistry

ELECTRONICS AND INFORMATION TECHNOLOGIES

- E1 Automation, Biocybernetics and Robotics
- E2 Systems and Control
- E3 Artificial Intelligence
- E5 Open Computer Systems and Networks
- E6 Communication Systems
- E7 Computer Systems
- E8 Knowledge Technologies
- E9 Intelligent Systems

- Study programmes :
- Nanotechnologies
 - Ecotechnologies
 - Information and communication technologies
 - Sensor technologies

O2
Environmental
Sciences

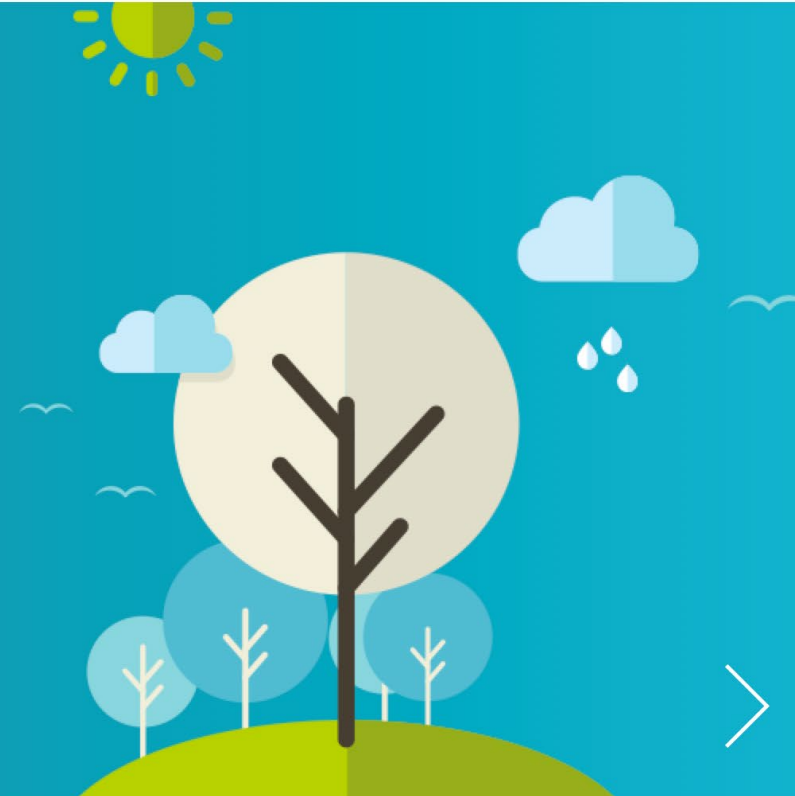


PHYSICS AND NUCLEAR TECHNOLOGY

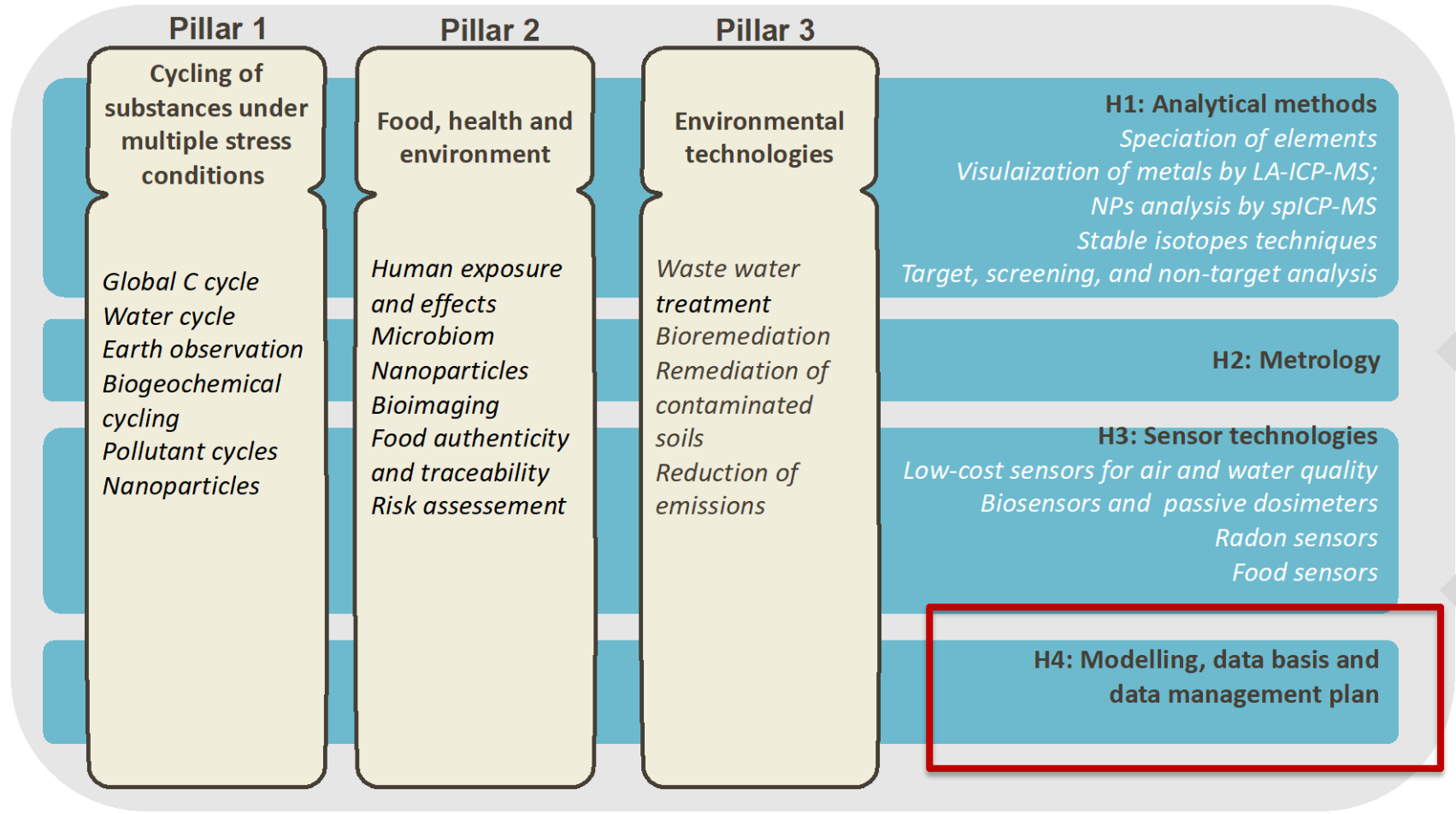
- F1 Theoretical Physics
- F2 Low and Medium Energy Physics
- F3 Thin Films and Surfaces
- F4 Surface Engineering and Optoelectronics
- F5 Solid State Physics
- F7 Complex Matter
- F8 Reactor Physics
- F9 Experimental Particle Physics
- R4 Nuclear Engineering

Department of Environmental Sciences

The Department of Environmental Sciences encompasses a broad range of research activities, diverse and varied as the environment itself.

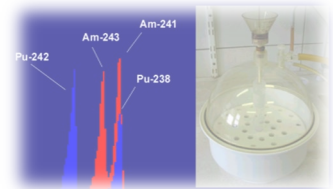
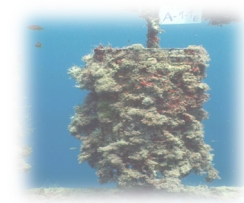


Department of Environmental Sciences



Exploitation, national and international stakeholder engagement (industry and policy sectors), participatory approach

Dissemination, Communication, Outreach, Education





Relevant expertise

- Environmental pollution research: toxic substances (metals, POPs, contaminants of emerging concern, etc.)
- Cooperation with international bodies and programmes (e.g. UN Environment, Minamata Convention, GEO, EU projects)
- Reinforced modelling activities for toxic metals and POPs
- Close co-operation with other modelling groups dealing with toxic metals and POPs – MIT (USA), Harvard Univ. (USA), ECCC (Canada), Hereon (Germany), CNR-IIA (Italy), OGS (Italy), IQF-CSIC (Spain)

Substances

Chemical elements and their species:

Speciation: As, Se, Hg, Cr, Sn, Sb, Pb, Cd, Al, Zn, Fe, Pt,

Organic substances: POPs (PCB-ji, PAH, etc..) CECs

(pharmaceuticals, pesticides, Phtalates, PFAS, bisphenols, flame retardants), chemical mixtures (sreening, non-target)

Nutrients: nitrogen, sulphur, carbon, water cycles

Stable isotopes: $\delta^{2}\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{18}\text{O}$, $\delta^{34}\text{S}$, and heavy elements (Hg, Sr, Pb, U, etc...)

