



# Lessons learned, the way ahead, and governance

Iris Ehlert (DKRZ), Anja Schmidt (DLR, LMU), and Jochem Marotzke (MPI-M)

# The natESM story

2017/18



Vision

2018/19



Technical criteria

2020/21



Funding

- Why: community effort required to address future technological and HPC challenges
- Vision: establish national ESM capability and support team that will help to save resources, create synergies, share insights, and disseminate knowledge

# The natESM story

2017/18



Vision

2018/19



Technical criteria

2020/21



Funding

- Why: community effort required to address future technological and HPC challenges
- Vision: establish national ESM capability and support team that will help to save resources, create synergies, share insights, and disseminate knowledge
- First Workshops
- Working groups (core components, technical requirements + infrastructure, governance)
- No agreement on core components
- Collectively agreed upon technical criteria
- Workshops crucial element of strategy

# The natESM story

2017/18



Vision

2018/19



Technical criteria

2020/21



Funding

- Why: community effort required to address future technological and HPC challenges
- Vision: establish national ESM capability and support team that will help to save resources, create synergies, share insights, and disseminate knowledge

- First Workshops
- Working groups (core components, technical requirements + infrastructure, governance)
- No agreement on core components
- Collectively agreed upon technical criteria
- Workshops crucial element of strategy

- Several online meetings
- No decision on core components
- Formation of steering committee
- Realization that funding is needed
- BMBF project started in Nov 2021

# The natESM story

2017/18



Vision

2018/19



Technical criteria

2020/21



Funding

2022/23



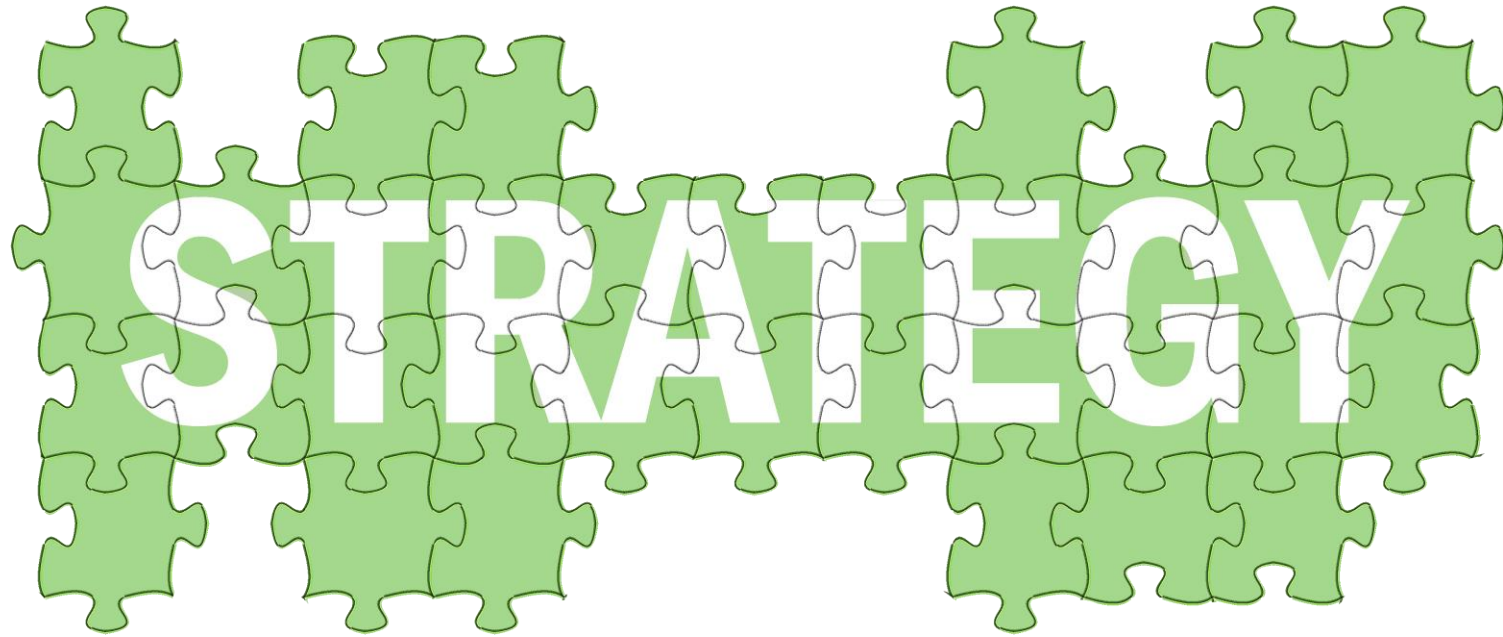
Initial agile strategy

- Why: community effort required to address future technological and HPC challenges
- Vision: establish national ESM capability and support team that will help to save resources, create synergies, share insights, and disseminate knowledge

- First Workshops
- Working groups (core components, technical requirements + infrastructure, governance)
- No agreement on core components
- Collectively agreed upon technical criteria
- Workshops crucial element of strategy

- Several online meetings
- No decision on core components
- Formation of steering committee
- Realization that funding is needed
- BMBF project started in Nov 2021

**Focus today:  
What happened  
since last  
workshop?**



# Agile: we consistently refine our strategic framework



Our strategy can only be further developed through collaboration with you during our workshops, sprint checks, sprints, and working groups.



