

GLORI4DE

GLObal to Regional Icon for Destination Earth

*Gabriella Scipione, Massimo Gisonni, CINECA
October 16th, 2024*



Funded by
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Destination Earth

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GLORI

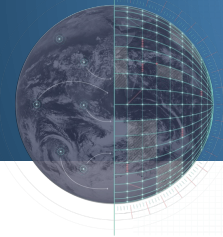
GLObal to Regional | ICON Digital Twin



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GLORI4DE: a European collaboration project



*Gabriella Scipione
Gian Franco Marras
Massimo Gisonni
Fabio Di Sante
Matteo Ippoliti*



*Davide Cesari
Virginia Poli
Thomas Gastaldo
Alfonso Ferrone*

*Thomas Geenen
Emanuele Danovaro*



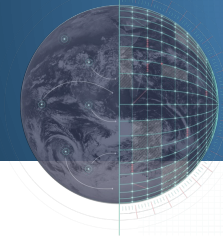
*Carlo Cacciamani
Chiara Marsigli
Eva Merloni*



*Gabriella Ceci
Angelo Campanale
Mario Raffa*



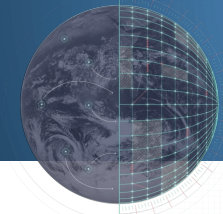
*Roland Potthast
Michael Kraye
Thorsten Steinert
Xu Xu*



