ETH zürich

Sovereign AI and Data: Advancing Supercomputing to the next Level

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CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

Dimensions of Sovereign AI

- Infrastructure: control data centres, hardware and software
- Data sovereignty: data storage, processing and training abide by ruling law
- Model sovereignty: developing and training “local” AI models
- Operational control: retaining authority to operate, govern and control AI systems

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MENU

USER PORTAL

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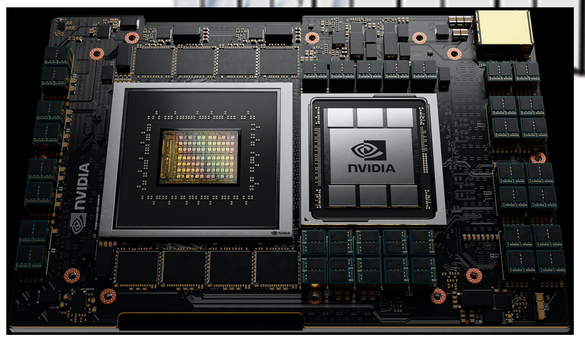
World’s Most Powerful AI-Capable Supercomputer?



GH200

CSCS, Hewlett Packard Enterprise and NVIDIA Announce World’s Most...

12.04.2021

"Alps" system to advance research across climate, physics, life sciences with 7x more powerful AI capabilities than...

MORE

MORE SCIENCE

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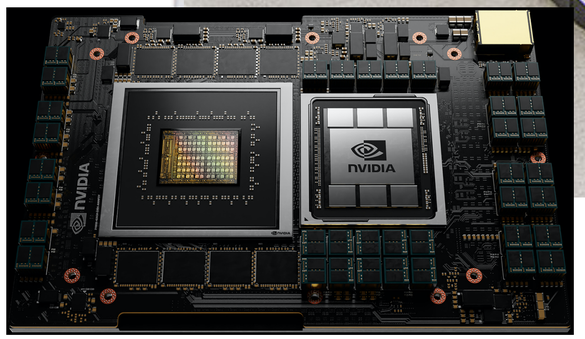


