



Estimating dairy cows' drinking water intake during alpine grazing using smaXtec bolus data: validation of estimated intake

L. Schüpfer¹, C. M. Pauler², M. K. Schneider², M. Feller¹, S. Gfeller¹

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¹ BFH-HAFL, ² Agroscope

Contents

- ▶ Climate Change and impact on the water management on alpine farms
- ▶ Scope of the project
- ▶ Initial results
- ▶ Outlook

Water shortages in Alpine regions – a real problem



Source: (Freiburger Nachrichten, 2022)

Die Schweizer Armee hat Alpbetriebe erfolgreich mit Wasser versorgt

Die Schweizer Armee hat die militärische Katastrophenhilfe zugunsten mehrerer Kantone mit Wassertransporten zu Alpbetrieben beendet, die unter der Trockenheit litten. Die Luftwaffe hat mit Super-Puma-Helikoptern total 585 Tonnen Wasser geflogen. Das Kommando Operationen beurteilt den Assistenzdienst und die Zusammenarbeit mit den zivilen Partnern als Erfolg.



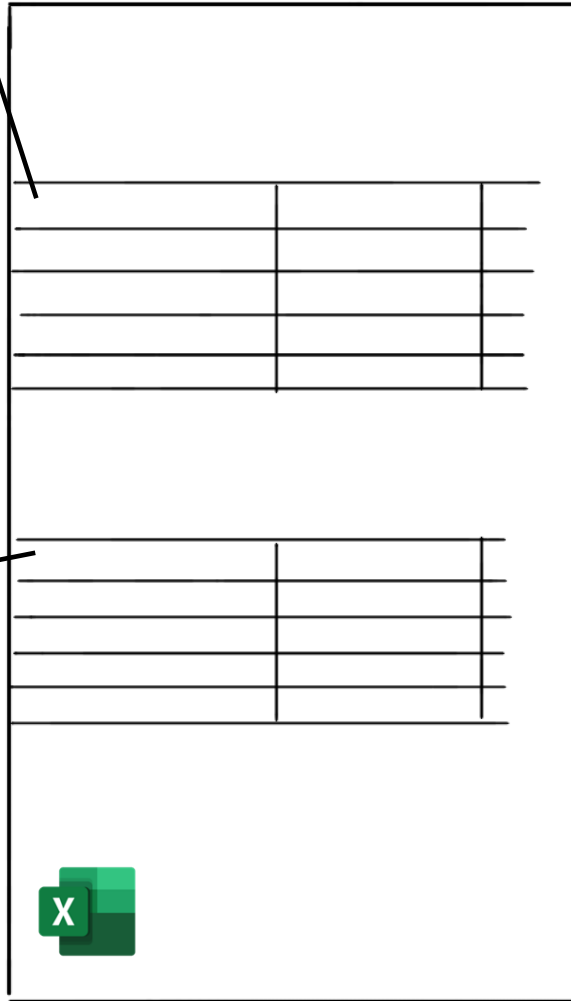
Die Wassertransporte der Schweizer Luftwaffe dienen dazu, auf 23 Alpen in den Kantonen Freiburg, Bern und Obwalden die Betriebe und deren Tiere zu versorgen.
— © VBS/DDPS | Rolf Dammer

Source: (VBS, 2022)

Water balance tool

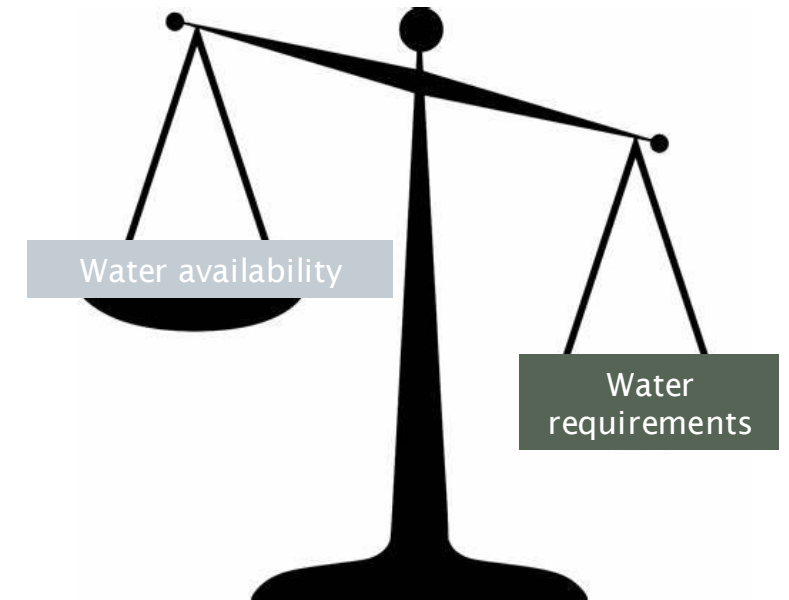
Potable Water	Livestock water	Process water
Household	Cows	Milking system
BnB	Pigs	Barn
Snack bar	Cattle	Cooling tank
Cheese factory	Other animals	Milk room