GOAL: make GLORI interoperable with DestinE system

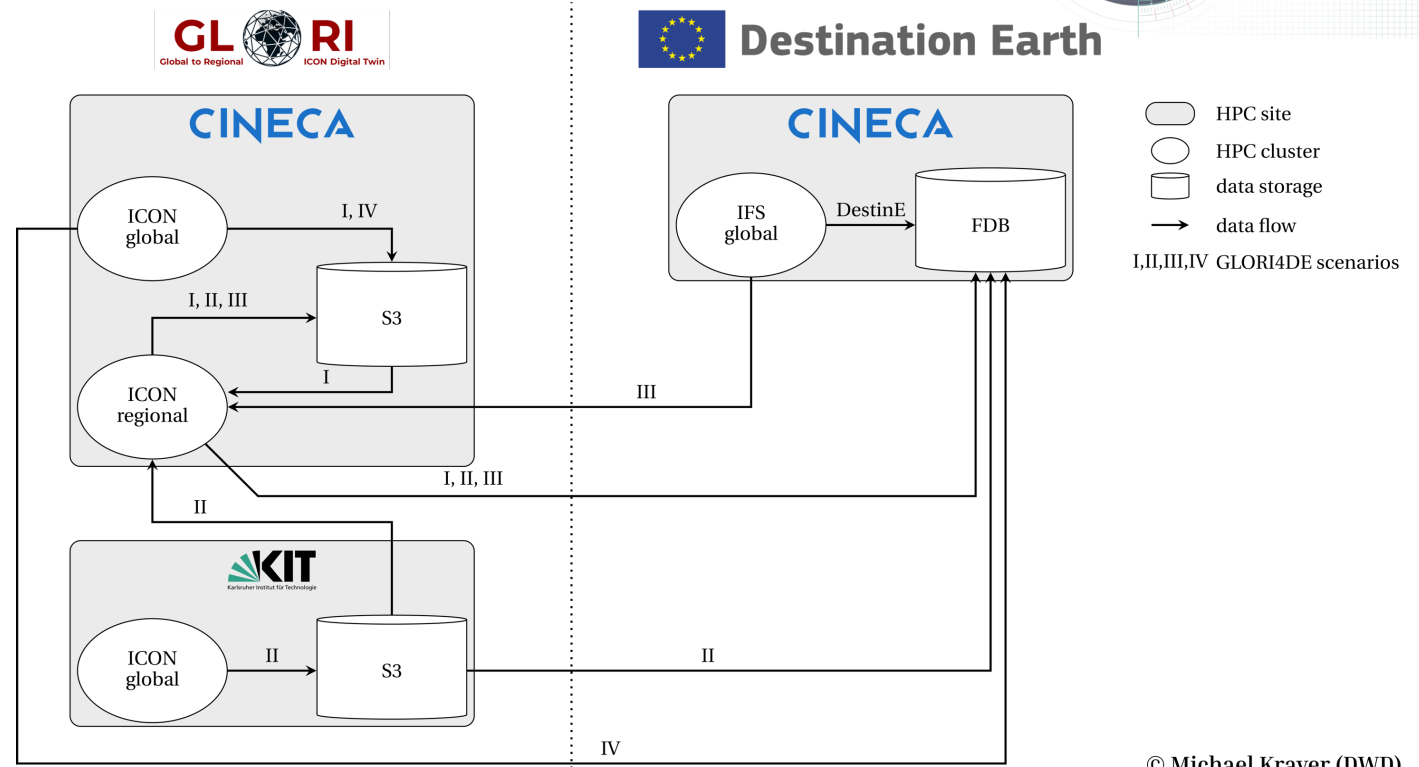


- **Enhanced Regional models forecasts:** take boundary and initial conditions from either *DestinE* (IFS) or *GLORI* (ICON) to trigger simulations of regional models
- **Integrate key services from *Destination Earth*:** Data Lake, FDB, ecFlow, Polytope, Aviso
- **Coordination with *GLORI* (CSCS, DWD):** test and assess ICON workflow, develop shared framework for data transfer (S3) amongst COSMO consortium sites
- **Test the *GLORI4DE* workflow on use case scenario:** analysis of the May 2023 Emilia-Romagna flood event



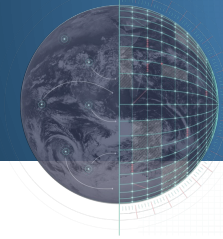
GLORI4DE roadmap

- **Four different scenarios** were identified to test the workflow
- Either an *ICON* or *IFS global run* is executed
- **Boundary & initial conditions** are retrieved *locally*, via S3 or through FDB
- Hence used for an *ICON-LAM* run and the output saved to *FDB*

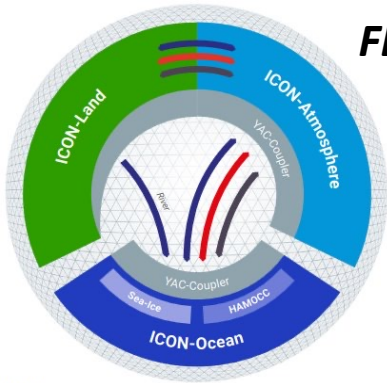


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Scenarios	Global model	Data movement (boundary & initial conditions)	Regional model	Final output
<i>I: Pure GLORI</i>	ICON on LEONARDO	Locally from LEONARDO filesystem	ICON-LAM on LEONARDO	FDB
<i>II: GLORI + Data Movement</i>	ICON on HoreKa	S3 data migration from HoreKa to LEONARDO		
<i>III: DE + ICON-LAM</i>	IFS on LEONARDO	Via MARS request		
<i>IV: GLORI + FDB</i>	ICON on LEONARDO	ICON output on FDB, retrieve via MARS request		



Integration with DestinE: FDB pipeline and ecFlow



FDB: creation of a pipeline to write *ICON* output on FDB (**ICON-YAC-YACO-FDB**) *

- On *ICON*, the **YAC coupler** (Yet Another Coupler) is switched on, and the *variables needed as boundary/initial conditions* for the regional models passed to the coupler
- The **Yaco** tool, is *run concurrently*, receives data from YAC and writes in FDB format
- An **FDB-schema** is provided, describing the data being stored and written
- The final **FDB output** is saved, atm, in a local FDB server in LEONARDO

ecFlow: creation of suites for handling the *workflow of the different scenarios*

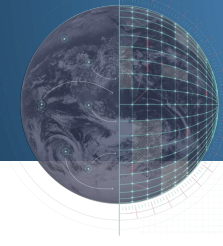
- The main *ICON* workflow (data assimilation, integration of initial and boundary conditions) is handled via **DWD Bacy software**
- An **ecFlow suite** is created for each scenario, wrapping the call to Bacy and integrating the rest of the GLORI4DE workflow (triggering of global/regional runs, data movement)

