From the Forest to Figures:

The Lifecycle of Pfynwald's Data

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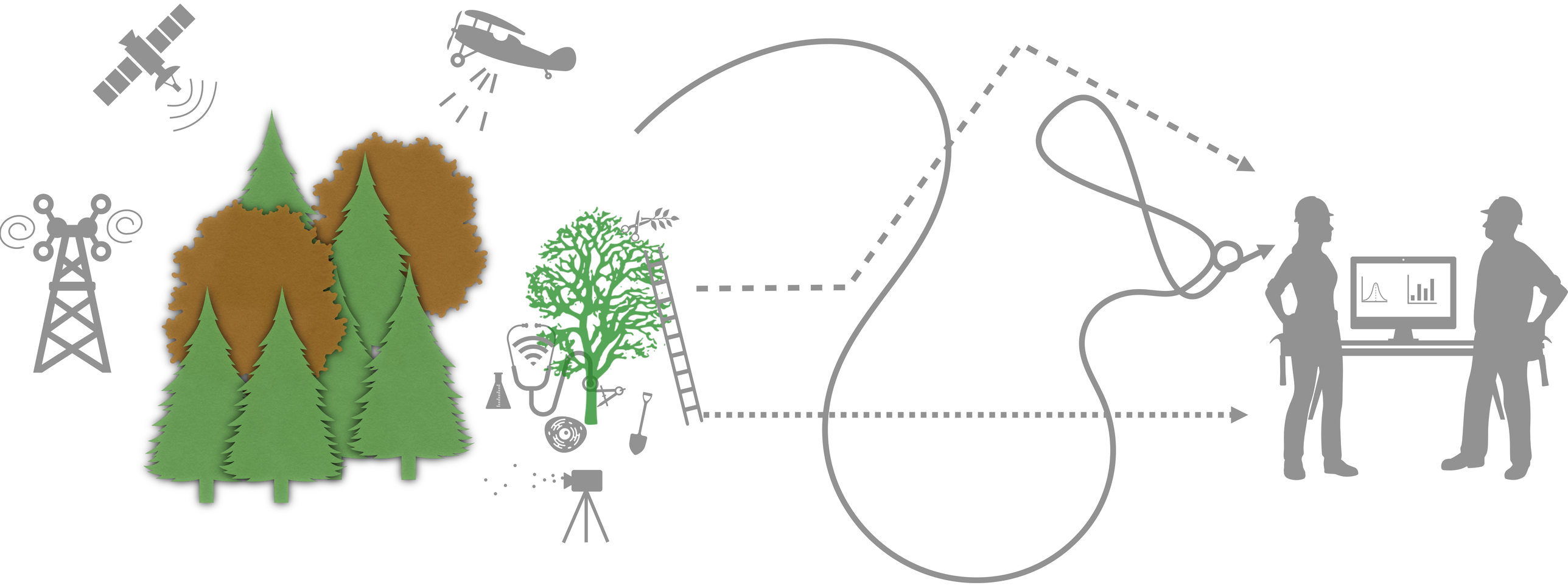


Data Stats

41 unique variables (e.g. Air temperature, VPD, Soil Temperature, …)