Water availability
Source(s)
Meltwater
Rainwater
Reservoir



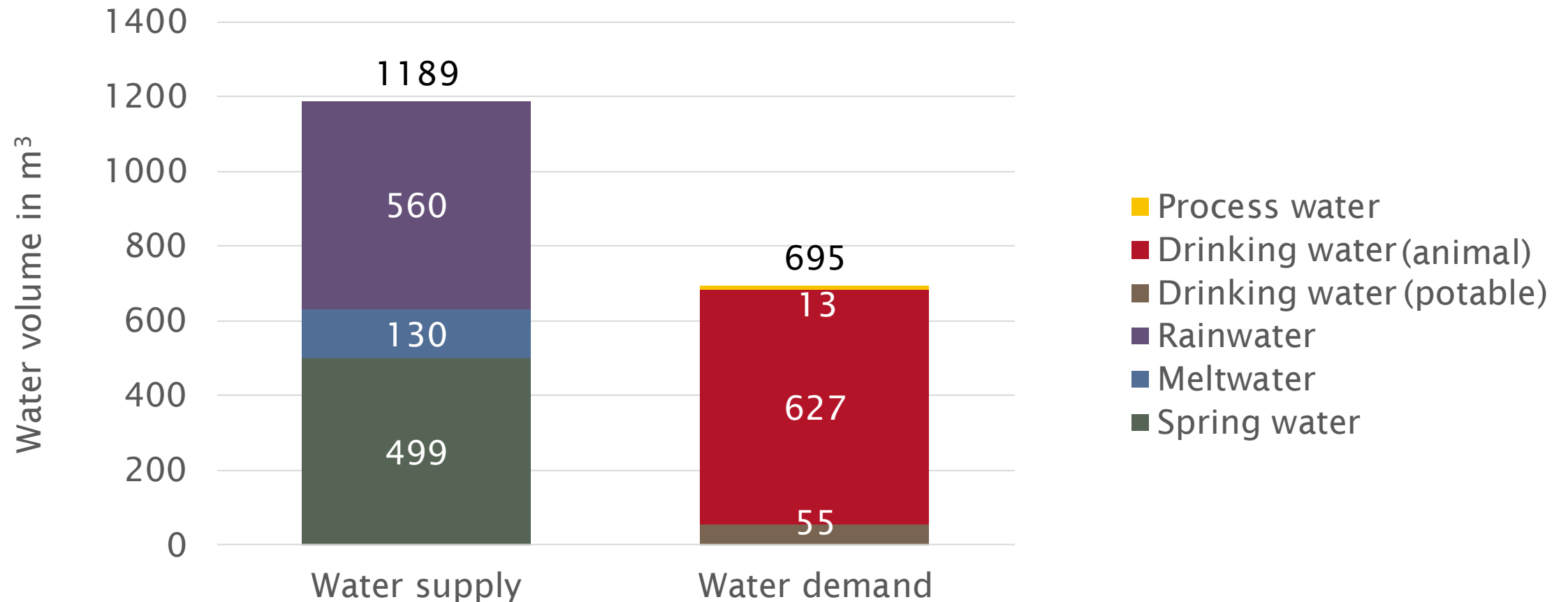
Weakness

Basic data on water consumption on alpine farms is unreliable or unknown.



Drinking water for animals usually accounts for the largest share

Water balance for Alp “Il Bot” for the entire 2021 alpine season



Case Studies: The farms

Unil.

CONSEIL
PATAGONIA
ROUET

PARC
OURA
VAUDSIS

Projet
Pays d'Enhaut

MONTANUM

SEA

Monitorer les demandes en eau
à l'échelle des alpages

Martin Calianno
Kim Fiaux
Lorena Roulin



Conférence BlueArk 2025, session « Eau et alpages »

12 novembre 2025

- A1, Furna
- A2, Trimmis
- A3 & A4, Matt
- A5, Lenk
- A6, Weissenstein, Albula

Formulas for calculating water requirements (cows)

- ▶ Formula (1) according to Beede D, 1993, and Meyer et al., 2002

$$\text{Waterintake} \left(\frac{l}{\text{day}} \right) = 20 - 0.012 * \text{Milkyield} \left(\frac{kg}{\text{day}} \right)^2 + 2.226 * \text{Milkyield} \left(\frac{kg}{\text{day}} \right) + 1.397 * \text{average temperature} (^{\circ}C)$$

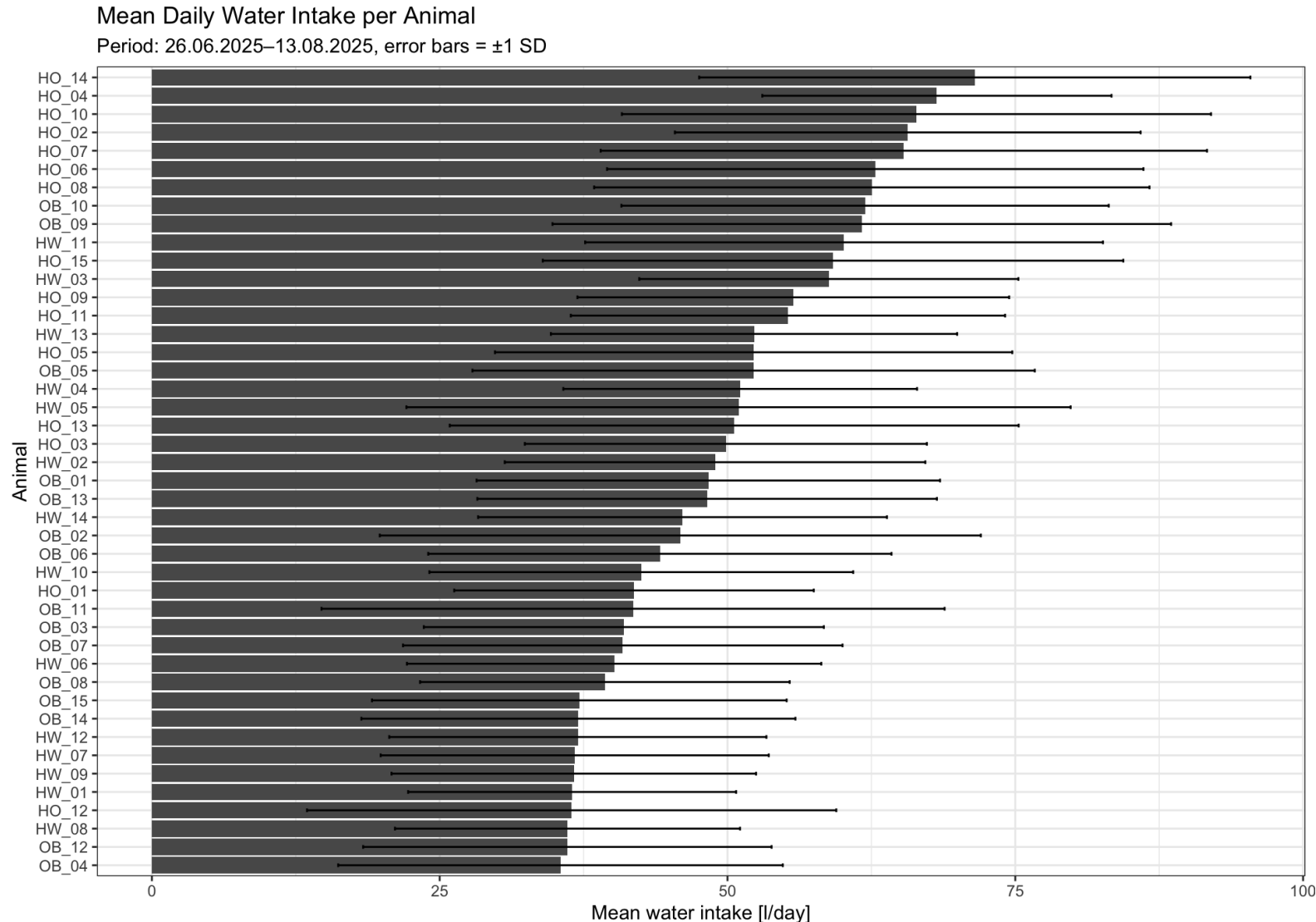
- ▶ Formula (2) according to Cardot et al., 2008