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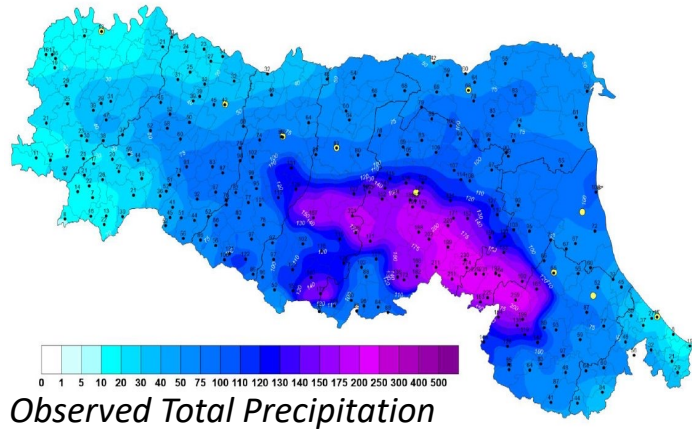
GLORI4DE > scenario_1 > ICON_lam > create_symlink_missing_analysis
├─ GLORI4DE ▲
│  └─ scenario_1
│     └─ ICON_global
│        ├── download_from_s3 ▲
│        ├── create_symlink_input_global
│        │  └─ download_from_s3 == complete
│        ├── global_cycle ▲
│        │  └─ create_symlink_input_global == complete
│        ├── global_more_init_ana
│        │  └─ global_cycle == complete
│        └─ move_and_link_output_bc ▲
│           └─ global_more_init_ana == complete
└─ ICON_lam
   ├── ICON_global == complete
   ├── create_lam_dirs
   ├── lam_prep_int2lm
   │  └─ create_lam_dirs == complete
   ├── lam_int2lm
   │  └─ lam_prep_int2lm == complete
   ├── lam_save_int2lm
   │  └─ lam_int2lm == complete
   ├── lam_prep_more
   │  └─ lam_save_int2lm == complete
   ├── create_symlink_missing_analysis
   │  └─ lam_prep_more == complete
   ├── lam_more
   │  └─ create_symlink_missing_analysis == complete
   └─ lam_save_more
      └─ lam_more == complete
  
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*Thanks to all people who are helping us understanding the pipeline! René Redler, Oliver Heidmann, Jairo Segura, Moritz Hanke, Emanuele Danovaro, Florian Prill