Nanoparticles: inorganics(metal particles), plastics, etc..

Radionuclides:

Natural: ^{235}U , ^{234}U , ^{238}U , ^{228}Th , ^{230}Th , ^{232}Th , ^{226}Ra , ^{226}Rn , ^{210}Po , ^{210}Pb , ^{40}K

Manmade: ^{241}Am , ^{238}Pu , $^{239+240}\text{Pu}$, ^{137}Cs , ^{134}Cs , $^{89/90}\text{Sr}$

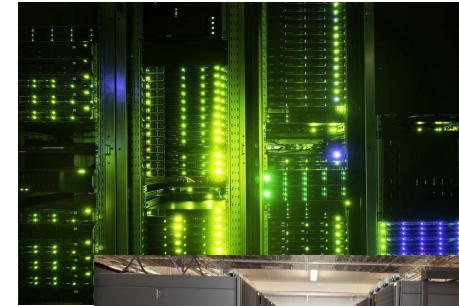
Infrastructure and equipment



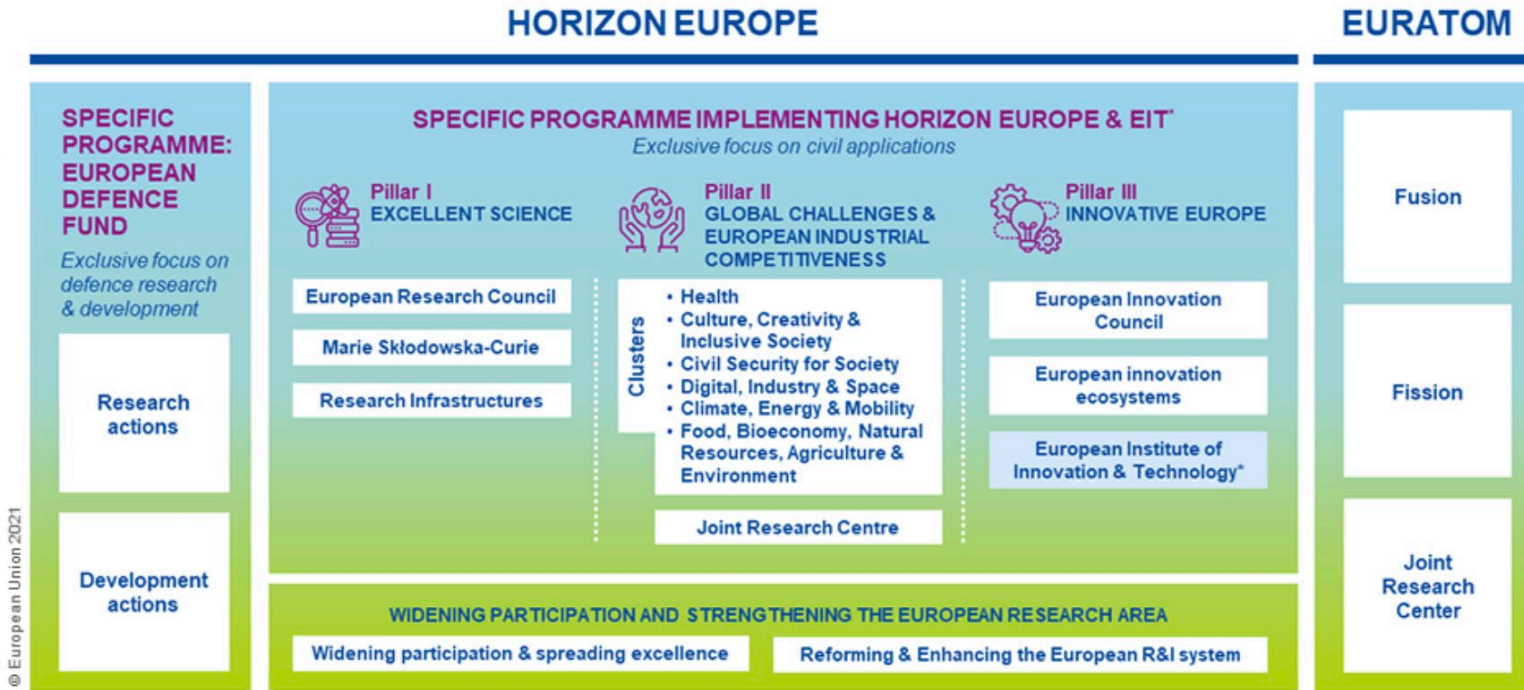
- **Clean laboratories and laboratories for radiochemistry (3000m² laboratory space, 800 m² office space)**
- **Isotope ratio mass spectrometry**
 - EA-IRMS, GC-C-IRMS, DI-IRMS, Py-IRMS, MC-ICP-MS
- **Mass spectrometry**
 - UPLC-qTOF-MS/MS, ICP-MS, ICP-MS QQQ, LA-ICP-MS, LC-ICP-MS, GC-ICP-MS, SP-ICP-MS, GC(IT)MS, GC-MSD, LC-MS/MS, GC-MS/MS, Orbitrap
- **Spectrophotometry**
 - HG-AFS, CV-AFS
- **Nuclear methods**
 - TRIGA MARK II nuclear reactor, alpha, beta and gama counting, NAA
- **Access to equipment: JSI departments & infrastructure (microscopy, NMR center, etc..)**