GH200

MORE SCIENCE

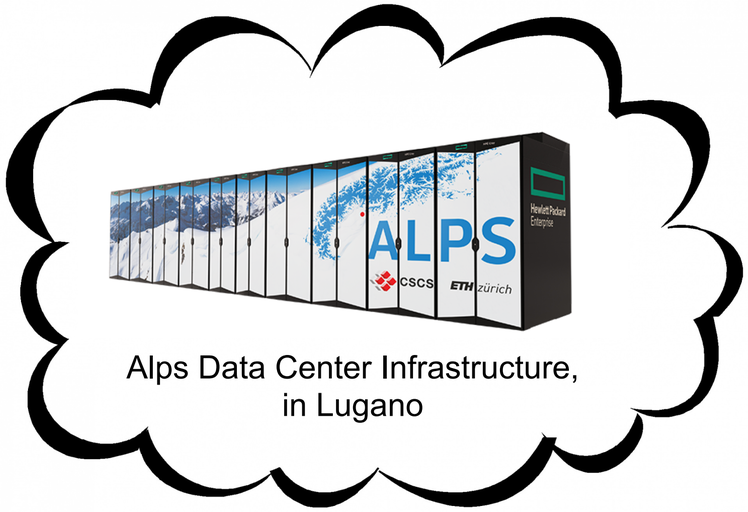

ALPS
CSCS


ALPS

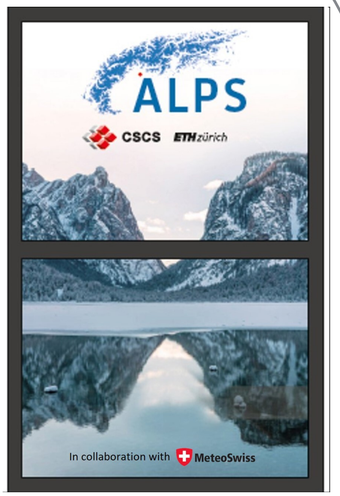

ALPS
CSCS

Alps data hyper-cube at ECMW in Bologna

IFS running @ ECMF in Bologna



Alps Data Center Infrastructure,
in Lugano

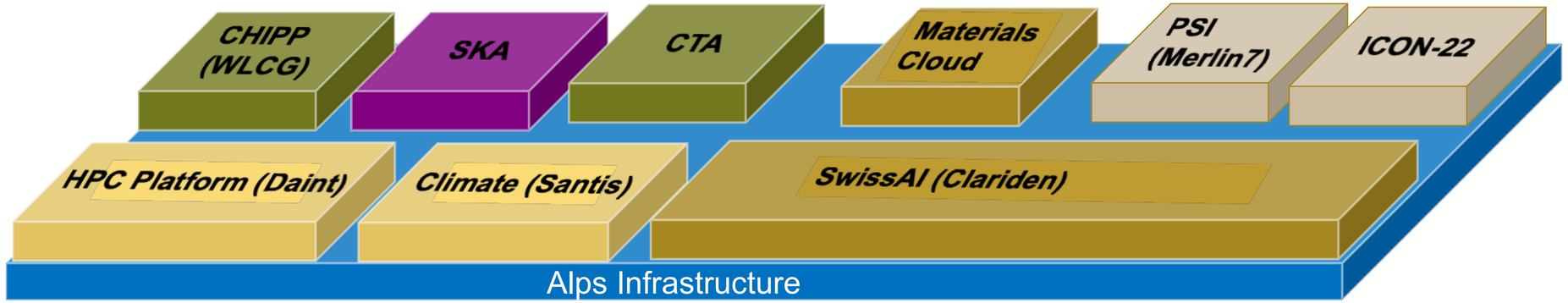


Alps Data Hypercube
in Bologna

ECMWF MARS archive in Bologna

Cloud-native systems architecture

To a particular community, a platform will look like a dedicated supercomputer



vClusters/vServices