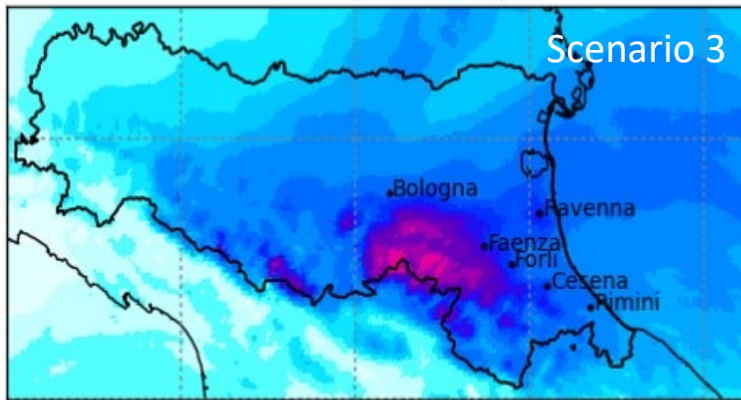


Use case with regional focus: Emilia Romagna flood event

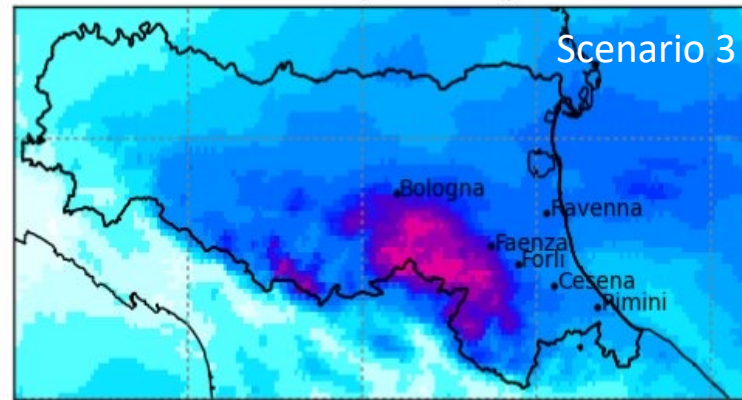


- During May 2023, Emilia-Romagna was hit by severe *flood events*
- *COSMO*, the production model at the time, failed to predict accurately the intensity and location of the precipitations
- We rerun the simulations via **Scenario3 of GLORI4DE (IFS + ICON-LAM)**
- The **IFS** data were retrieved via a MARS request and the initial/boundary conditions adapted for an **ICON-LAM** run via the *ICON Tools* software
- The output showed a clear **improvement with respect to the COSMO** forecasts

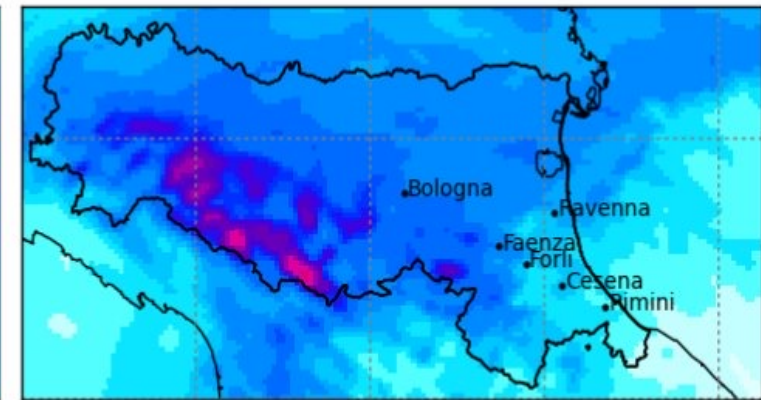
ICON 1km IFS driven (hindcast)



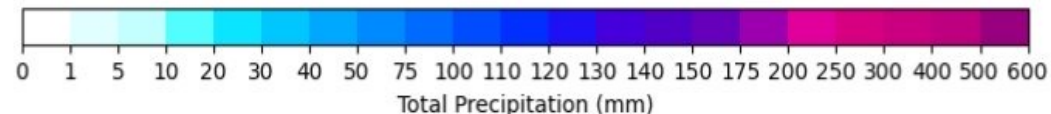
ICON 2km IFS driven (hindcast)

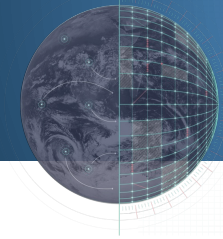


COSMO 2km ERA5 driven



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Main achievements



Next steps

- *Deployment and testing of the latest version of **ICON-nwp** on **LEONARDO***
- *Definition of a workflow for running **ICON** on **LEONARDO** retrieving initial **data from an external centre (HoreKa, via S3)***
- *Definition of a pipeline to write **ICON** output on **FDB***
- *Definition of **ecFlow** suites handling the **GLORI4DE** different scenarios*
- *Collaboration between a number of **different institutions***

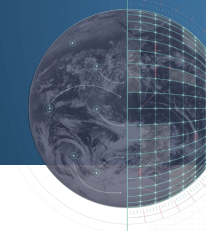
- *Finalizing the **FDB** pipeline employing an **external fdb server***
- *Implementation of **Polytope** and **Aviso** components in the **GLORI4DE** workflow*
- *Integration of the **ocean component** for **ICON-LAM***
- *Local authorization for running **GLORI4DE** in a production environment (**data access, management, movement**)*
- *Development of a tool for **output** visualization*



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THANKS FOR THE ATTENTION!

