

Report on National ICP IM activities in the Czech Republic – CZ01

Anenské catchment

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Introduction

Monitoring of small forest catchments within the Czech Republic, as part of the International Cooperative Programme on Integrated Monitoring (ICP IM), is conducted at two sites: Anenské catchment (CZ01; 49°34'24" N, 15°4'49" E; 487–543 m a.s.l.) and Lysina (CZ02; 50°03' N, 12°40' E; 829–949 m a.s.l.). Anenské catchment is situated in the central part of the country and is part of the GEOMON monitoring network. This report focuses on Anenské catchment; detailed information about Lysina catchment can be found in Oulehle et al. (2021), Hruška and Krám (2024).



Figure 1: ICP IM small forest catchments in the Czech Republic - Anenské catchment (ANE) CZ01, Lysina catchment (LYS) CZ02.

Site description -Anenské catchment

The monitored catchment, which includes a 250-meter-long stream, was about 90% forested until 2021, with the remaining area used for agriculture. The forest mainly consisted of 90-year-old spruce monocultures, with smaller amounts of pine, beech, larch, and birch.

Table 1. Basic characteristics of Anenské catchment.

	Catchment area km ²	Average annual flow (1990 – 2024) l·s ⁻¹	Average runoff (1990 – 2024) l·s ⁻¹ ·km ⁻²
Anenské catchment	0.285	0.51	1.79

Due to a bark beetle outbreak that began in 2019, affected trees had to be removed. Logging has taken place in parts of the catchment, and reforestation is currently ongoing.

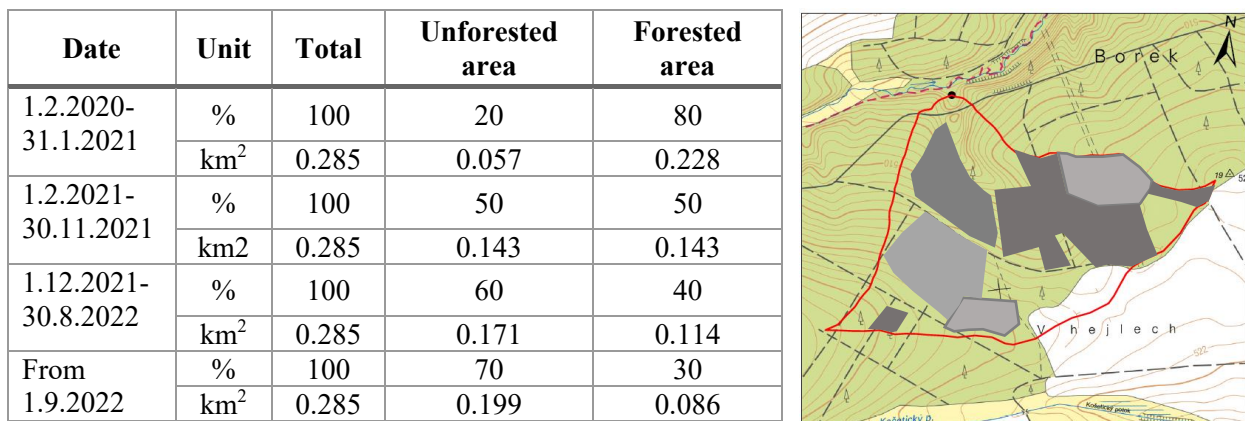


Figure 2: Overview of land cover changes around the Anenské catchment. The red line delineates the catchment boundary, while grey areas represent deforested patches. The table shows forest cover changes over time.

Meteorological Conditions

The year 2024 was exceptional in terms of air temperature. With a mean annual temperature of 10.3 °C, it became the warmest year on record at the Košetice Observatory since the beginning of measurements in 1988. This significantly exceeded both the long-term average and previous record years, such as 2015, 2018, and 2023, when average temperatures reached 9.5 °C and 9.7 °C. At the forest catchment, 2024 also recorded the highest annual temperature in recent years, reaching 9.2 °C. The previous highest value was 8.7 °C in 2023.