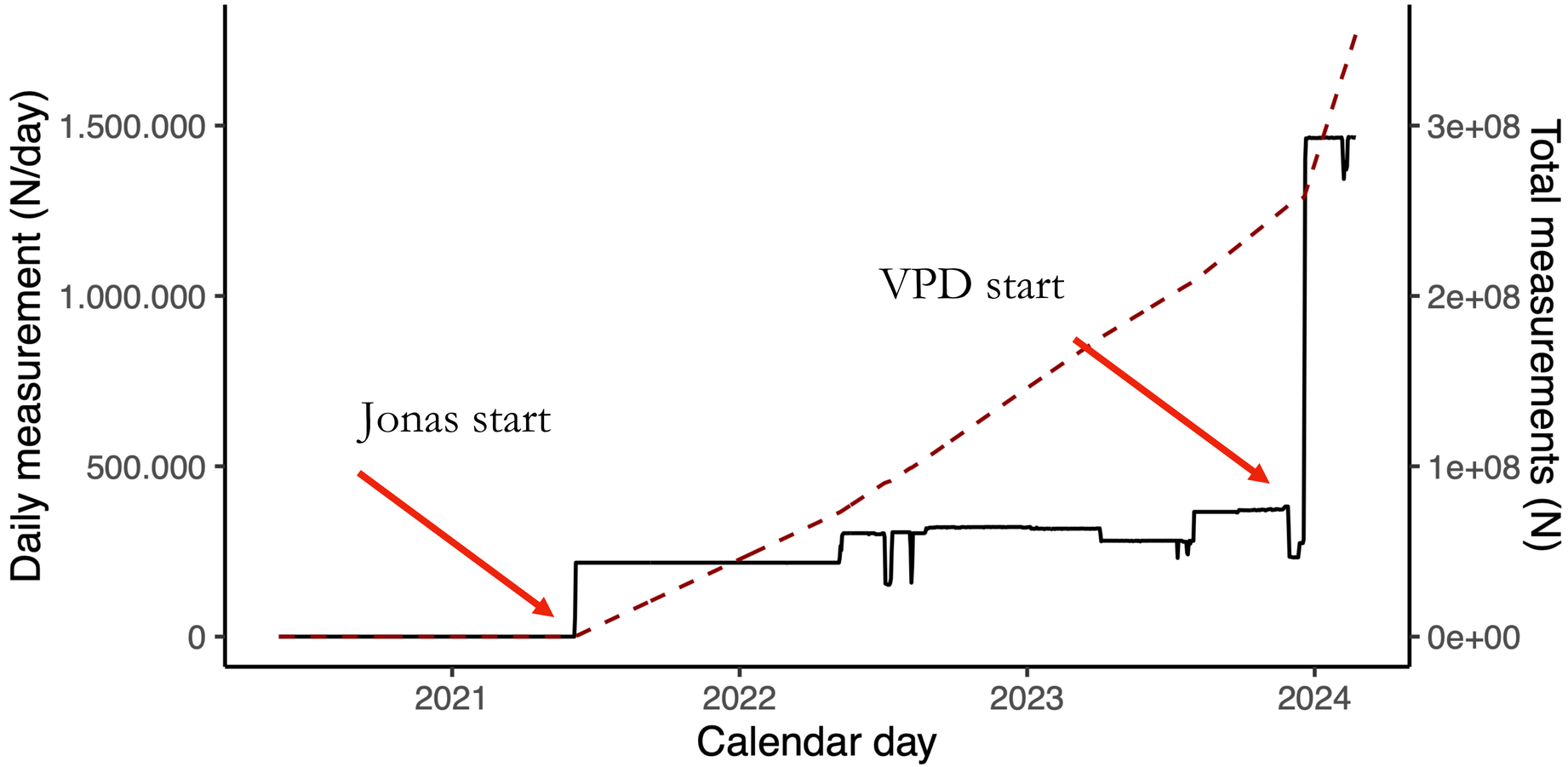
3 247 unique measured points (e.g. Air temperature mean in C° at 10 min in 12 m Scaffold 8, ..)