$$\begin{aligned} \text{Waterintake} \left(\frac{l}{\text{day}} \right) &= 1.54 * \text{DM} + 1.33 * \text{Milkyield} \left(\frac{kg}{\text{day}} \right) + 0.89 * \text{DM \%} + 0.57 * \text{average temperature} (^{\circ}C) \\ &- 0.3 * \text{precipitation} (mm) - 26.65 \end{aligned}$$

What data the smaXtec sensor provides



Water absorption according to smaXtec – Alp Weissenstein



44

Animals measured

~40 L

Average HW group

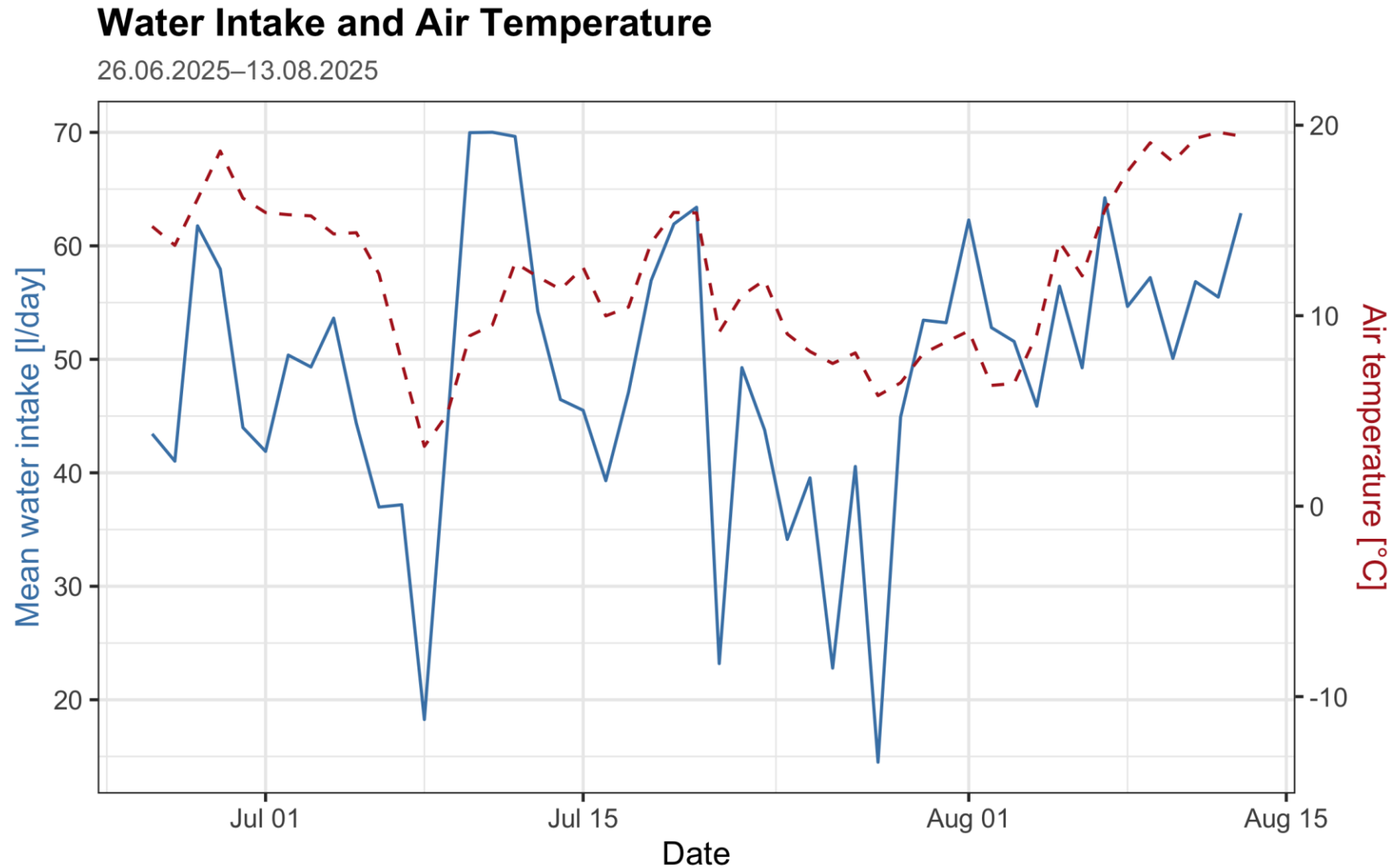
~55 L

Average OB group

~62 l

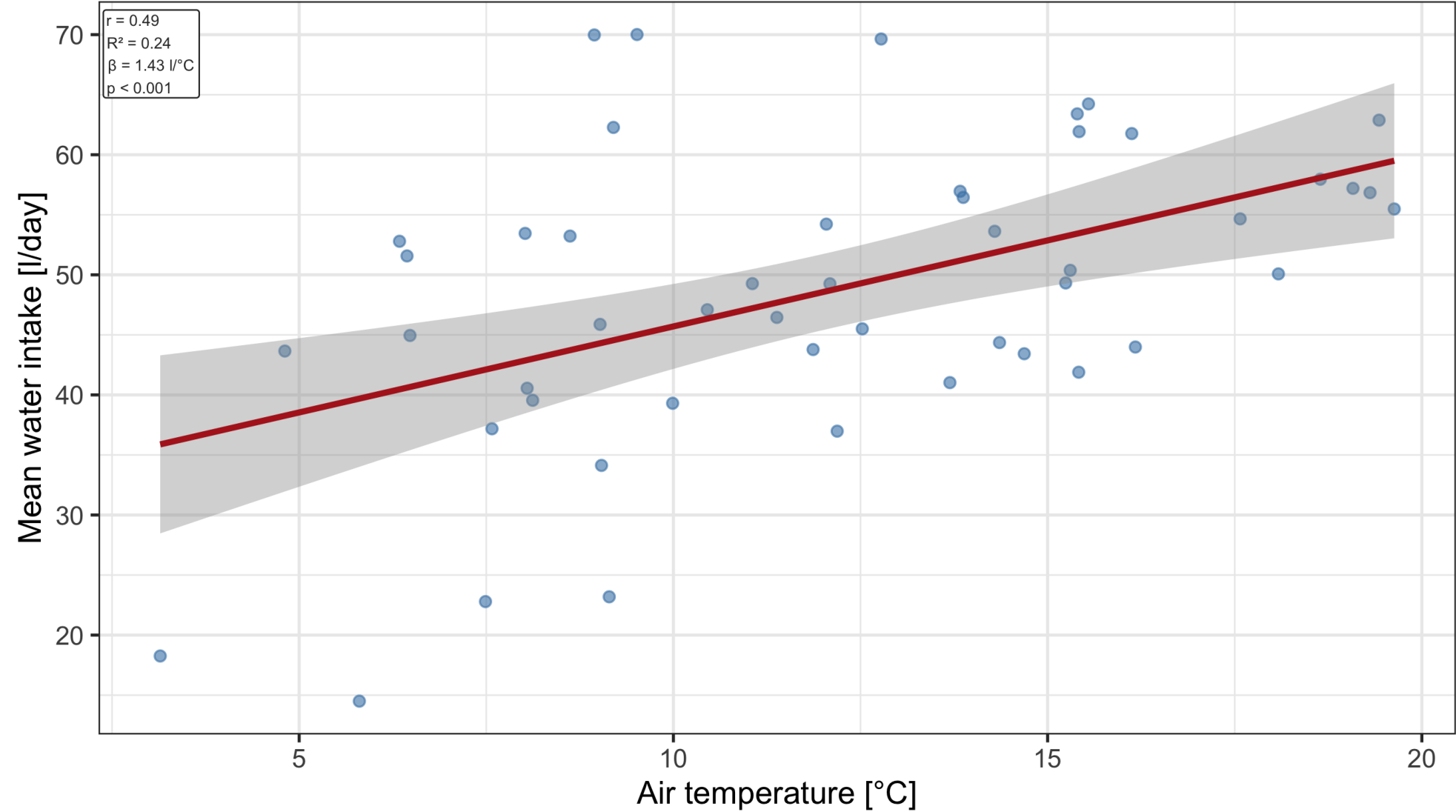
Average HO group