Computer resources of J ožef Stefan Institute

- JSI is a member of **SLING** (National Supercomputing Consortium):
 - Over 10 supercomputing/HPC systems
 - EuroHPC membership and competence centre
- **NSC Supercomputer Cluster (JSI, Ljubljana)**
2880 cores, 0.2 PFLOPS
- **ARNES National Cluster (Ljubljana)**
4500 cores, 0.5 PFLOPS
- **EuroHPC VEGA (IZUM, Maribor)**
122000 cores, 6.9 PFLOPS



International cooperation - current



* The European Institute of Innovation & Technology (EIT) is not part of the Specific Programme

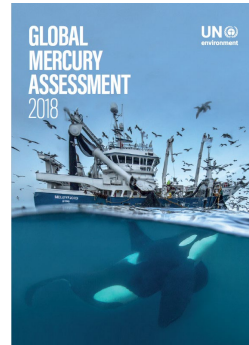
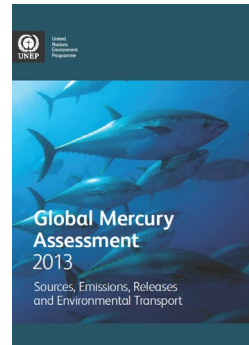
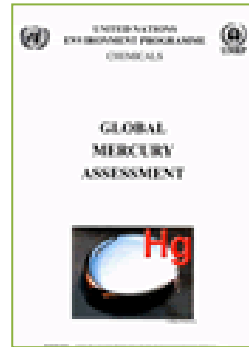
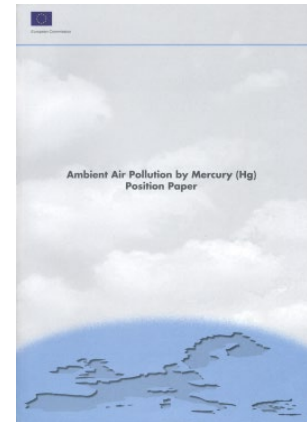
MSCA:
 DN GMOS-Train and
 FoodTranet
 IF: STROMASS
RI:
 EIRENE and
 MetroFood

URBANOME, GREENER,
 THEROS, PARC,
 DanubeHazard,
 AgroServ, Biosysmo
 SECURE, INQUIRE,
 EARLY WARNING...