~ 10 178 values every 10 minutes

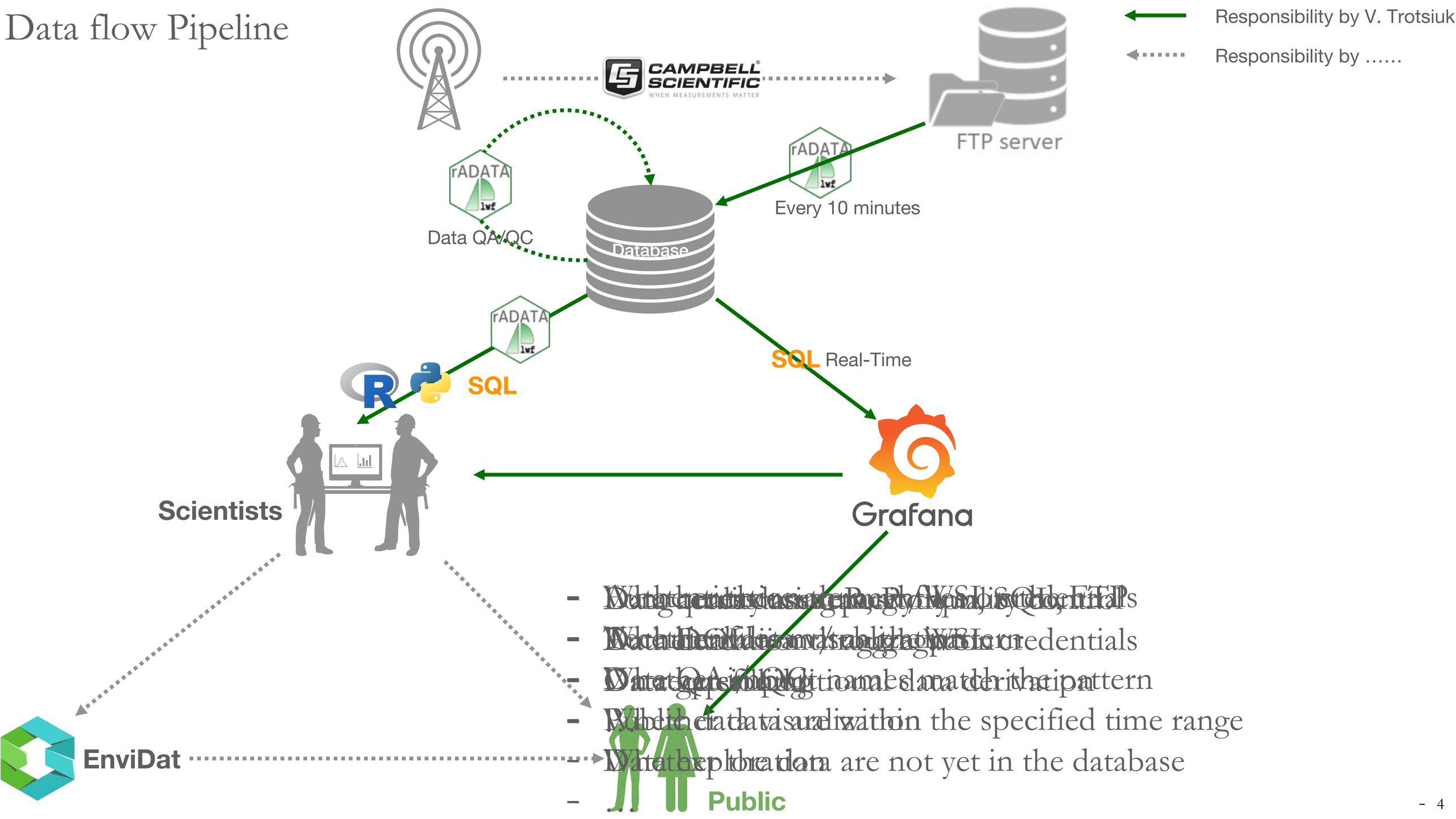
~ 1 464 795 values daily (1.464 Mil)

> 367 943 846 values total (368 Mil, ~22 GB)

