IS-ENES3 Deliverable D6.6

Third periodical report on service statistics for models and tools

Reporting period: 01/01/2022 – 31/03/2023

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ABSTRACT

IS-ENES services for European ESMs (Earth System Models) and Software Tools have been provided to the user community during months 37 to 48 of the IS-ENES3 project. The services have been continuously monitored and KPIs were collected every 6 month from the groups that run the service endpoints.

This deliverable compiles the results of the two final KPI reporting periods, evaluates the outreach of services based on these findings, and summaries the KPIs over the whole project period.

Version history		
Version	**Date**	**Name**
0	2023-03-17	Initial version UF
1	2023-03-17	Updates EM
2	2023-03-23	Revised after review by SJ
Dissemination Level		
PU	Public	x
CO	Confidential, only for the partners of the IS-ENES3 project	

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Executive Summary

IS-ENES services for European ESMs (Earth System Models) and Software Tools have been provided to the user community over the whole runtime of the IS-ENES3 project. This is a continuation and extension of services provided in earlier phases of IS-ENES. The current phase covers the following installations:

- the HadGEM/UKESM models by MetO

- the EC-Earth model by the EC-Earth consortium

- the NorESM model by met.no and UniRes

- the NEMO ocean model by CNRS-IPSL

- the OASIS coupler tool by CERFACS

- the XIOS I/O server by CNRS-IPSL and CERFACS

- the Cylc workflow scheduler and Rose suite toolkit by the MetO

- the ESMValTool for evaluation of model results by DLR, BSC and NleSC

These installations constitute the service endpoints for the user communities. The main objective for the services is the easy access to information, provision of interfaces between ESM or tool developers and users, and the definition of interfaces for feedback from user communities.

All services are continuously monitored using the following key performance indicators (KPIs):

- KPI 1: Number of released versions

- KPI 2: Active contributors

- KPI 3: Issues opened/closed

- KPI 4: Mails or forum messages exchanged

KPIs are gathered every 6 months from all service providers and cover in particular the provision of updated software to the user (KPI1), the activities to maintain momentum in the development (KPI2). The quantitative uptake of the services by users (KPI3+4) and the quantitative response activities by service providing groups (also KPI3+4).

This report concludes a high level of service activities for all KPIs and all participating service providing groups.

1. Objectives

The overarching objective for VA1/WP6 is to maintain, extend, and improve the services around the European Earth System Models (ESMs), the NEMO ocean model, and related critical infrastructure software tools. These services help to efficiently connect the respective development and user communities and thus support the usage and development of European ESMs as well as the exploitation of climate model data. In short, the services support the European climate modelling community.

In order to monitor the effectiveness of level 2 services for European ESMs (cf. task 2) and for European infrastructure tools (task 3), KPIs have been set up at the beginning of the project period. This deliverable describes the KPIs that were identified for the work package, reports the collected KPIs for the third reporting period, and other service activities in tasks 2 and 3.

2. Methodology and Results

2.1 Key Performance Indicators (KPIs) for VA1/WP6

The KPIs for this work package have been discussed among VA1/WP6 partners at the beginning of the project and have been chosen to match the following criteria:

- support sustainability for services covering IS-ENES phases 2 and 3
- make it reasonably easy for partners to deliver KPIs for ESM and software tools services

In particular, the following KPIs have been gathered every six months, starting in June 2019 and throughput the project:

KPI 1: Number of released versions

>   The number of releases and the respective version numbers that were published (through channels chosen by the respective group, e.g. public software repositories) during the reporting period. Used to track activity related to provision of improved software.

KPI 2: Active contributors

>   Number of people that have actively contributed to the development of the ESM/software tool during the reporting period. Could be retrieved from the version control system. Used to track development resources dedicated to serve the user community.

KPI 3: Issues opened/closed

The number of issues that were (i) opened, and the number of issues (ii) closed, in the issue tracking system of the ESM/software during the reporting period. Used to track (i) the level of service usage by the community, and (ii) the response by the development groups.

KPI 4: Mails or forum messages exchanged

Either the number of mail exchanges between developers and users or the number of messages exchanged in dedicated discussion forums concerning the ESM/software tool, accumulated during the reporting period. Used to track the service usage and interactions between ESM/software tool developers and users.

These KPIs reflect to a large degree the development cycle for large software development projects, which is in good agreement with the workflow of the participating institutes. Thus, all groups were able to regularly provide the KPIs without major overhead.

