

CUG 2025 – New Member Site

# GeoSphere Austria

**HPC Activities at Austrian Weather Service**

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8. Mai 2025

## Common Confusion

### “No Kangaroos in Austria!”

- Not Australia. No kangaroos.
- But yes: mountains, dialects, and Lederhosen.
- We *do* know the difference — even if the rest of the world doesn’t.

## The Sound of Music – A Hit Abroad, a Mystery at Home

- Filmed in Salzburg, loved in the U.S
- In Austria? Most people haven't even seen it.
- Singing in the hills = confused cows, amused locals.

## Culinary National Pride - Schnitzel

- Flat, Fried, and Fantastic
- Veal or pork — as long as it's breaded.
- Pan-fried to perfection.
- Side dish: potato salad and national pride.

## Arnold Schwarzenegger

- Most famous Export
- Born in Styria
- Bodybuilder, Hollywood icon, and California governor.
- Proof: Austria is small, but strong.

## GeoSphere Austria

- GeoSphere Austria is the Federal Institute for Geology, Geophysics, Climatology and Meteorology since January 1, 2023.
- GeoSphere Austria is based on the merger of the Central Institute for Meteorology and Geodynamics (**ZAMG**), founded in 1851, as the National weather and earthquake service, and the Federal Geological Survey (GBA), founded in 1849, as the geological service. GeoSphere Austria employs about 500 people.
- According to the GeoSphere Austria Act (Federal Law Gazette I, No.60/2022) of 14 April 2022, GeoSphere Austria, as the national geological, geophysical, climatological and meteorological service, is responsible for advising the Federal Government and warning the public on geological, geophysical, climatological and meteorological matters.
- By contributing to a prevention-oriented approach to climate change, Geosphere Austria aims to secure a sustainable development of Austria.

### Other national weather services in Austria:

- Austro Control Aviation Weather Service
- Military Weather Service

## GeoSphere Austria

- In the area of the atmosphere, the main service and research activities are related to the topics **weather**, **climate** and **environment** (air pollution).
- Today for a modern weather service dealing with these topics, it is common to work with numerical atmospheric models on powerful HPC systems.
- Until the 1990s, ZAMG weather forecasts were mainly based on products of global weather models (with coarse resolution) provided by other NWP centres (ECMWF, DWD, and other). The horizontal resolution (100-150km) was too coarse to take complex topography (alps) and mesoscale processes into account
- In the past only few NWP centres worked on mesoscale limited-area-models (horizontal resolution 10-20 km). Global NWP models today can operate at a resolution of 10 km or less (ECMWF).
- Challenges working with model data from external NWP centers:  
Are the required data available for the geographical region of interest ?  
How can the required data be obtained, and when will the data be available?

## Trigger event: The Chernobyl reactor accident in April 1986

- Austria was severely affected by the radioactive fallout; the alpine regions received the highest fallout contamination, showing a very inhomogeneous spatial distribution of the surface deposition.
- It was obvious that the forecasting tools based on rough data were not sufficient to more detailed advise to the national authorities (radiation protection, etc.). Better tools were needed for nuclear emergency response, especially in the case of an accident at one of the many nuclear power plants near Austria's borders.
- To improve the treatment of mesoscale processes, ZAMG started to push efforts in the field of Limited Area modeling (incl.HPC) and became a member of RC-**LACE** (Regional Cooperation for Limited Area modeling in Central Europe, 1994) for working with the **ALADIN** model (MeteoFrance).
- The Czech Hydrometeorological Institute (CHMI) became the regional center of NWP operations to provide a daily dissemination of NWP products to LACE member institutes; the Prague centre started the ALADIN operations on a **NEC** computer in 1998.
- In 2001, ZAMG received funding for the ITT of the first HPC capable of running mesoscale models operationally („Krisenrechner“).
- As part of the national critical infrastructure, ZAMG must operate its own highly available, robust HPC system.
- This is not only necessary in case of technical accidents, but also in case of weather-related natural disasters (storm, heavy rain, etc.).

# Operational HPC systems at ZAMG

	year of ITT	budget w/o taxes	loss of purch.power (since last ITT)	system	peak perf.	el. power	cooling
I)	2001	454.205 €		SGI ORIGIN 3400 28 R14000 CPUs	8 GFlops	< 10 kW	Air
II)	2006	916.660 €	- 8 %	NEC SX8R (+1 AMD-opteron) 2 nodes , 16 SX8R CPUs	560 GFlops	19 kW	Air
III)	2011	1.416.660 €	- 7,5 %	SGI ICEx cluster (SNB) 256 nodes, 4032 cores	82 TFlops	107 kW	Air/Liquid
IV)	2017	1750.000 €	- 7,2 %	HPE ICExa cluster (SKL) 192 nodes, 6912 cores	550 TFlops	95 kW	DLC
V)	2023	2.083.333 €	-14.6 %	HPE/CRAY XD2000 Cluster, AMD-Genoa, 100 compute nodes, 19200 cores	866 TFlops	99 kW	DLC
VI)	???	???	???	???	???	???	???

HPC system	Weather forecast	Environment/Air Pollution Models	Climate research
I) SGI ORIGIN	ALADIN (12km)	MM5, preproc.	---
II) NEC SX8 (+)	ALARO	MM5, preproc. (SX8) CAMX (opteron)	COSMO-CLM (reg.)
III) SGI ICEx	AROME	WRF-chem	COSMO-CLM (reg.)
IV) HPE ICExa	AROME (2.5km)	WRF-chem	PALM-4U (urban)
V) CRAY XD2000	AROME (<1km)	WRF-chem	PALM-4U (urban)

# THANK YOU