# Focus today:

Four points that shaped our strategy over the past year





1. Specify components
2. Enhance community engagement
3. Refine sprint process
4. Sprint allocation and Code of Conduct



- 1. Specify components**
2. Enhance community engagement
3. Refine sprint process
4. Sprint allocation and Code of Conduct



## Core

- Foundational elements
- Prerequisites for most other models
- Currently:
  - ICON-A, FESOM, ICON-O



# Four component categories

## Core

- Foundational elements
- Prerequisites for most other models
- Currency.

**Further suitable models discussed in afternoon BOGs!**



## Core

- Foundational elements
- Prerequisites for most other models
- Currently:  
ICON-A, FESOM, ICON-O



## Optional

- Not required by majority of users
- Remain optional, providing flexibility for specific use cases

# Four component categories

## Core

- Foundational elements
- Prerequisites for most other models
- Currently:  
ICON-A, FESOM, ICON-O



## Optional

- Not required by majority of users
- Remain optional, providing flexibility for specific use cases

## Impact

- Facilitate primarily one-way interactions within system

# Four component categories

## Core

- Foundational elements
- Prerequisites for most other models
- Currently:  
ICON-A, FESOM, ICON-O



## Infrastructure

- Enable the interaction with core and optional components
  - Current coupler and interface: YAC and ComIn

## Optional

- Not required by majority of users
- Remain optional, providing flexibility for specific use cases

## Impact

- Facilitate primarily one-way interactions within system

## Core

It's **natESM's responsibility** to seamlessly integrate core components into natESM system.



## Infrastructure

## Optional

## Impact



## Core

It's **natESM's responsibility** to seamlessly integrate core components into natESM system.



## Infrastructure

## Optional

**natESM supports** integration of these components into the system.

## Impact

## Core

It's **natESM's responsibility** to seamlessly integrate core components into natESM system.



## Infrastructure

## Optional

**natESM supports** integration of these components into the system.

## Impact

**natESM supports** integration of these components into the system.

## Core

It's **natESM's responsibility** to seamlessly integrate core components into natESM system.



## Infrastructure

It's **natESM's responsibility** to oversee integration of these components into the system.

## Optional

**natESM supports** integration of these components into the system.

## Impact

**natESM supports** integration of these components into the system.

## Congruence of institutional and collective goals

- We align our individual and collective objectives to create a harmonious and effective collaborative environment
- Cooperation and dedication of contributing organizations are crucial for natESM
- Formal contracts are impractical; voluntary participation is essential due to evolving priorities of model-developing institutions
- Community usage and organizational commitments are key

## Steering group's role is pivotal

- Composition and role endorsed by PT-DLR and BMBF
- Determines natESM direction and strategy, in consultation with community
- Evaluates inclusion of components, based on technical criteria and sprint outcomes
- Lessons learned through sprints are vital
- Unsustainable components will be removed

1. Specify components
- 2. Enhance community engagement**
3. Refine sprint process
4. Sprint allocation and Code of Conduct



# Contribute to our GitLab platform



1. Promote your model or module
2. Share your experiences with other community members

<https://nat-esm-system.dkrz.de/>

# Initiate a working group



Current working groups:

1. Communication  
(completed → Website, GitLab, Mattermost)
2. Training  
(running)
3. Land-ice component  
(running, WG meets this afternoon!)



# Initiate a working group

**Take the lead! Interested in starting and leading a working group? Contact Iris to discuss the details.**



Current working groups:

1. Communication  
(completed → Website, GitLab, Mattermost)
2. Training  
(running)
3. Land-ice component  
(running, WG meets this afternoon!)