* all information as of 2024-03-04



Data flow Pipeline



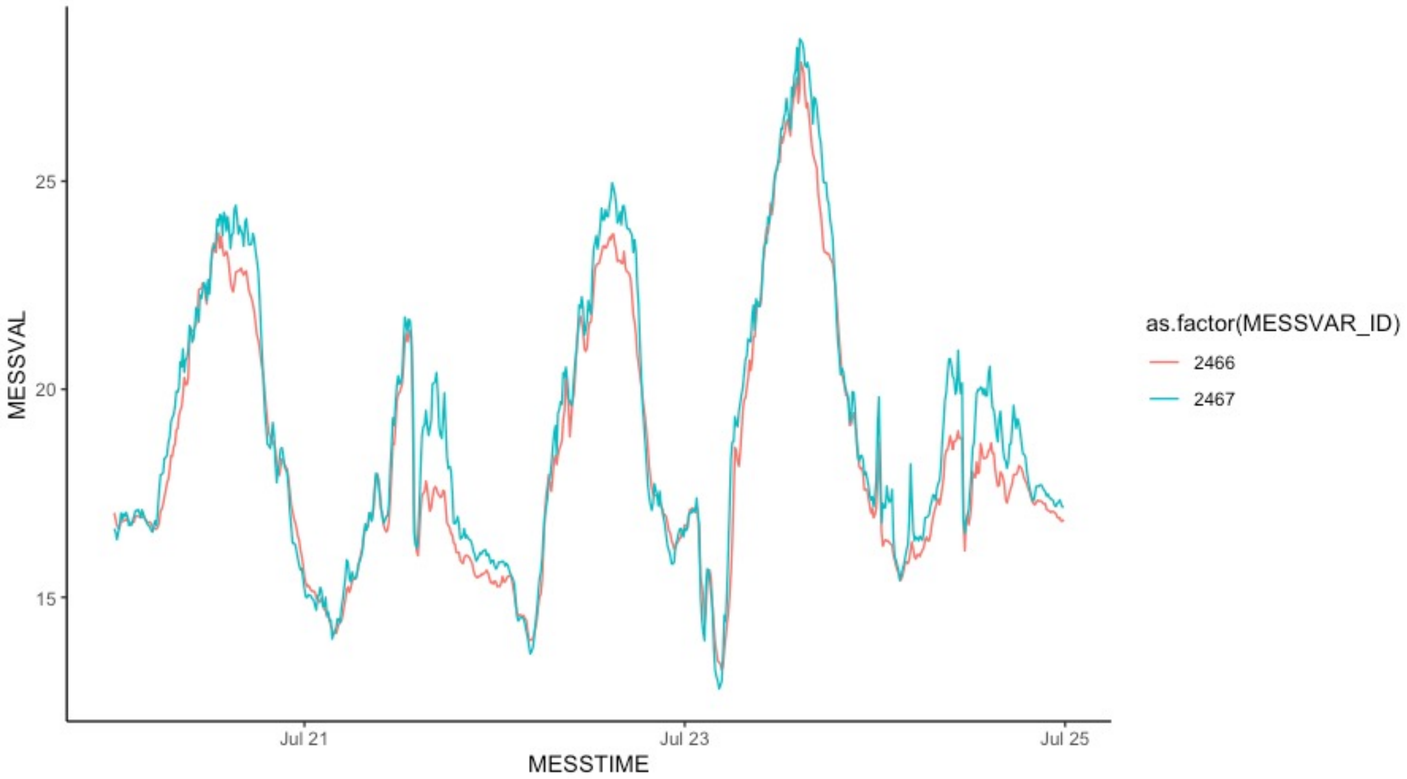
Accessing the Data: Bridging to Science

```
data.df <- pg_get_adata(
  conn = conn_pg,
  installation = c(122, 189),
  variable = 30,
  messtime_from = '2023-07-20',
  messtime_to = '2023-07-25',
  retrieve = TRUE
)
```

```
# A tibble: 1,440 × 4
   MESSVAR_ID MESSTIME            INSERTTIME          MESSVAL
        <int> <dttm>              <dttm>                <dbl>
 1       2466 2023-07-20 00:00:00 2023-07-20 00:04:44    17.0
 2       2466 2023-07-20 00:10:00 2023-07-20 00:14:14    16.9
 3       2466 2023-07-20 00:20:00 2023-07-20 00:24:16    16.7
 4       2466 2023-07-20 00:30:00 2023-07-20 00:34:15    16.6
 5       2466 2023-07-20 00:40:00 2023-07-20 00:44:15    16.7
```

```
library(ggplot2)

data.df %>%
  ggplot( aes( MESSTIME, MESSVAL, color = as.factor(MESSVAR_ID)) )+
  geom_line()+
  theme_classic()
```



Monitoring with Grafana

IMP_TABLE_ID	IMPORT_TABLE	IMPORT_LAG (DA	MESSTIME_LAST	INSERTTIME_LAS
2	PFY_TW8_Table10...	0.06	2024-02-23 09:3...	2024-02-23 09:4...
300	PFY_SC10_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
304	PFY_SC11_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
296	PFY_SC12_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
306	PFY_SC13_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
282	PFY_SC14_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
302	PFY_SC15_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
298	PFY_SC16_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
308	PFY_SC17_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
314	PFY_SC18_Table1...	0.05	2024-02-23 09:3...	2024-02-23 09:4...
284	PFY_SC1_Table1Min	0.05	2024-02-23 09:3...	2024-02-23 09:4...
288	PFY_SC3_Table1Min	0.05	2024-02-23 09:3...	2024-02-23 09:4...
290	PFY_SC4_Table1Min	0.05	2024-02-23 09:3...	2024-02-23 09:4...
294	PFY_SC6_Table1Min	0.05	2024-02-23 09:3...	2024-02-23 09:4...