The relationship between water intake and air temperature



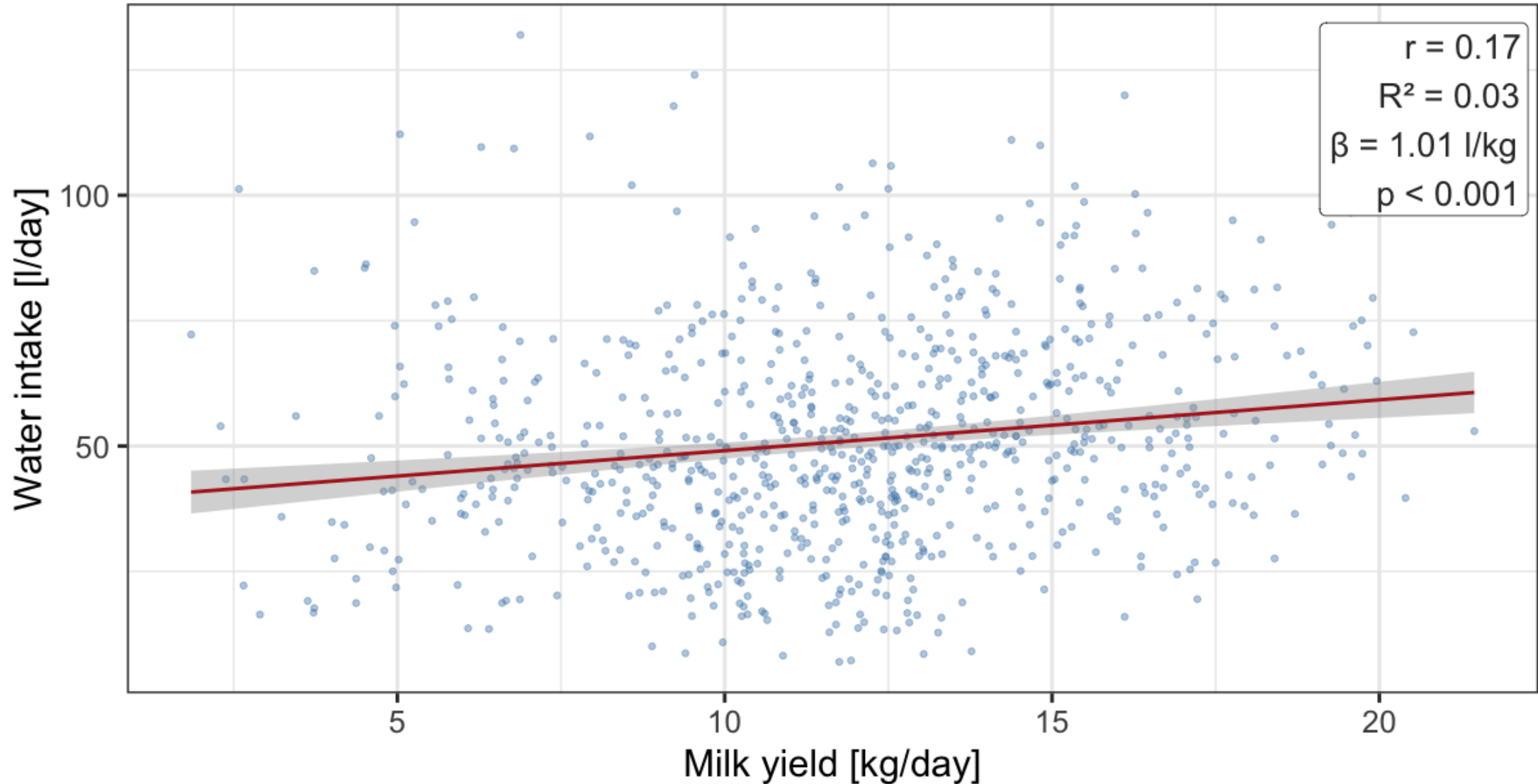
Relationship: Air Temperature and Water Intake

26.06.2025–13.08.2025 – each point = 1 day (herd mean)



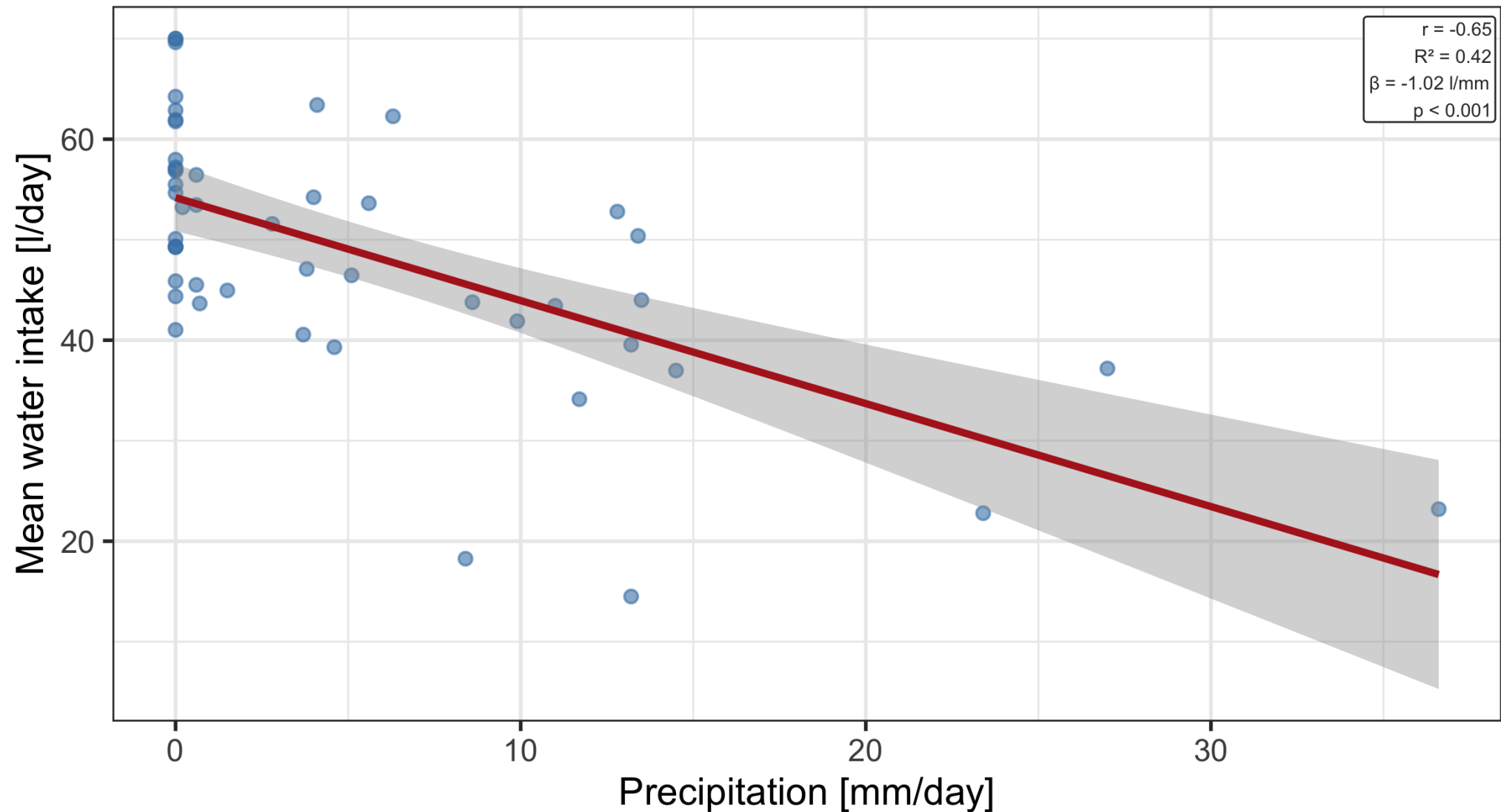
Relationship: Milk Yield and Water Intake

