

RESPONSIBLE HPC WORKSHOP, REYKJAVIK DOWNTOWN

Applications – Simulation & Data Labs in Iceland

Prof. Dr. – Ing. Morris Riedel et al.

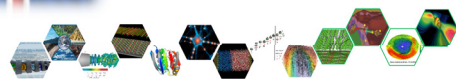
Full Professor, Computer Science Department, University of Iceland
EuroHPC Joint Undertaking Governing Board Member for Iceland



EuroHPC
Joint Undertaking



**IHPC National Competence Center
for HPC & AI in Iceland**

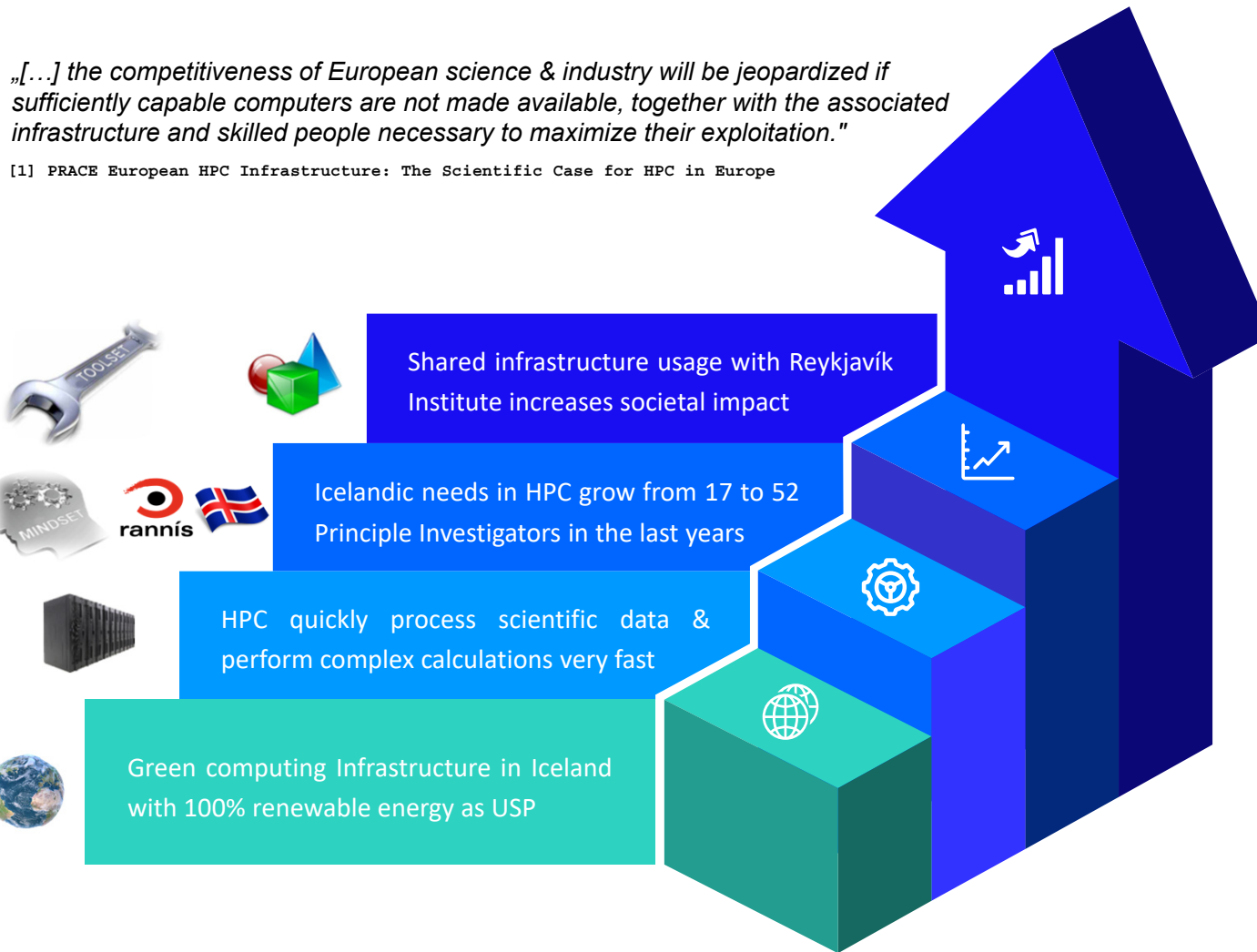


**FACULTY OF INDUSTRIAL ENGINEERING, MECHANICAL
ENGINEERING AND COMPUTER SCIENCE**

HPC Application Example – Societal Impact

„[...] the competitiveness of European science & industry will be jeopardized if sufficiently capable computers are not made available, together with the associated infrastructure and skilled people necessary to maximize their exploitation.”