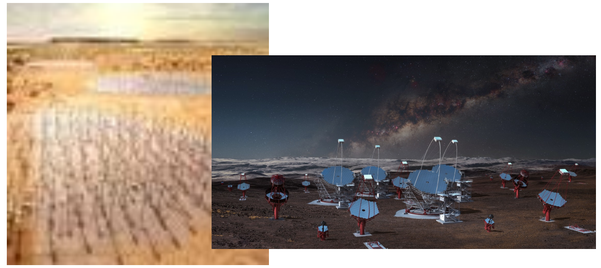
FIRECREST

SARUS

Slingshot network

Cray System Management (CSM) software (μ-service arch.)

Alps: several mission critical applications at scale



APERTUS

EPFL ETH zürich CSCS

8B & 70B fully open LLM

eteoSwiss

CHIPP (WLCG)

SKA

CTA

HPC Platform (Daint)

Climate (Santis)

SwissAI (Clariden)

Alps Infrastructure

User Program (HPCN)

EXCLAIM

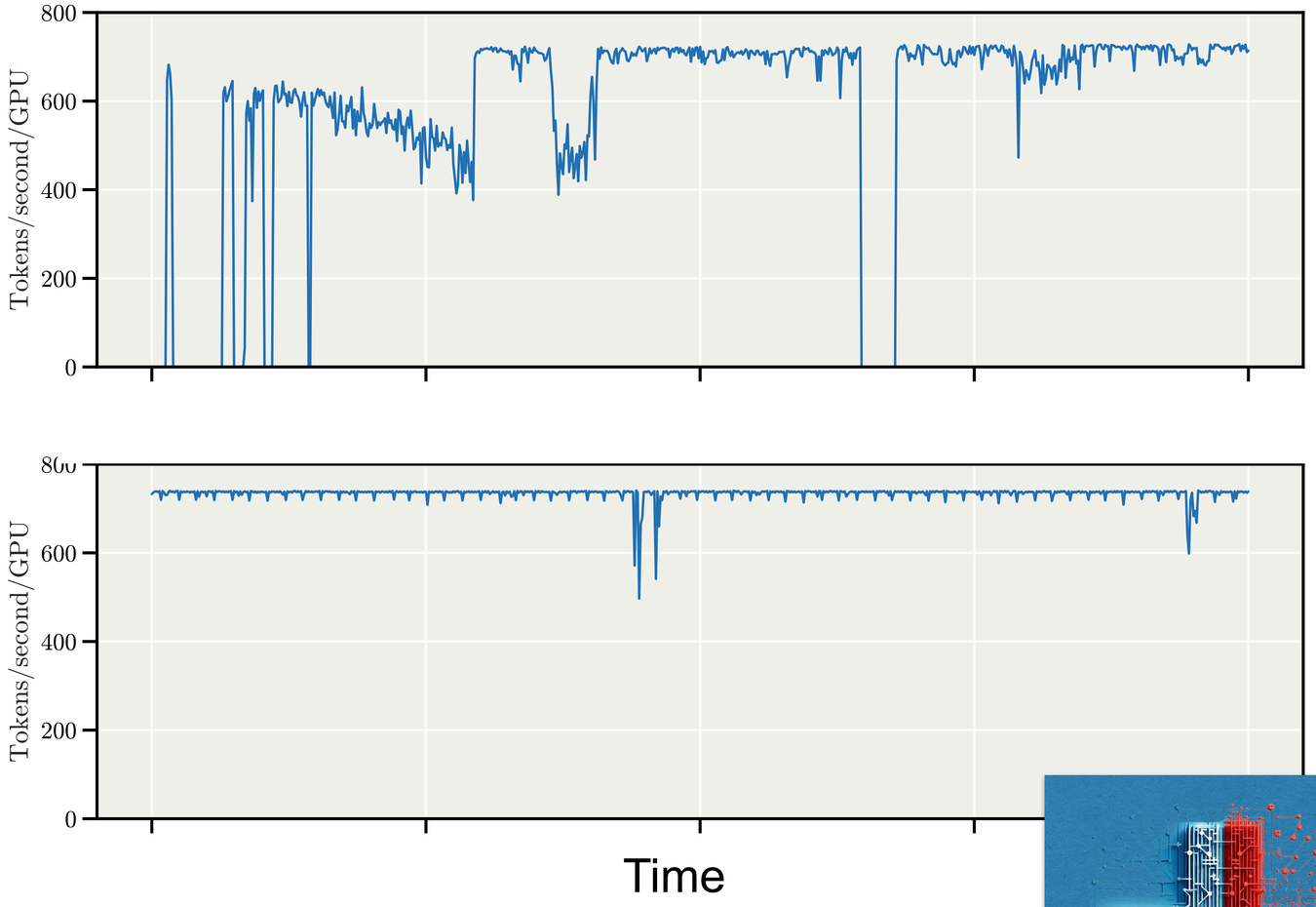
C2SM Center for Climate Systems Modeling