26.06.2025–13.08.2025 – each point = 1 animal-day (zeros excluded)



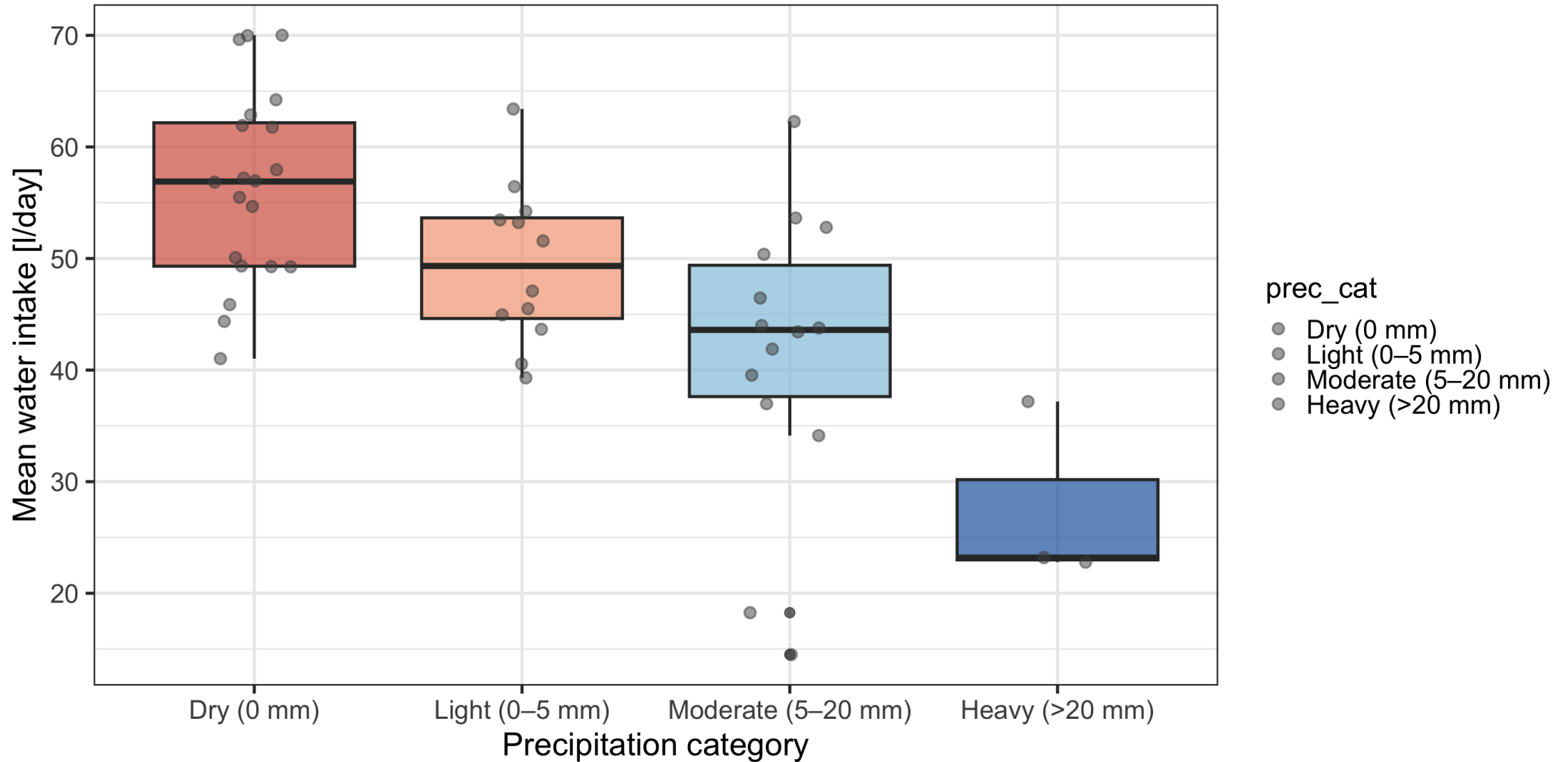
Relationship: Precipitation and Water Intake

26.06.2025–13.08.2025 – each point = 1 day (herd mean)