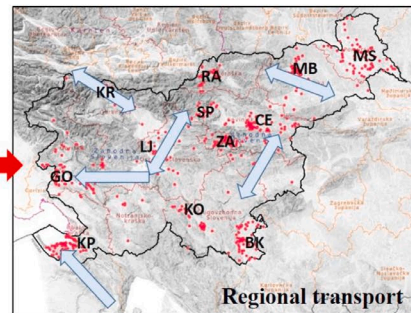
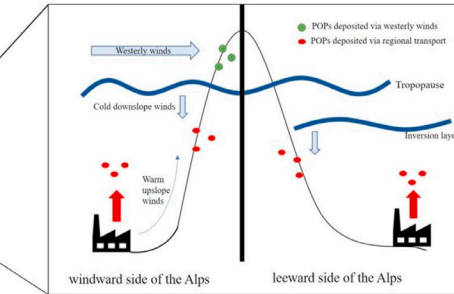
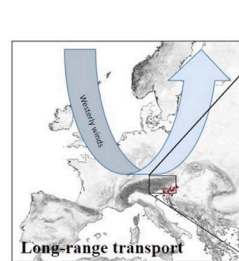
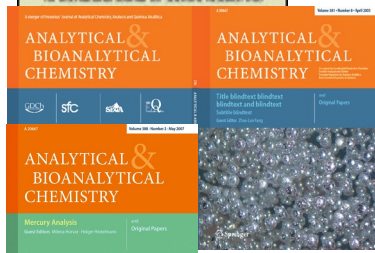
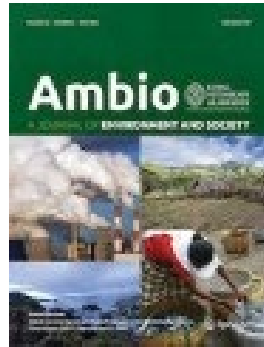
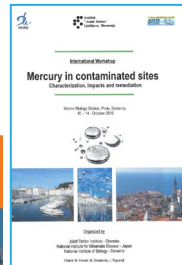
PianoForte,
 C-CINCH,
 EURAD

Widening: SurfBio, MERFish, TunTwin, Masstwin, ERAChair Isofood, etc..

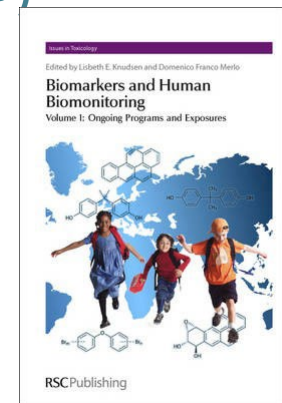
Policy relevant activities



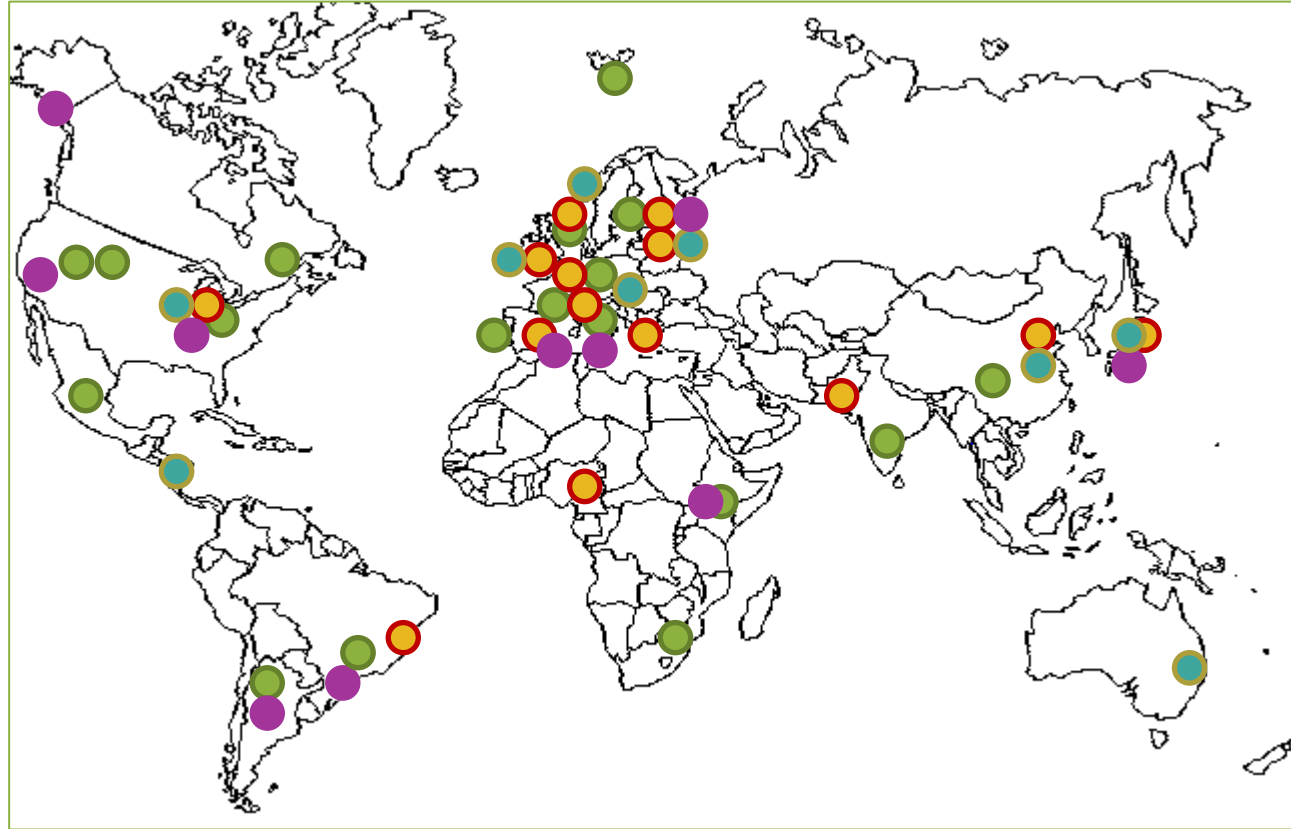
- EU Mercury Position Paper, **2001**
- UNEP Mercury expert group, UNEP Mercury Assessment Report, **2002, 2013, 2018**
- Effectiveness evaluation - Minamata Convention
- WHO; Stockholm Convention
- WGE ICP-Vegetation (lichens/mosses)