[1] PRACE European HPC Infrastructure: The Scientific Case for HPC in Europe



Avalanche Simulation at Flateyri, Iceland

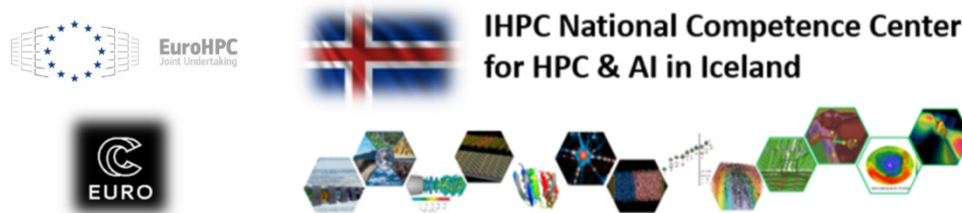
granular flow in OpenFOAM, based on a regularized $\mu(I)$ rheology
spatial resolution 0.5 m, 25 million cells
velocity magnitude (m/s) on top of 0.1 volume fraction iso-surface
ongoing project in collaboration with:
Veðurstofa Íslands



[2] Tómas Jóhannesson, Icelandic MetOffice, 3rd IHPC Workshop



EuroCC Activities – Selected Benefits towards Bottom-Up Community Building & Competence Maps



[3] Icelandic HPC Community Web page

- Simulation & Data Lab Communities
 - Experts w.r.t. HPC in domain-specific topics
- Based on extensive community experience
 - Juelich Supercomputing Centre in Germany works with the model for ~18 years



Simulation and Data Lab Computational Chemistry

General Information

Advancement of theory and methodology for atomic scale simulations, with broad ranging applications for chemistry and physical chemistry, reaction rate theory, adsorption spectroscopy, and magnetism, to name a few.

Prof. Hannes Jonsson

Dr. Elvar Örn Jónsson

Development of explicit polarizable classical solvent models and methodology for hybrid simulations coupling classical and quantum mechanics for the simulation of solvated molecules and the solid / liquid interface.

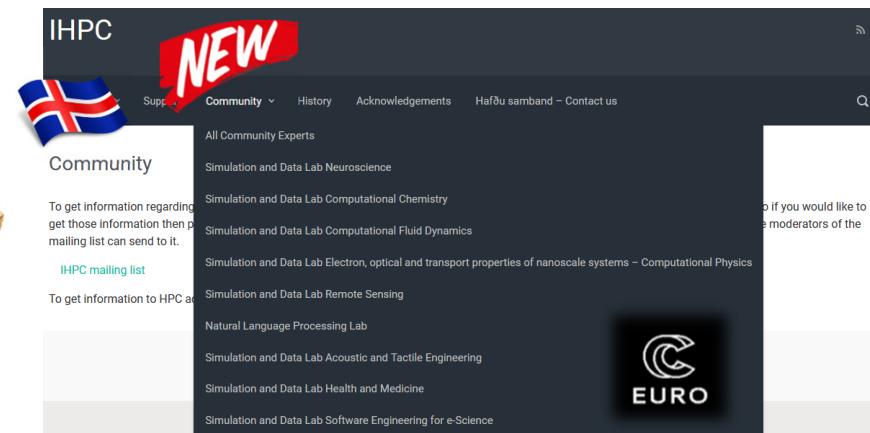
Dr. Pavel Bessarab



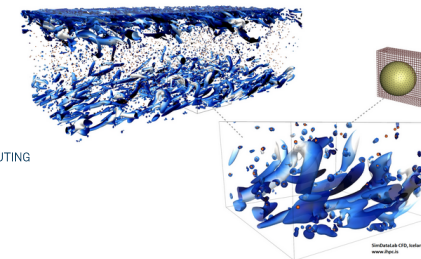
[7] Juelich Supercomputing Centre, Simlabs

[9] IHPC SimDataLab Computational Chemistry Web Page

<http://ihpc.is> Website



Simulation and Data Lab Computational Fluid Dynamics



Dr. Pedro Costa



Dr. Ásdís Helgadóttir



Ph.D. Student S. Reza Hassanian, M



Prologue

The Simulation and Data Lab computational fluid dynamics (SimDataLab CFD) is leading parallel computing in Computational fluid dynamics in Iceland at the University of Iceland. The SimDataLab is Iceland's representative in the international projects in CFD and parallel computing. SimDataLab CFD aims to develop parallel code applications in CFD and support users who have already developed parallel application codes. SimDataLab CFD participates in the European project network in parallel computing and has an infrastructure and access to powerful parallel systems in-memory optimization, processing system architecture, high scalability, and have performance optimization computer nodes.