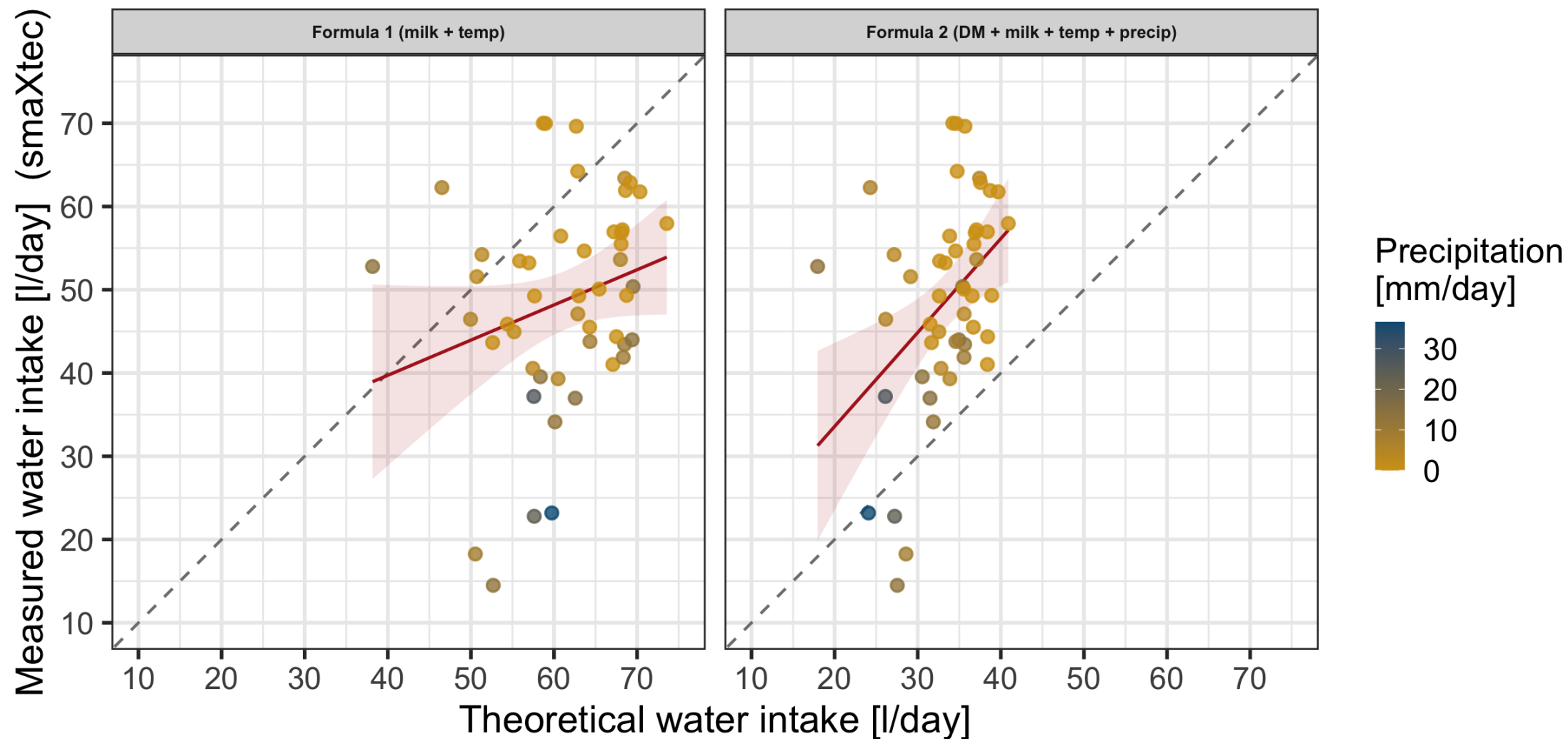
Water Intake by Precipitation Category

26.06.2025–13.08.2025



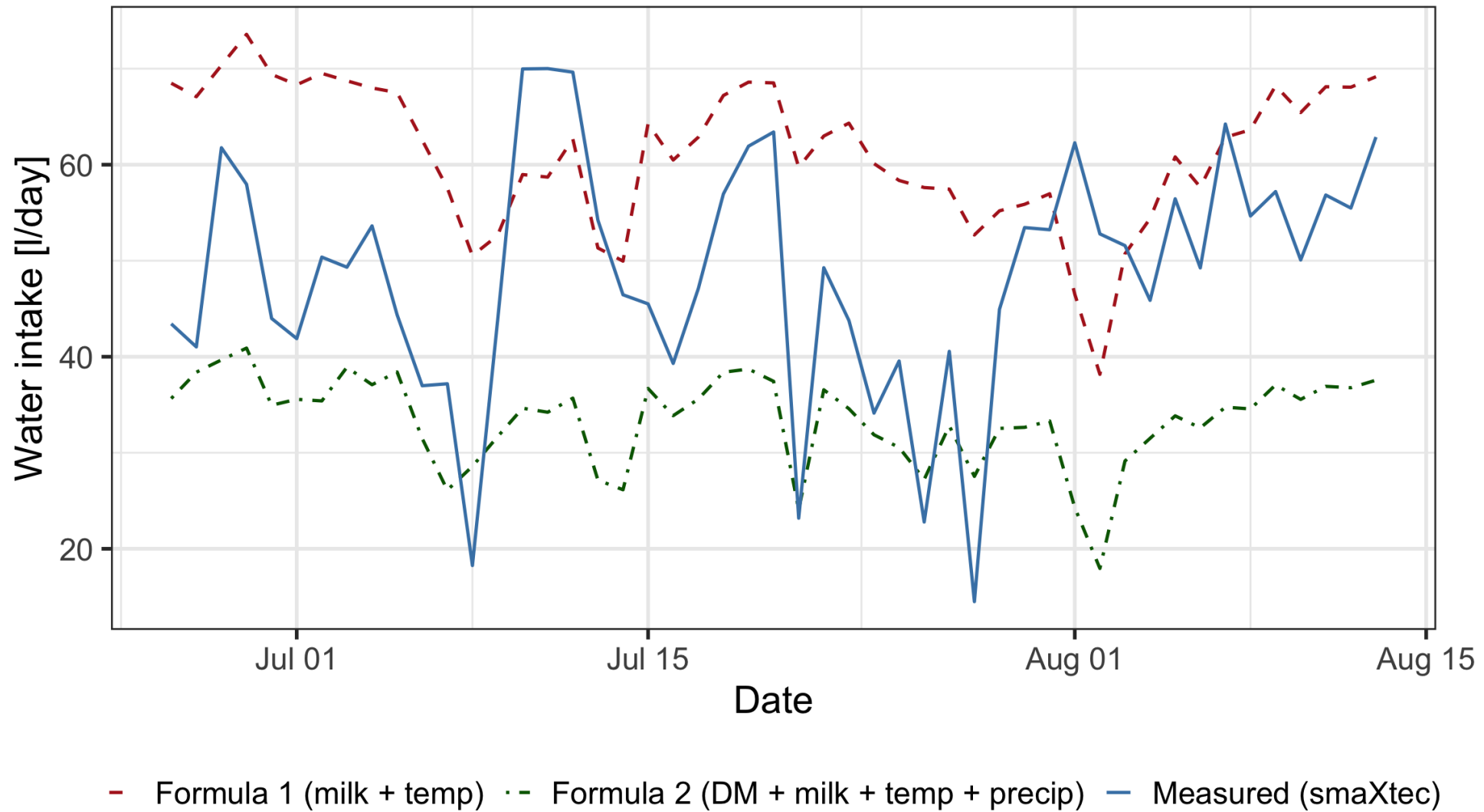
Measured vs. Theoretical Water Intake – Formula Comparison