The KPIs reflect, on the other hand, the interaction between the modeling/development groups and their user community. KPI1 (releases), for example, indicates how users can rely on updated and improved versions of the software they need. Another example, KPI3, measures interactions both ways: The number of "issues opened" indicates how much users turn to the service providers, asking for help. Thus, this number provides an indication as to how much the service is used. The "issues closed" metric monitors the response of the service providers, as they answer the incoming questions or solve problems.

Even though a common set of KPIs is used for all models/tools, there are differences in the particular services individual groups offer. Some rely more on mails or forum messages, while others use their ticketing services much more extensively. Some use a more frequent release schedule, while others package larger changes in infrequent releases. Thus, the actual quantities of the KPIs can have systematic differences between the service providers. This had to be taken into account when evaluating KPIs between groups. Another aspect is the temporal evaluation of KPIs. There may be phases with high activity alternating with periods of lower service usage. The pre-CMIP6 phase is an example of intensive development for the ESMs, which leads presumably to a higher service activity levels.

The next two sections give a detailed list and evaluate the KPI collections for the two half-year periods in 2022. A summary of KPIs for all groups and collection periods is given in section 2.5.

2.2　7th half-year collection of KPIs

The seventh KPI period covers six months from 1 January 2022 until 30 June 2022.

Institute	ESM/tool	KPI 1 (versions)	KPI 2 (contributors)	KPI 3 (issues)	KPI 4 (messages)
CERFACS	OASIS	0	4	1 opened 7 closed	mail+forum 113
SMHI	EC-Earth	2 (3.3.4, 4.0)	23	73 opened 28 closed	
MetO	Cylc (core only)	5	7	139 opened 90 closed	forum 33
	Rose	5	5	19 opened 18 closed	
MetO	HadGEM UK-ESM	1	32	83 tickets	mail 363
CNRS-IPSL	XIOS	0	2	3 opened 0 closed	-
CNRS-IPSL	NEMO	1 (4.2.0)	19	42 opened 18 closed	Discourse 61
UniRes, met.no	NorESM	0	est. 30-40	9 opened 9 closed	forum ~200 email ~20000
DLR, BSC, NleSC	ESMValTool	10 1 ESMVtool 9 ESMVcore	25	ESMVtool 32 opened 57 closed ESMVcore 25 opened 48 closed	mail 27 Github forum ~5000

All development groups have reported KPIs and results show regular support activities. The diverse results regarding the interaction between developers and user community (KPIs 3 and 4) continues to be clearly visible in the statistics.

2.3 8th half-year collection of KPIs

The eights, and last, KPI period covers six months from 1 July 2022 until 31 December 2022.

Institute	ESM/tool	KPI 1 (versions)	KPI 2 (contributors)	KPI 3 (issues)	KPI 4 (messages)
CERFACS	OASIS	1 (OASIS3-MCT 5.2)	6	0	48
SMHI	EC-Earth	2 (3.3.3.2, 3.3.4.1)	29	24 opened 22 closed	
MetO	Cylc (core only)	7 (7.8.12, 7.9.7, 8.0.0, 8.0.1, 8.0.2, 8.0.3, 8.0.4)	7	110 opened 80 closed	forum 38
	Rose	4 (2019.01.8, 2.0.0, 2.0.1, 2.0.2)	3	14 opened 6 closed	
MetO	HadGEM UK-ESM	2	~45	162 tickets	800
CNRS-IPSL	XIOS	0	3	7 opened 1 closed	n/a
CNRS-IPSL	NEMO	0	23	46 opened 56 closed	Discourse 41
UniRes, met.no	NorESM	1	30-40	22 opened 14 closed	forum ~200 email ~20000
DLR, BSC, NleSC	ESMValTool	8 (2 ESMVT, 6 ESMVCore)	22	92 opened 94 closed	mail 32 Github ~5000

KPI reporting has been completed in this period, with all groups contributing to the statistics. Compared to previous results, this period shows regular activity on what appears to be a stable post-CMIP6 level.

2.4   Other service activities

As described in deliverable D6.5, the accessibility and quality of our services for European ESMs and software tools, provided collaboratively via the ENES Portal pages, have been assessed for the second time by two external reviewers. The positive evaluation was taken into account during the re-design of the ENES portal pages (Services section), such as the need to simplify the section's overall structure.

A dedicated effort has been made during the reporting period by the UK MetO to improve the Cylc User Guide and complement the documentation with a Migration Guide to aid the transition from Cylc version 7 to version 8 for users.