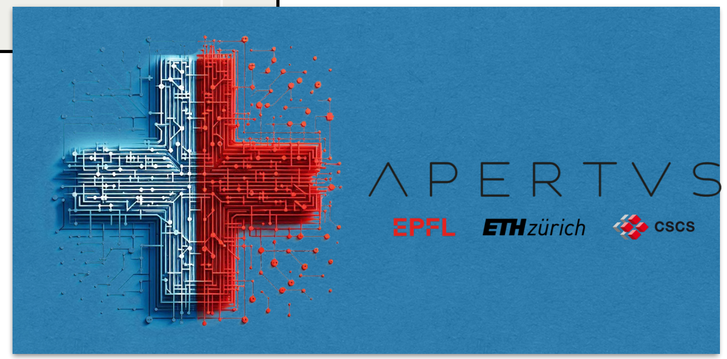
EPFL AI Center

ETH AI CENTER

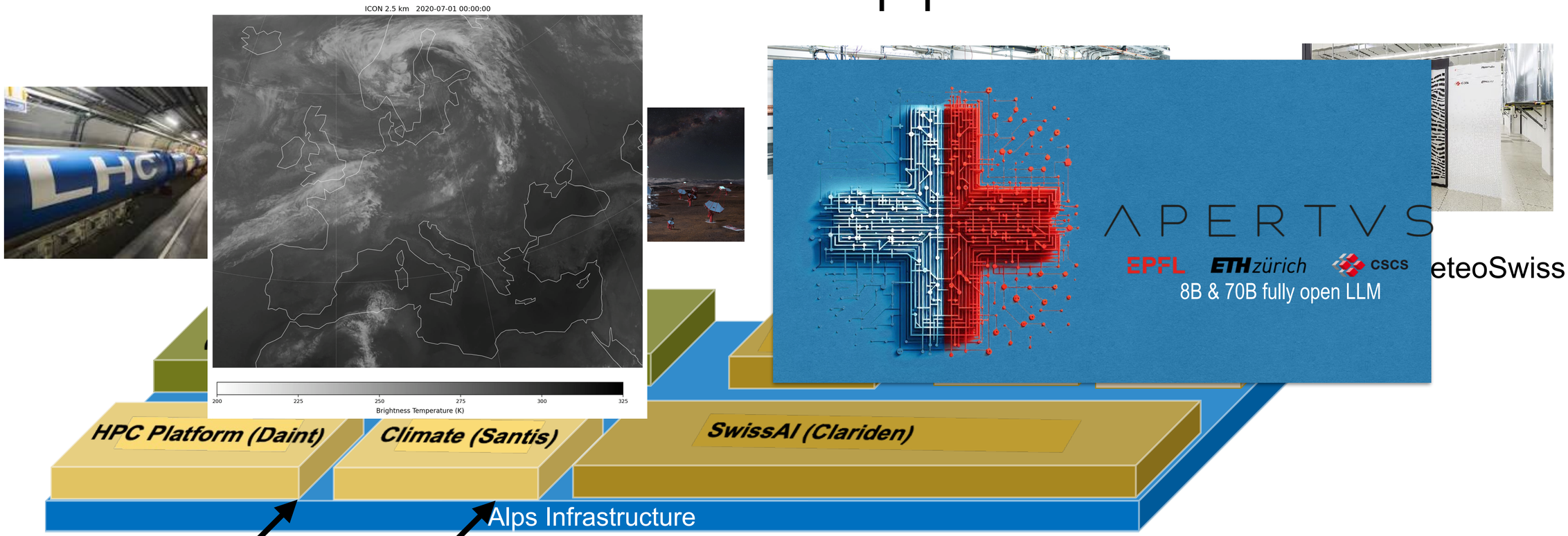
Before

After





Alps: several mission critical applications at scale



User Program (HPCN)

EXCLAIM

C2SM
Center for Climate
Systems Modeling

EPFL
AI Center

ETH AI CENTER

ETH zürich

ICON

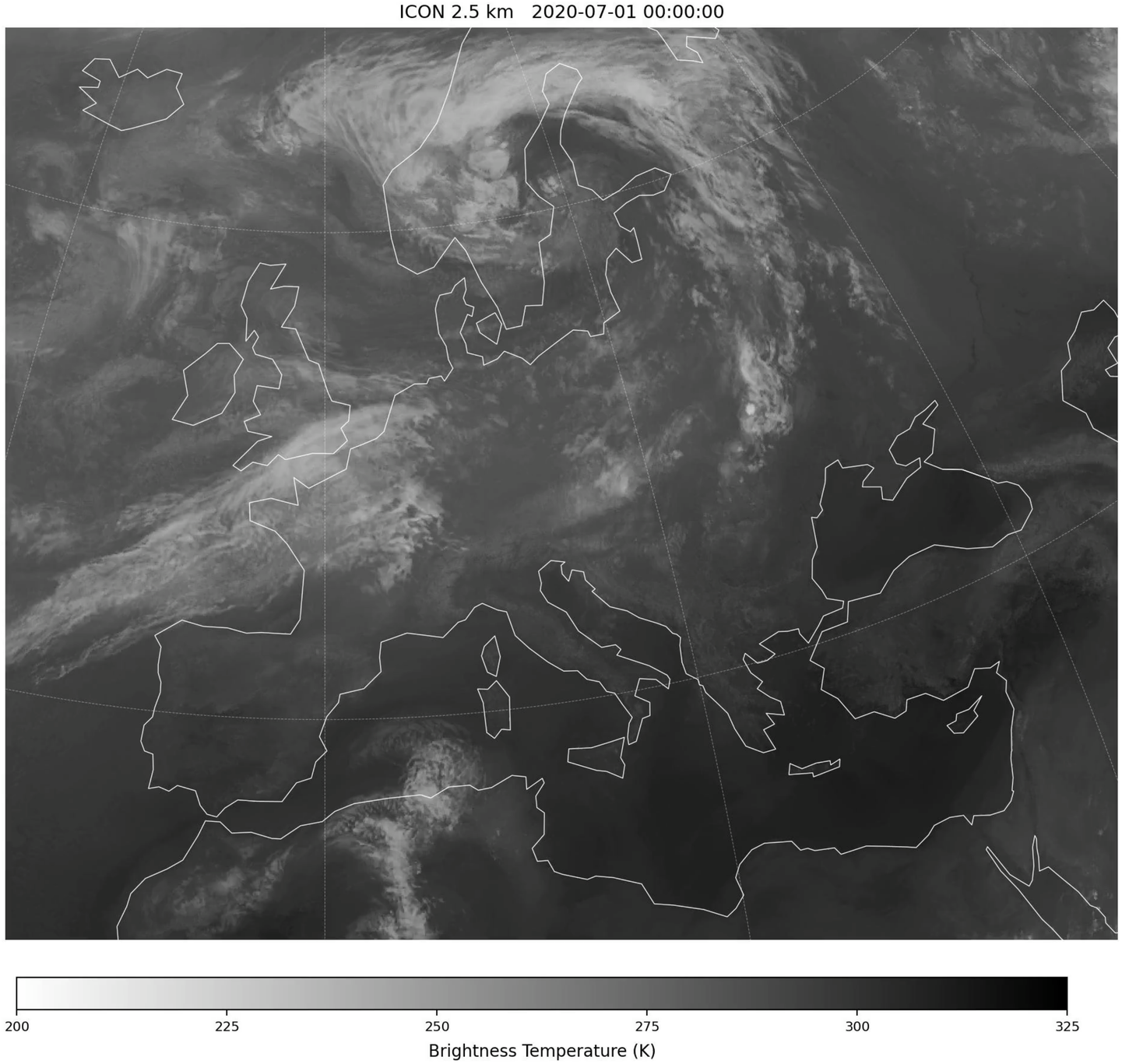
Cloud field from Icosahedral Nonhydrostatic (ICON) 2.5 km model simulation