[8] IHPC SimDataLab CFD Web Page

HPC Application Example – Supporting Startups



IHPC National Competence Center for HPC & AI in Iceland

Simulation and Data Labs of NCC Iceland

The NCC Iceland consists of a variety of **Simulation and Data Labs (SDLs)** that offer their expertise, skillset, and specific application community knowledge within NCC Iceland to interested national and international collaborators.

1. Simulation and Data Lab Neuroscience
2. Simulation and Data Lab Computational Chemistry
3. Simulation and Data Lab Computational Fluid Dynamics
4. Simulation and Data Lab Remote Sensing
5. Simulation and Data Lab Electron, optical and transport properties of nanoscale systems – Computational Physics
6. Natural Language Processing Lab
7. Simulation and Data Lab Acoustic and Tactile Engineering
8. Simulation and Data Lab Health and Medicine
9. Algorithmic Mathematics Lab
10. Simulation and Data Lab Software Engineering

[3] Icelandic HPC Community, ihpc.is



Joint Laboratories with Industry

Maintain identity with dual affiliations, but increase & enlarge international visibility & win additional grants



ILLINOIS
NCSA | National Center for Supercomputing Applications

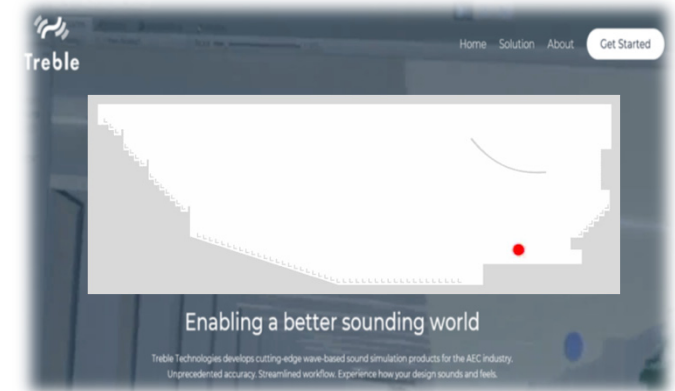
TACC
TEXAS ADVANCED COMPUTING CENTER

National Science Foundation
WHERE DISCOVERIES BEGIN

Icelandic HPC Community

Simulation & Data Labs in a wide variety of science & engineering disciplines in Iceland & industry

Applications – Simulation & Data Labs in Iceland



[4] Finnur Pind, Treble Technologies SME, 1st IHPC Workshop



HPC Application Example – NLP @ Iceland



PI: Hafsteinn Einarsson, assistant professor in CS at the University of Iceland, co-founder of Nordverse, and research scientist at deCODE

Product used heavily: ‘used like Google Translate – but better for Iceland’

To appear at LREC 2022

- Transformer-based language models for Icelandic
- Reading comprehension dataset and models for Icelandic
- Entity linking dataset and models for Icelandic
- Games for crowdsourcing language resources

To appear at NAACL 2022

- Open QA for Icelandic (winner of the incentive innovation award at the University of Iceland 2021)

In preparation

- Summarization models for Icelandic
- App for learning to read in Icelandic with s2t and t2s functionality