The ESMValTool team has organised a webinar and a workshop during the reporting period[1]. The one-hour webinar had about 50 participants online and covered a general overview of ESMValTool. The four-hour workshop included a hands-on session on DKRZ machines and provided ca. 25 participants with a practical introduction on how to run the tool. Both events were particularly aimed at broadening the ESMValTool user base and targeted specifically impact researchers.

2.5   KPI Summary and overview

KPIs have been continuously collected over the course of IS-ENES3, which allowed for a precise monitoring of the services around the development of models and tools for the climate modelling community in Europe. This monitoring covers common development workflows and service end points provided by the participating IS-ENES3 partners.

KPIs 1 and 2 reflect the level of development activities for models and tools, the service being to provide the community with high-quality software products. By tracking the number of active developers (KPI2) and released versions (KPI1) the indicators allow to measure the services qualitatively and quantitatively.

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1 See https://is.enes.org/training-detailed/#esmvaltool-training
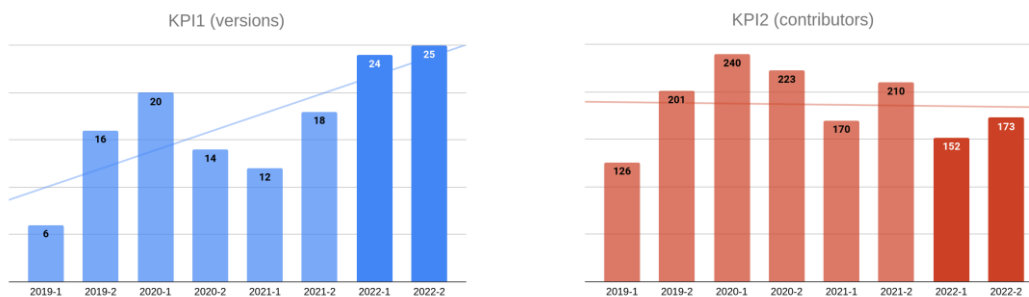
The plots above show the development of KPI1 (number of released versions, left plot) and KPI2 (number of active contributors, right plot) over the course of IS-ENES3 (8 reporting periods from 2019 to 2022 on the x-axes of the plots). The two most recent collection periods, particularly covered in this deliverable, are highlighted. A trend line has been added to indicate the general KPI development over the whole time period.

Note that the KPIs in these and all following plots have been aggregated for all individual services. This is done in order to illustrate the overall service activities of the work package. Hence, the numbers given in the plots are the sums for the KPIs for the respective model/tool development groups. In order to see the individual results, the reader is referred to the tables in sections 2.2 and 2.3.

Both KPIs are maintained quantitatively over the whole period, which indicates well-functioning services. The number of released versions shows a distinct positive trend, whereas the number of active developers is more or less stable. We note, however, that the positive trend in released versions is sustained by the frequent release schedule of some of the tools covered and not evenly seen across development groups.

There is also a distinct peak in KPIs 1+2 from mid-2019 to mid-2020, which can be seen in most of the KPIs. We attribute this increased activity to the CMIP live cycle, particularly the CMIP6 phase, which triggered intense development phases for models and tools.

KPI 3 (sub-divided into KPI3a and 3b) covers the developer-user interaction by measuring the opening (by users) and closing (by developers) of issues directed to the development groups. As such, it indicates service end points being activated by the user community and service requests being answered by VA1/WP6 development groups.
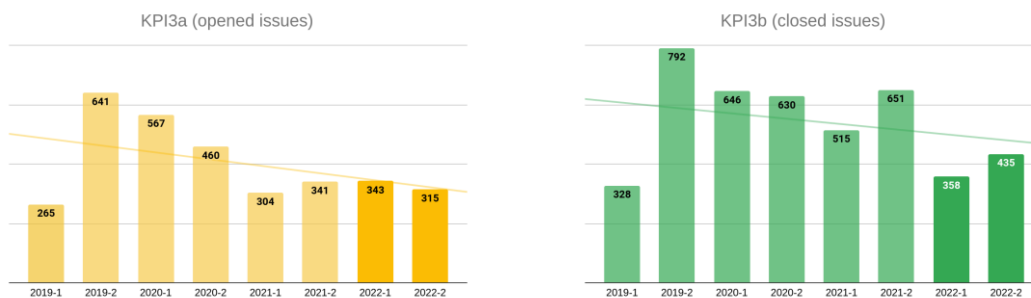

Also these KPIs prove a well maintained level of service activities over the whole project. The peak in activities during development for CMIP6, as mentioned before, creates a somewhat negative trend because these peaks are in the earlier phase of the range. However, it is apparent that the level of activities is stable in the post-CMIP6 period and does not decline below the early levels measured in the project.