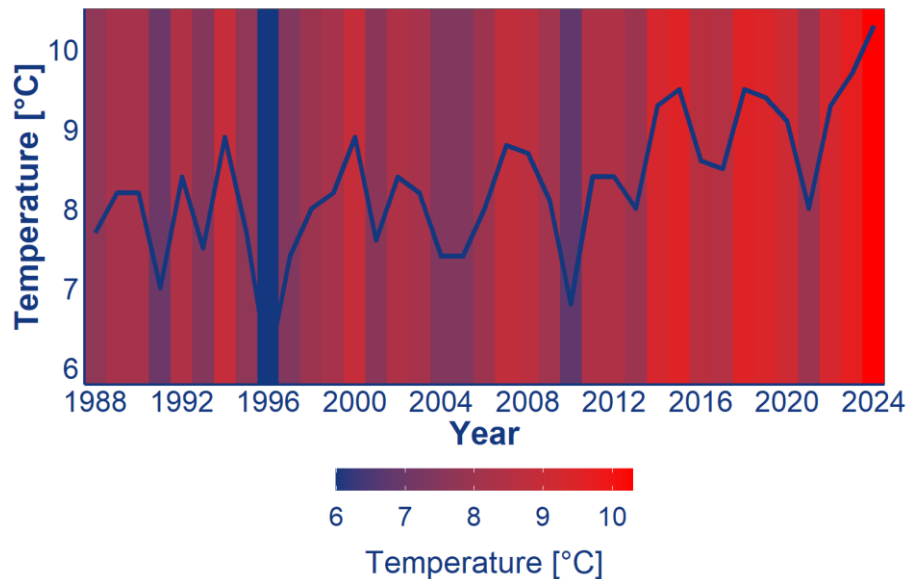


Figure 3: Annual air temperature average at Košetice Observatory 1988–2024.

The annual precipitation total in 2024 was 724 mm, which slightly exceeds the long-term average (1991–2020: 658 mm). This value confirms the ongoing trend of high inter annual variability in precipitation totals, typical for the past decade, with alternating dry and wet years.

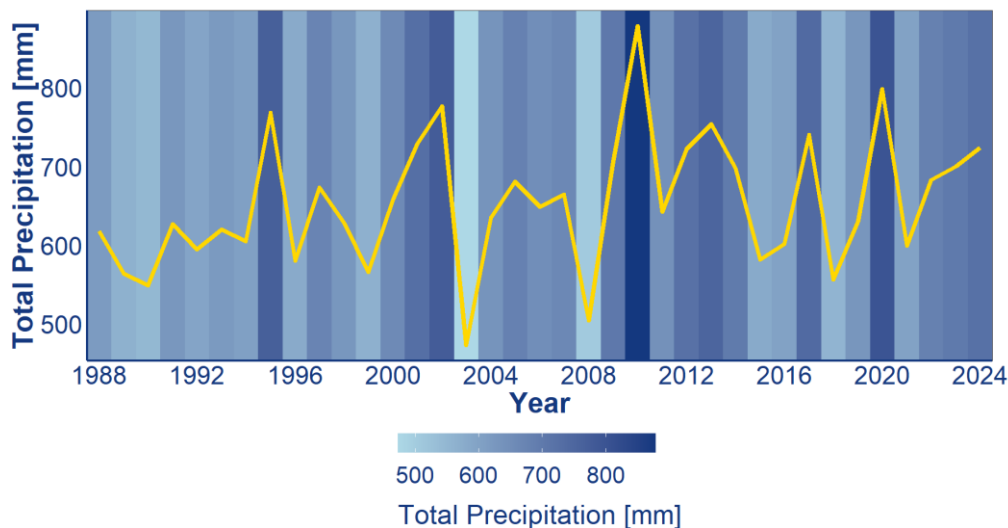


Figure 4: Annual total precipitation at Košetice Observatory 1988–2024.

Water chemistry

The chemical composition of atmospheric deposition at the Košetice Observatory has been monitored since the early 1990s. Various types of deposition are regularly analysed, including bulk, wet-only (Wet), throughfall (THF), and streamwater (STR). The year 2024 continued some of the long-term trends but also brought a few remarkable deviations in several components.

SO₄_S concentrations decreased in most deposition types compared to the long-term median. In bulk deposition, the median concentration dropped from 0.58 mg·l⁻¹ (1994–2023) to 0.34 mg·l⁻¹ in 2024, and in wet deposition, from 0.48 to 0.14 mg·l⁻¹. In contrast, STR samples showed an increase from 16.15 to 19.96 mg·l⁻¹.

A significant shift was observed in NO₃_N concentrations in STR, where the median increased from 0.85 mg·l⁻¹ to 1.40 mg·l⁻¹. In other deposition types, NO₃_N decreased, e.g., from 0.58 to 0.41 mg·l⁻¹ in bulk and from 0.47 mg·l⁻¹ to 0.20 mg·l⁻¹ in wet deposition.

NH₄_N concentrations generally decreased across all deposition types and STR. For example, the median in THF declined from 1.87 mg·l⁻¹ to 0.75 mg·l⁻¹, and in wet deposition from 0.61 to 0.28 mg·l⁻¹.