- Period: 2020-01-20 to 2024-04-01
- 15 min. precipitation
- hourly output of other forcing variables

cscs

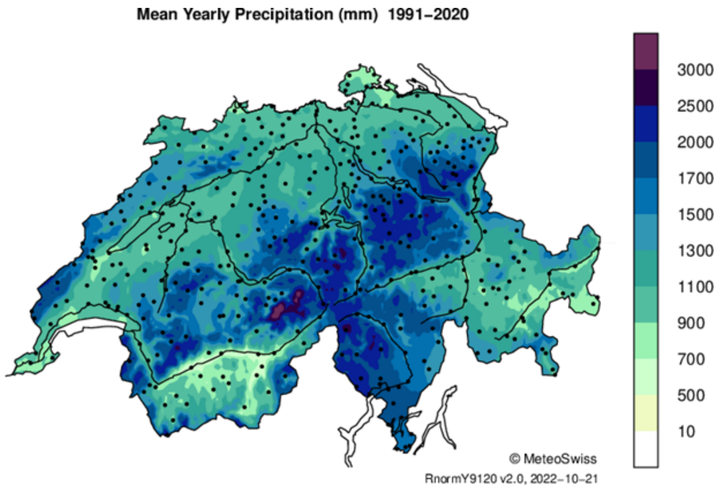
XCLAIM

GridTools 4python



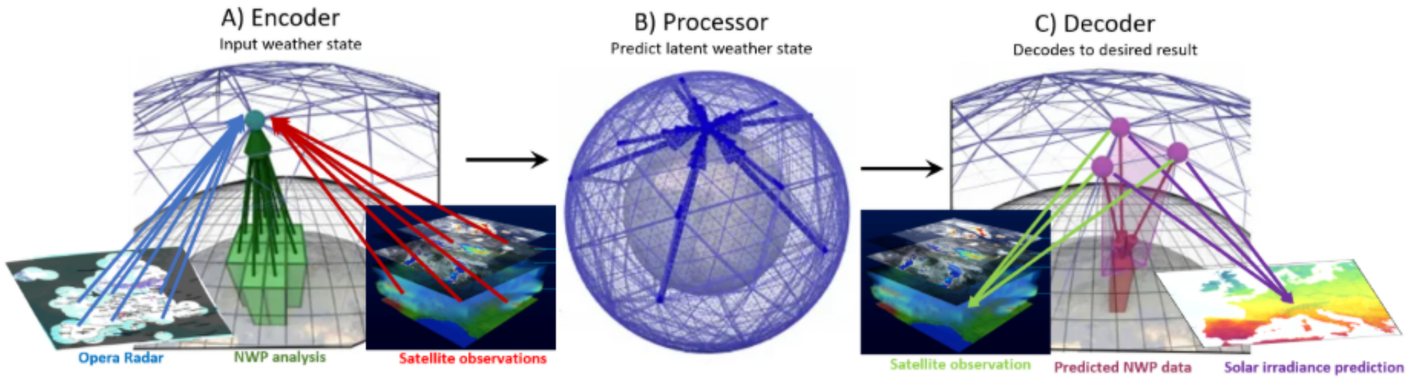
Source: Andreas Prein (ETH Zurich)