Also the last KPI4 measures direct interaction between service providers and the community by covering messages sent between those groups as mails or forum messages:

KPI4 (mail and forum messages)
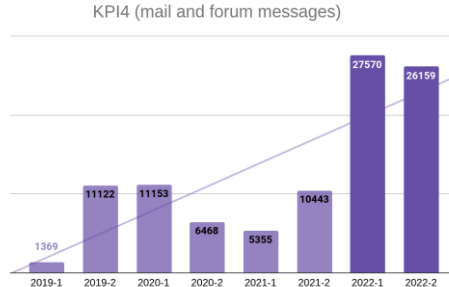
This is a complementary measure to KPI3, because it captures interactions for groups that are not using issue tracking systems to the same extend as others. However, also it appears to be a measure that is somewhat difficult to quantify, because it depends heavily on the actual communication system used and also the user community context. Some of the groups (NEMO, NorESM, ESMValTool) have switched to new communication channels (Discord, Github, email lists), which vastly increased the volume of communication. This is clearly visible during the last two KPI collection periods, which is dominated by the values for the NorESM and ESMValTool groups. Nevertheless, even KPI4 indicates a well-maintained level of services.

The following figures shows, as comparison, a KPI summary for all models and tools, and for all reporting periods. Displayed are KPIs 1 (released versions, blue), 2 (active developers, red), 3a (opened issues, yellow) and 3b (closed issues, green) over all 8 KPI reporting periods from 2019 to 2022:

KPI summary
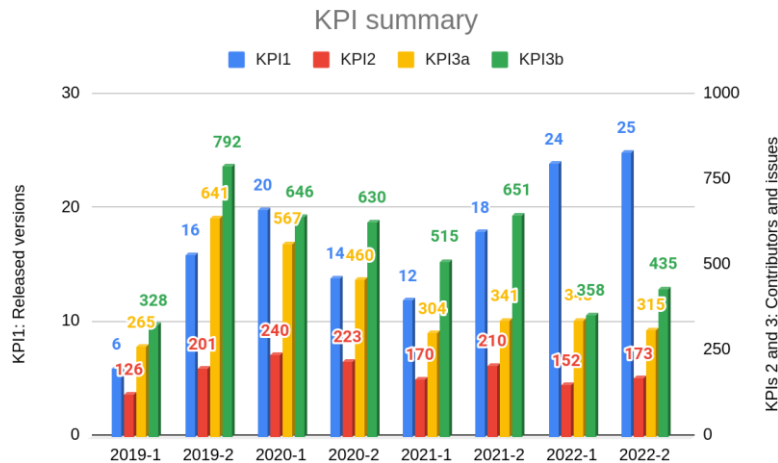
KPI4 has been excluded from this figure because of the changing context and therefore large variation over the project period. This overall view confirms the findings for the individual KPIs, namely that the VA1/WP6 services for models and tools are well maintained over the course of the

project. The intensive development period in support for the CMIP6 experiments stands out in this summary, but it also shows that services are maintained afterwards.

3. Conclusions and Recommendations

IS-ENES3 Services on European ESMs and software tools have been maintained and further developed over the course of the IS-ENES3 project. Four software tools (OASIS, Cylc/Rose, XIOS, ESMValTool), three ESMs (EC-Earth, HadGEM/UK-ESM, NorESM) and the NEMO ocean model have been regularly reporting service KPIs, which is an extension in the coverage of European models and tools compared to the previous IS-ENES2 phase.

All ESMs and tools have maintained a high level of service activities, as already proven by the KPIs of the previous reporting periods. All groups have actively developed their software (KPI2) and practically all have provided new versions to their respective users (KPI1). The services are widely used by the community (KPI3, opened issues) and all groups make great effort in providing help to users (KPI3, closed issues). While many groups rely on issue tracking for user interaction, some other forms, like forums and mailing lists, are also used.

There are, overall, quantitative differences between groups, regarding the users interactions covered by KPI3 and KPI4. This reflects to a large degree the differences in the respective user groups, mostly regarding the size, but possibly also the structure (e.g. development vs downstream usage).

While some of the differences in KPI values may be natural and explained by different development and support workflows, as well as the characteristics of the respective user communities, the differences between groups could also be an incentive to review the way the groups work. For example, it appears that some groups have adopted a rather frequent release schedule for the software, while others have not. The KPI assessment could be used to propagate best practices in software development among the project partners.