## **natESM workshops:**

1. Annual community workshop
2. Technical training workshops
3. Focused workshops (not pre-planned; based on your needs)



**Next technical training:  
5 to 6 Nov 2024 at JSC  
Contact: Sabine Griebbach**

## natESM workshops:

1. Annual community workshop
2. Technical training workshops
3. Focused workshops (not pre-planned; based on your needs)

1. Specify components
2. Enhance community engagement
- 3. Refine sprint process**
4. Sprint allocation and Code of Conduct



# Completed 8 sprints (6 since last workshop)



01	<b>ICON-Art</b>	Analysis of ART code for GPU porting	2 months
02	<b>ICON-mHM-YAC</b>	Online coupling mHM into ICON using YAC	6 months
03	<b>FESOM</b>	Port FESOM 2.1 to JUWELS booster and Levante- GPU	6 months
04	<b>ParFlow</b>	Port ParFlow to AMD GPUs, inspection of RAPID Memory Manager and Hipification, performance analysis	6 months
05	<b>MESSy</b>	Optimize data transfers between host (CPU) and device (GPU)	4 months
06	<b>ESMValTool</b>	Updating the remaining non-lazy preprocessor functions to be memory efficient AND updating ESMValCore	6 months
07	<b>HAMOCC</b>	Concurrent HAMOCC on GPU	6 months
08	<b>MESSy-ComIn</b>	Couple MESSy to ICON via ComIn	6 months

# Completed even more sprint checks (10)



1	<b>MESSy-ComIn</b>	Couple MESSy to ICON via ComIn	Full sprint
2	<b>PDAF</b>	Porting Kalman filter to GPUs	Plans to apply
3	<b>PALM</b>	Is porting of modules to GPU possible?	Full sprint
4	<b>TSMPv2</b>	Replace OASIS with YAC	Full sprint
5	<b>Jena CSIS</b>	Check if GPU porting is possible	
6	<b>CLEO</b>	Parallelize CLEO using Kokkos	Full sprint
7	<b>MESSy</b>	Solving performance issues	Full sprint
8	<b>PISM</b>	Check if GPU improvement is possible	Plans to apply
9	<b>ISSM</b>	Check if GPU improvment is possible	Plans to apply
10	<b>FABM</b>	ICON-O-FABM interface	Plans to apply
11	<b>netCDF</b>	Define format for data with time-changing resolution	Under review

Exchange with our RSEs proved beneficial, leading to two changes:

## **1. Sprint check mandatory now**

Every full application must be preceded by a sprint check

## **2. Flexible sprint duration**

Sprints now available for flexible durations ranging from  
3 to 6 months



# Connect with our RSEs today and tomorrow

**Jörg**  
Benke



**Wilton**  
Loch



**Sergey**  
Sukov



**Enrico**  
Degregori



**Catrin**  
Meyer



**Seize the opportunity and talk to our RSEs to explore whether a sprint check could be beneficial for you**



1. Specify components
2. Enhance community engagement
3. Refine sprint process
- 4. Sprint allocation and Code of Conduct**



# Sprint allocation and Code of Conduct



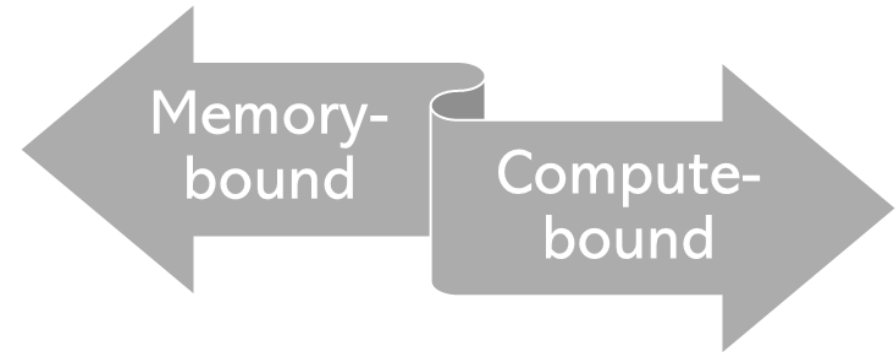
- Sprint allocation is based on a ticket system
- Sprint assignments are decided by natESM leadership team in consultation with RSEs
- Collaboration between sprint applicants and RSEs represents an unusual constellation (no line management)
- RSEs continually improve their skills, enhancing their ability to support our core and infrastructure components
- Please review and internalize our first version of the natESM Code of Conduct, which will be made available in spring



# natESM is not just about GPUs and GPU porting



- **Misconception:** Some think our support is limited to GPU porting
- **Clarification:** GPUs are not always the ultimate solution
  - CPU systems will always be around
  - Some components and algorithms do not map well onto GPU architecture
- **RSEs recommended solution:**
  - Exploit heterogeneous systems through CPU-GPU coupling and hybrid approaches
  - Components running only on CPU systems can still be heavily optimized (Communication, IO, Shared memory, etc.)



# The natESM story

2017/18



Vision

2018/19



Technical criteria

2020/21



Funding

2022/23



Initial agile strategy

- Community engagement strengthened through workshops and sprints
- Introduction of sprint checks
- Community platforms: GitLab, Mattermost
- 1<sup>st</sup> version of agile strategy in Dec 2023 with decisions on first components
- 1<sup>st</sup> version of Code of Conduct for natESM ready in spring