ML-based forecasting on the Swiss domain

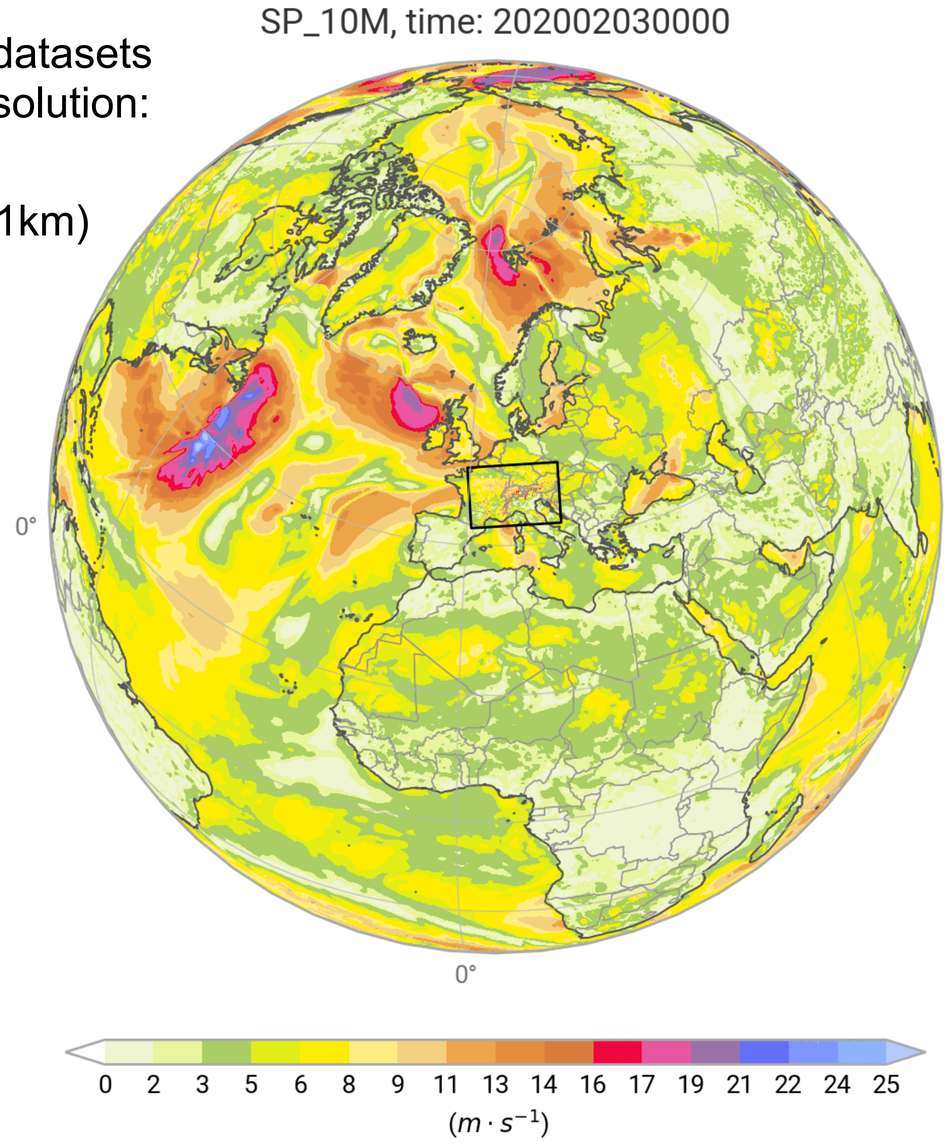


MeteoSwiss computed large reanalysis datasets on Swiss domain with spatiotemporal resolution: 1km & 10 min.