26.06.2025–13.08.2025 – each point = 1 day (herd mean)
Dashed line = perfect agreement · Colour = precipitation

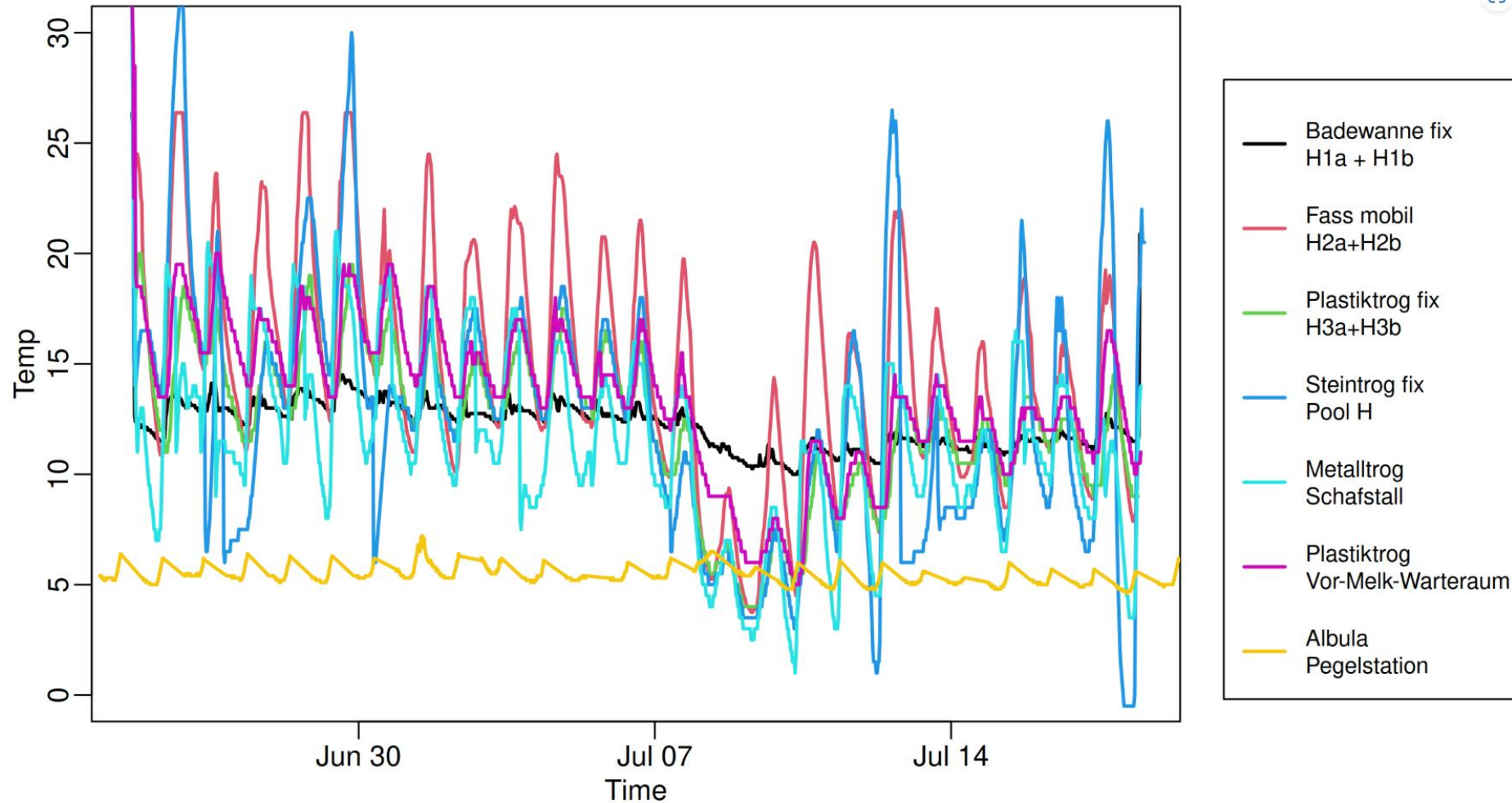


Water Intake: Measured vs. Two Literature Formulas

26.06.2025–13.08.2025 – herd mean per day



Does water temperature affect sensor accuracy?



Initial findings and outlook



- ▶ Water requirements for livestock in summer grazing areas are overestimated using the traditional formula (1)
- ▶ Precipitation has a major influence on water intake
- ▶ Temperature has a moderate influence on water intake
- ▶ Milk yield has a minor influence on water intake
- ▶ The formula by Beede D, 1993, and Meyer et al., 2002 is not applicable to primary grazing
- ▶ Measuring dry matter intake is difficult and can only be estimated, as can dry matter content.

→ Validation of measured smaXtec data using flow-through sensors

Thank you very much for your attention! Any questions?



Stefan Gfeller

Agronomy

Research Associate

Head of Digitalization and New Technologies

stefan.gfeller@BFH.ch

031 848 51 66