Runkel et al., 2022



JSI– Current mercury related international cooperation



- Health related studies
- Mercury remediation and removal from coal use and waste
- Hg in contaminated sites
- GMOS - Global Mercury Observing System (atmosphere, water, soil, biota)



MSC-E activities

Main tasks according to the mandate

- Development and updates of the chemical transport model for HMs and POPs
- Research activities aimed at improvement of the modelling tools
- Operational model assessment of HM and POP pollution levels and transboundary transport
 - Preparation of input data for modelling (emissions, wind re-suspension, meteorological fields, chemical reactants, etc.)
 - Conducting model simulations (global and regional)
 - Quality assurance and quality control of modelling results
- Annual reporting (status report, country reports, website)
- Outreach activities, cooperation with international bodies and experts



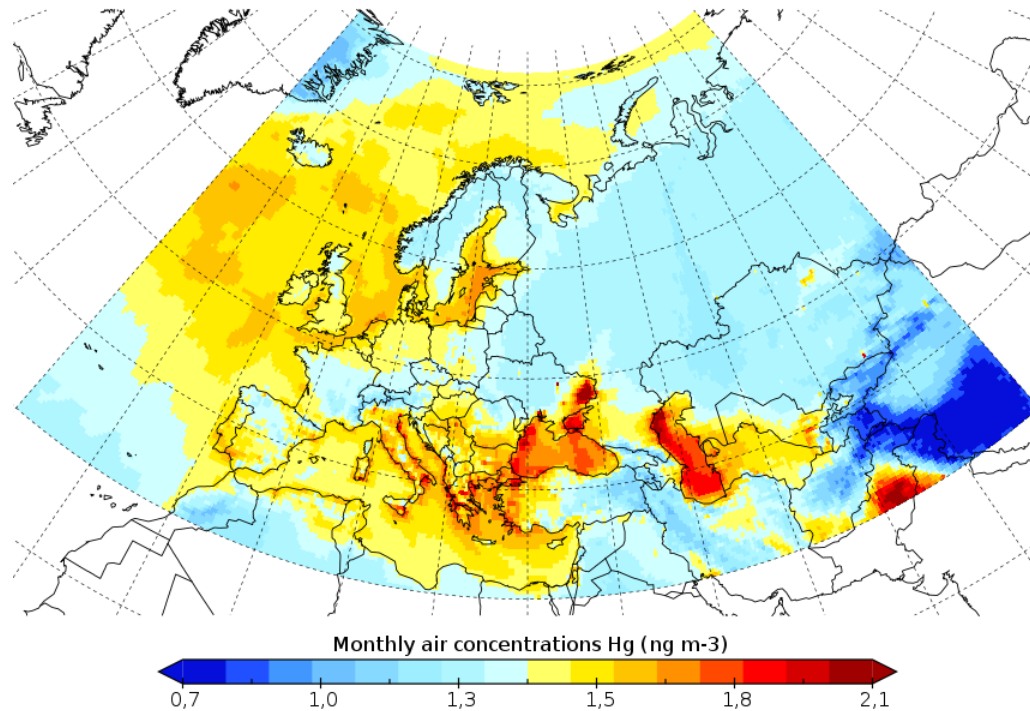
Available resources

- JSI computer resources:
- JSI data storage and network infrastructure