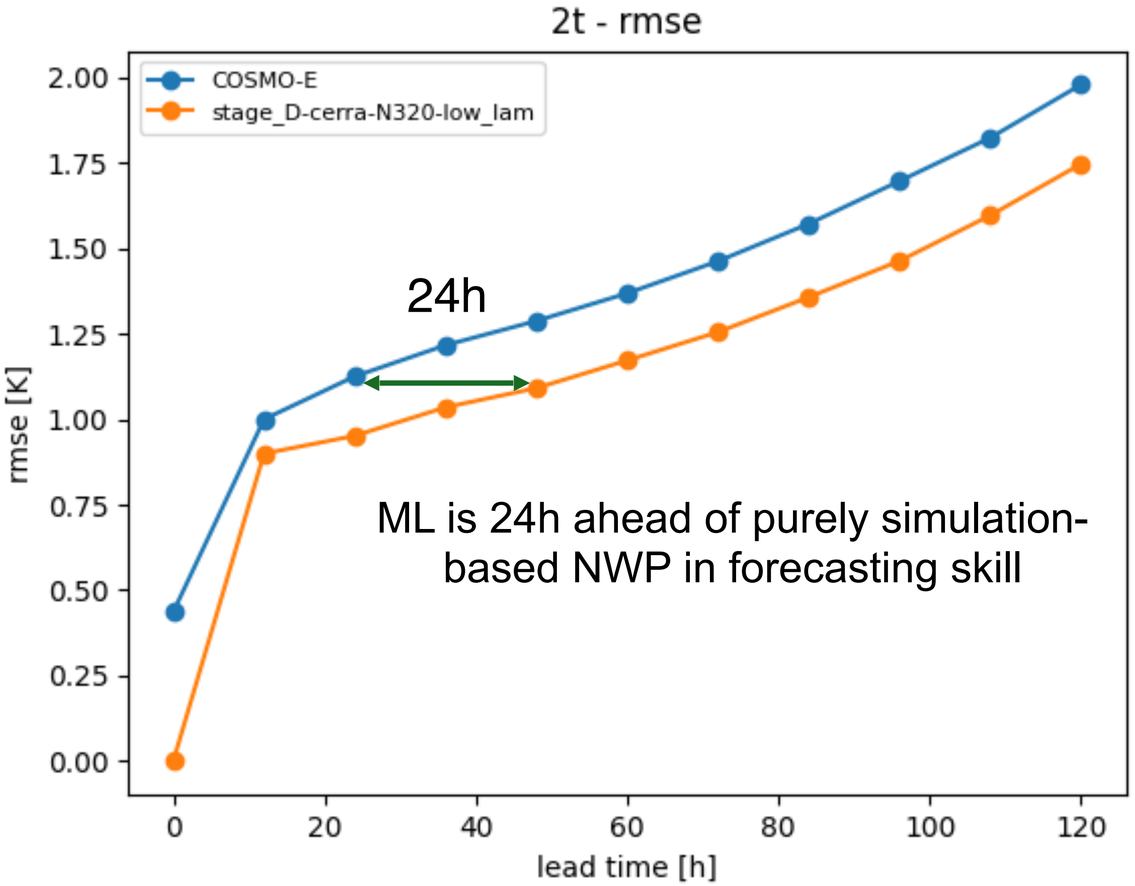
- Deterministic downscaling with ICON (1km)
- Swiss domain with 1km resolution
- ERA5 at the lateral boundaries
- Assimilating selected observations
- Latent Heat Nudging (LHN)