Applications – Simulation & Data Labs in Iceland



Vésteinn
Snæbjarnarson



Haukur Barri
Símonarson



Pétur Orri
Ragnarsson



Svanhvít Lilja
Ingólfssdóttir



Haukur Páll
Jónsson

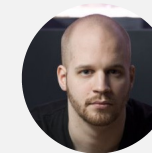


Vilhjálmur
Þorsteinsson

Entity linking for Icelandic



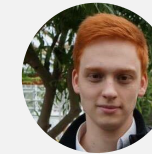
Steinunn Rut
Friðriksdóttir



Hjalti
Danielsson



Valdimar Ágúst
Eggertsson



Benedikt Geir
Jóhannsson



Hrafn
Loftsson

Students working in NLP



Þuríður
Hilmarsdóttir



Alexander
Guðmundsson

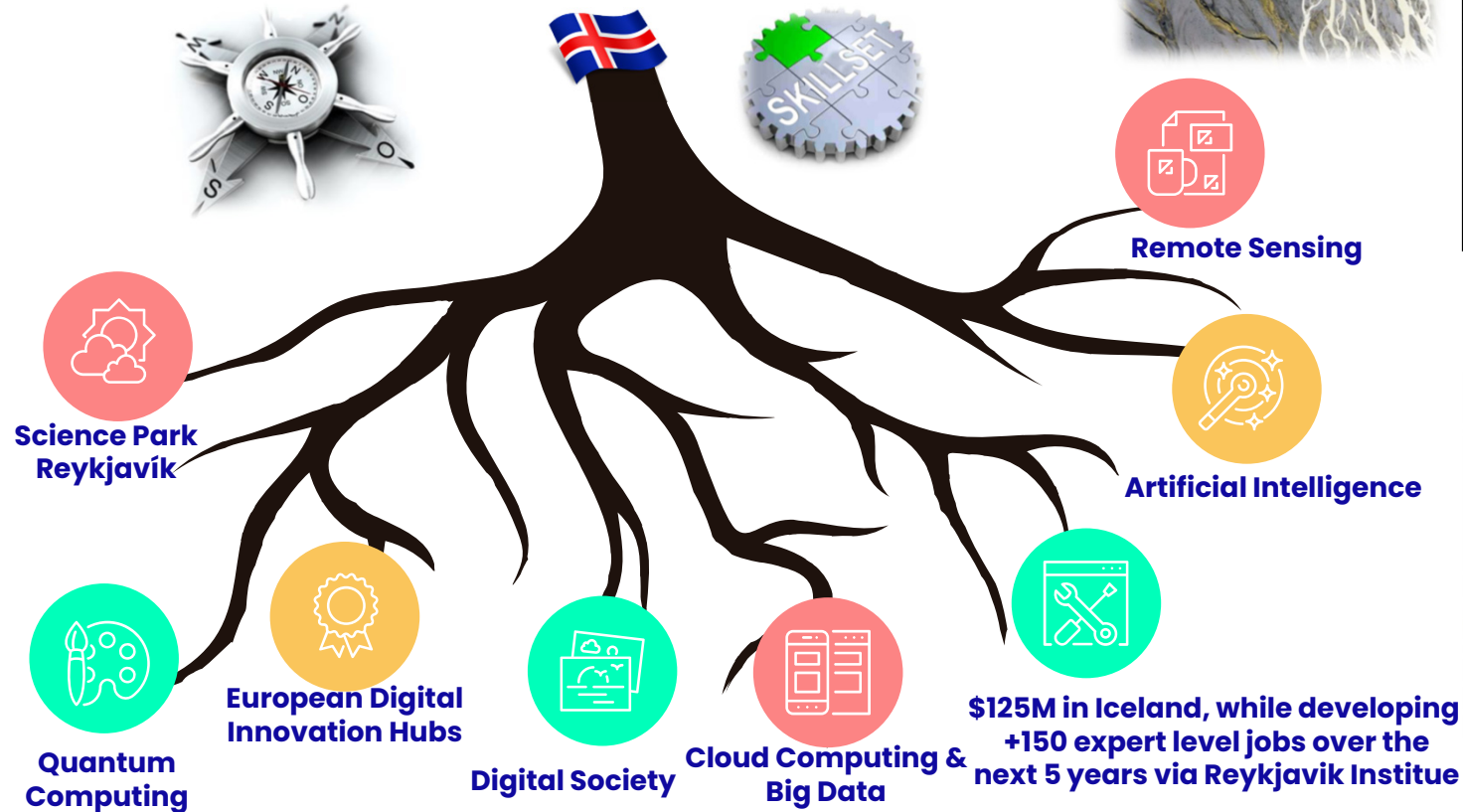


Þór
Sverrisson

HPC Application Example – Big Data Sets

„Advanced Computing is a research or engineering capability built using technologies and processes to deliver clear business value and impact. It is not just supercomputing, Artificial Intelligence/Machine Learning, and Quantum Computing”

[5] Dan Stanzione, executive Director, TACC, HPC Leaders Summit 2021



Applications – Simulation & Data Labs in Iceland



[6] ESA Sentinel 2 satellite data source for earth sciences



References

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- [2] Tómas Jóhannesson, Icelandic MetOffice, presentation at the 3rd IHPC Workshop, 2021-12-15, Online:
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- [3] Icelandic HPC (IHPC) – National Competence Center for HPC & AI Community, Online:
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- [5] Dan Stanzione, executive Director at TACC HPC Center, HPC Leaders Summit 2021, Online:
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- [6] ESA Sentinel 2 satellite data source for earth sciences, Online:
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- [7] Juelich Supercomputing Centre (JSC) Simulation and Data Labs, Online:
https://www.fz-juelich.de/ias/jsc/EN/Expertise/SimLab/simlab_node.html
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- [9] Icelandic HPC Simulation and Data Lab Computational Chemistry, Online:
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- Euro High Performance Computing (HPC) Joint Undertaking, Online:
<https://eurohpc-ju.europa.eu/>





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