Heavy metals, cadmium (Cd) and lead (Pb) showed a consistent decrease in all deposition types. In bulk deposition, the Cd median dropped from 0.07 µg·l⁻¹ to 0.02 µg·l⁻¹, and Pb from 1.2 to 0.3 µg·l⁻¹. Similarly low 2024 values were observed in wet and THF samples, confirming long-term emission reductions.

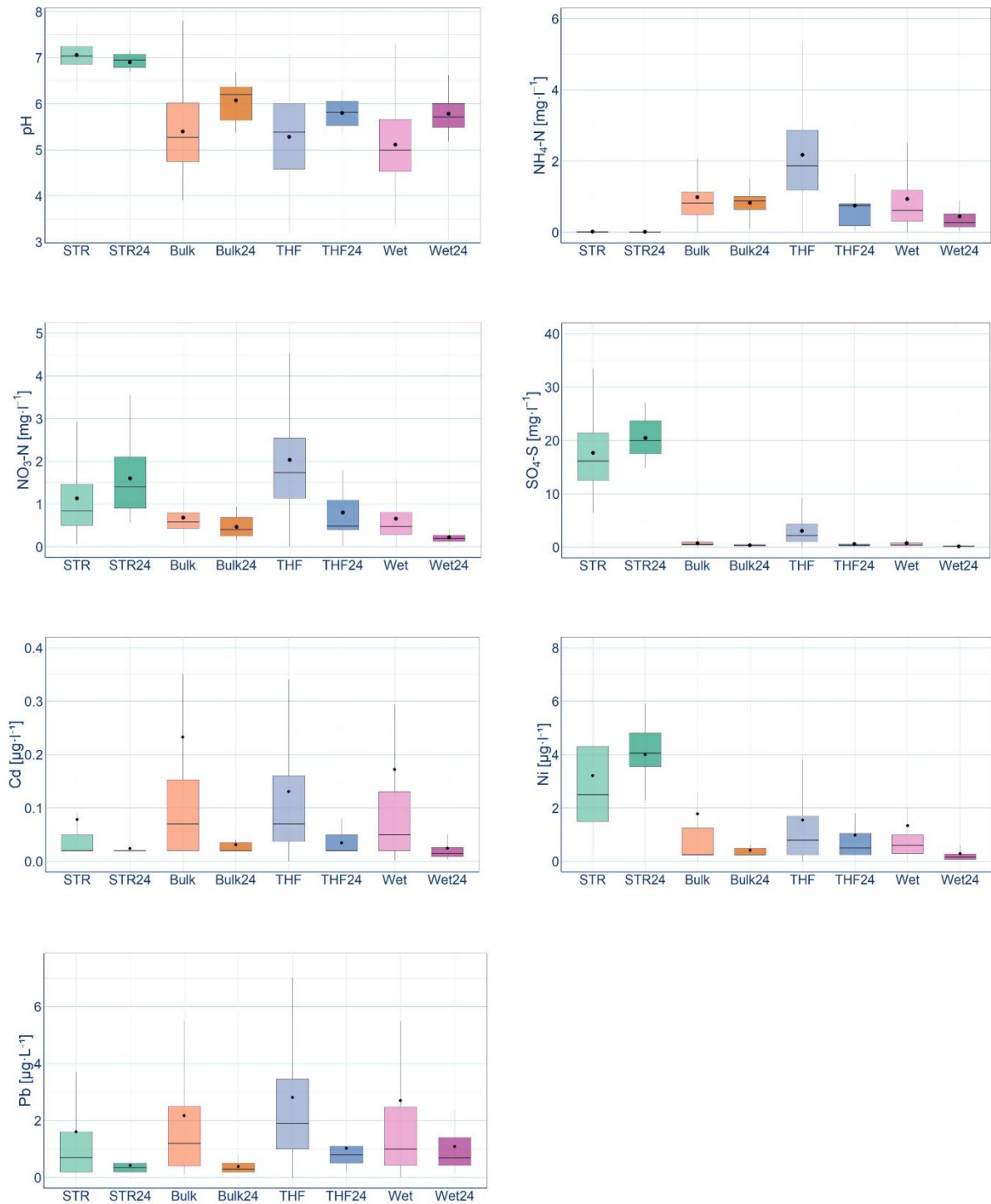


Figure 5: Boxplots of pH and concentrations of $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, $\text{SO}_4\text{-S}$, Cd, Ni, and Pb in precipitation (THF – throughfall; Bulk; Wet – wet-only) and stream water (STR), shown for the periods 1994–2023 and for the year 2024.