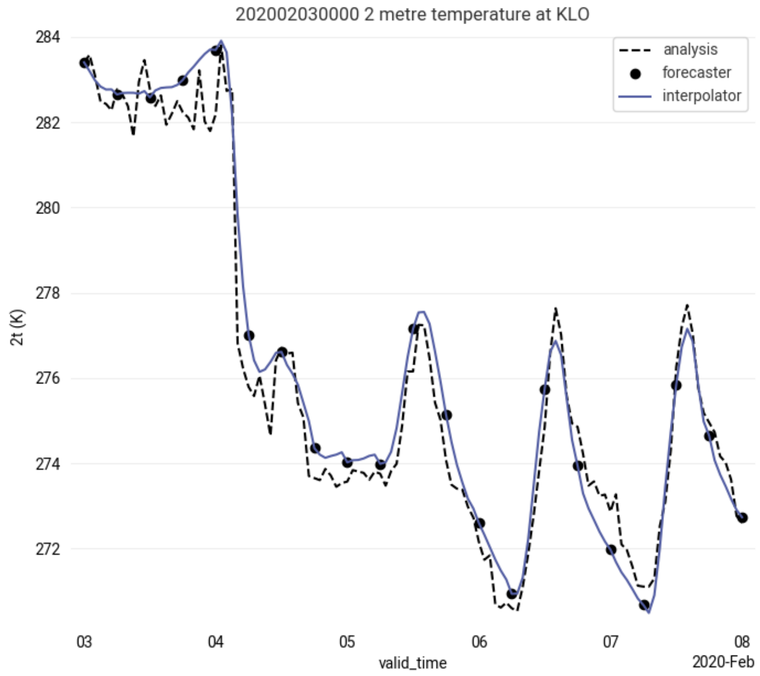


Graph transformer architecture of the ML model



MeteoSwiss' ML model





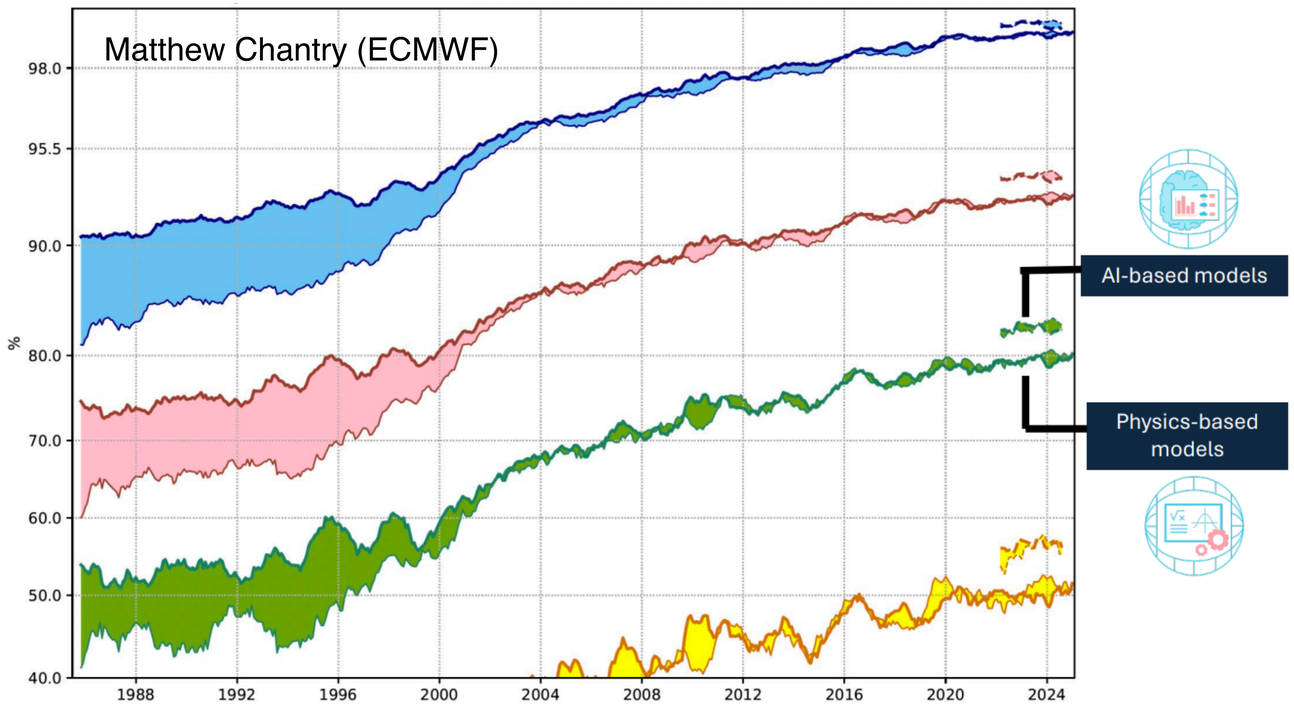
gional forecast +10d, hourly resolution

nowcasting +6h

sharp forecasts and uncertainty quantification

finer space-time resolutions

Global leadership by ECMWF and its members (incl. MeteoSwiss, supported by C2SM/CSCS)



Supercomputing with micro-services: not such a straightforward story

- CSCS and Cray/HPE shared a simple vision in 2019 – and both learned through mistakes
- First implementation of Cray System Management (CSM) proved monolithic and inflexible
  - Frist delivered in 2020; we've been backing out of design flaws ever since
- Initial inertia at CSCS to adopting software-defined infrastructure
  - We started in 2017 → reorganised in 2021 → had a cultural transformation 2022-2024 → introduced our version of scaled agile framework and planning in 2023-2024
- HPE (acquired Cray) continues to struggle with supporting the CSM product – innovator's dilemma
- LANL, LBNL, CSCS, and BriCS (Bristol) now collaborating with HPE – and recently with DELL - to more forward with a fully open-source system management framework (OpenCHAMI)

OpenCHAMI: HPC system management for cloud & HPC

(**Open C**omposable, **H**eterogenous, **A**daptable, **M**anagement **I**nfrastructure)

- Founding members: BriCS (Bristol), CSCS (Lugano), LANL (Los Alamos), NERSC (Berkley), HPE
- June 2025: DELL joins the OpenCHAMI consortium at second vendor
- Goal is to release OpenCHAMI under High-Performance Software Foundation (Linux Foundation)
- LANL will move all its CSM system to OpenCHAMI in 2026
- CSCS will move Alps from CSM to OpenCHAMI in 2027
- Discussions with other vendors / tech.-firms (NVIDIA) ongoing

Invest in things we can sustain

- Open source software & models
- Collaborate on data & infrastructure

Enjoy the conference!