- Chemical transport models:
 - GLEMOS open source v2.2.2 (<https://github.com/glemos-model>)
 - GEOS-Chem v14.1.1 (<https://geoschem.github.io/>)
 - WRF - Weather Research & Forecasting Model (v4.5) (<https://www.mmm.ucar.edu/models/wrf>)

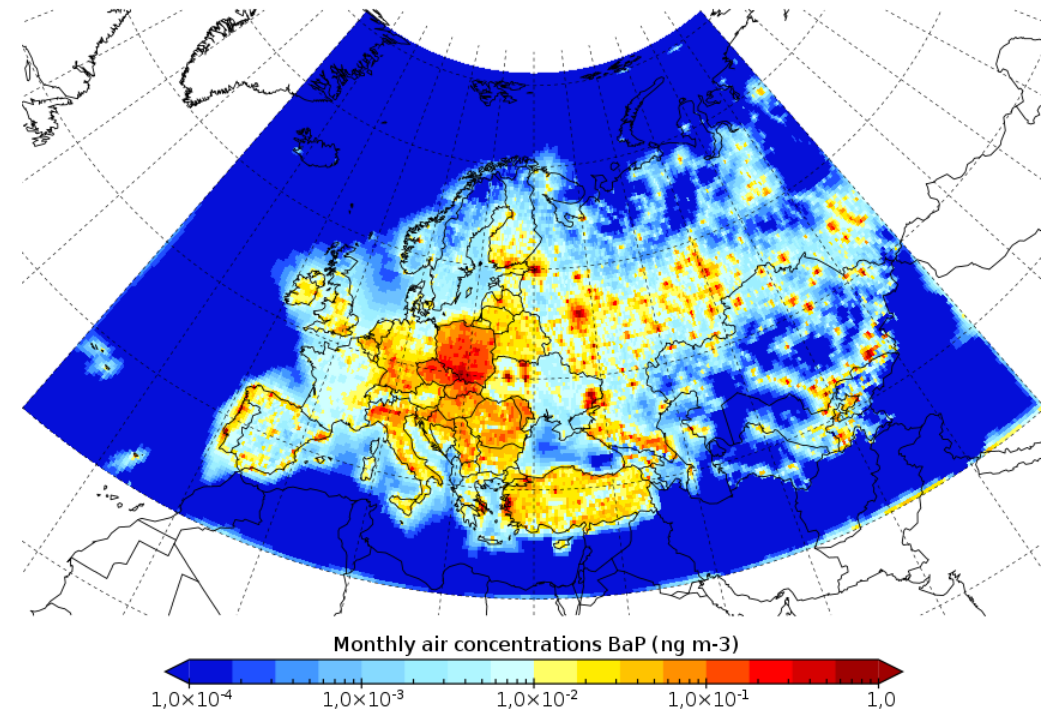
Pilot simulations

- Simulated pollutants: Hg and B(a)P
- HPC cluster: ARNES (Ljubljana)
- Model: GLEMOS open source (v2.2.2)
- Emissions: 2021 (EMEP submission 2023)

Hg⁰ air concentration (June 2021)



B(a)P air concentration (June 2021)





Contribution to EMEP workplan 2024

- Operational modelling of heavy metals (Cd, Pb, Hg) and POP (PAHs)
- Contribution to TFMM activities:
 - Investigate monitoring of chemicals of emerging concern (CEC) (1.1.1.2)
- Contribution to TF HTAP activities:
 - Multi-model evaluation and attribution of Hg pollution trends (1.1.4.3)
 - Model intercomparison of multi-pollutant impacts of fires (1.1.4.4)
- Contribution to Minamata Convention's effectiveness evaluation (1.3.4)

Thank you for your attention

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