IMP_TABLE_ID	FROM	TO	FILENAME	NROWS	INSERTTIME
1	2024-02-23 09:3...	2024-02-23 09:3...	PFY_TW8_Table1...	990	2024-02-23 09:4...
1	2024-02-23 09:2...	2024-02-23 09:2...	PFY_TW8_Table1...	990	2024-02-23 09:3...
1	2024-02-23 09:10...	2024-02-23 09:19...	PFY_TW8_Table1...	990	2024-02-23 09:2...
1	2024-02-23 09:0...	2024-02-23 09:0...	PFY_TW8_Table1...	990	2024-02-23 09:14.
1	2024-02-23 08:5...	2024-02-23 08:5...	PFY_TW8_Table1...	990	2024-02-23 09:0...
1	2024-02-23 08:4...	2024-02-23 08:4...	PFY_TW8_Table1...	990	2024-02-23 08:5...
1	2024-02-23 08:3...	2024-02-23 08:3...	PFY_TW8_Table1...	990	2024-02-23 08:4...
1	2024-02-23 08:2...	2024-02-23 08:2...	PFY_TW8_Table1...	990	2024-02-23 08:3...
1	2024-02-23 08:10...	2024-02-23 08:19...	PFY_TW8_Table1...	990	2024-02-23 08:24
1	2024-02-23 08:0...	2024-02-23 08:0...	PFY_TW8_Table1...	990	2024-02-23 08:14.
1	2024-02-23 07:50...	2024-02-23 07:59...	PFY_TW8_Table1...	990	2024-02-23 08:0...
1	2024-02-23 07:4...	2024-02-23 07:4...	PFY_TW8_Table1...	990	2024-02-23 07:54.
1	2024-02-23 07:30...	2024-02-23 07:39...	PFY_TW8_Table1...	990	2024-02-23 07:44.
1	2024-02-23 07:20...	2024-02-23 07:29...	PFY_TW8_Table1...	990	2024-02-23 07:34.

Table level overview

Variable last time import

MESSVAR_ID	IMPORT_TABLE	MESSVAR_NAME	MESSTIME_LAST	MESSVAR_LAG (DAYS
102	PFY_TW8_Table10Min	V_24_Min	2024-02-23 09:30:00	0.06
103	PFY_TW8_Table10Min	TA_oc_Avg	2024-02-23 09:30:00	0.06
104	PFY_TW8_Table10Min	TA_ic_Avg	2024-02-23 09:30:00	0.06
105	PFY_TW8_Table10Min	TA_uc_Avg	2024-02-23 09:30:00	0.06
106	PFY_TW8_Table10Min	TA_2m_Avg	2024-02-23 09:30:00	0.06
107	PFY_TW8_Table10Min	RH_oc_Avg	2024-02-23 09:30:00	0.06
108	PFY_TW8_Table10Min	RH_ic_Avg	2024-02-23 09:30:00	0.06
109	PFY_TW8_Table10Min	RH_uc_Avg	2024-02-23 09:30:00	0.06
110	PFY_TW8_Table10Min	RH_2m_Avg	2024-02-23 09:30:00	0.06
111	PFY_TW8_Table10Min	VPD_oc_Avg	2024-02-23 09:30:00	0.06
112	PFY_TW8_Table10Min	VPD_ic_Avg	2024-02-23 09:30:00	0.06
113	PFY_TW8_Table10Min	VPD_uc_Avg	2024-02-23 09:30:00	0.06
114	PFY_TW8_Table10Min	VPD_2m_Avg	2024-02-23 09:30:00	0.06

Variable completeness

MESSVAR_ID	IMPORT_TABLE	MESSVAR_NAME	MESSTIME_LAST	COMPLETENESS
557	PFY_SS1_Table10Min	SF2HE_mV_3_Avg	2024-02-23 09:40:00	38.013
540	PFY_SS1_Table1Min	SF2HE_mV_3	2024-02-23 09:42:00	38.792
555	PFY_SS1_Table10Min	SF2HE_mV_1_Avg	2024-02-23 09:40:00	78.596
538	PFY_SS1_Table1Min	SF2HE_mV_1	2024-02-23 09:42:00	86.763
5379	PFY_SC14_Table1Min	TA_oc_fr	2024-02-23 09:39:00	98.311
5380	PFY_SC14_Table1Min	RH_oc_fr	2024-02-23 09:39:00	98.311
5381	PFY_SC14_Table1Min	VPD_oc_fr	2024-02-23 09:39:00	98.311
632	PFY_SS2_Table10Min	SF2HE_mV_1_Avg	2024-02-23 09:40:00	98.749
86	PFY_TW8_Table1Min	WS100_DrCl10	2024-02-23 09:39:00	99.750
87	PFY_TW8_Table1Min	WS100_DrCl11	2024-02-23 09:39:00	99.750
88	PFY_TW8_Table1Min	IRTemp_1	2024-02-23 09:39:00	99.750
89	PFY_TW8_Table1Min	IRTemp_2	2024-02-23 09:39:00	99.750
90	PFY_TW8_Table1Min	IRSensVolt_1	2024-02-23 09:39:00	99.750

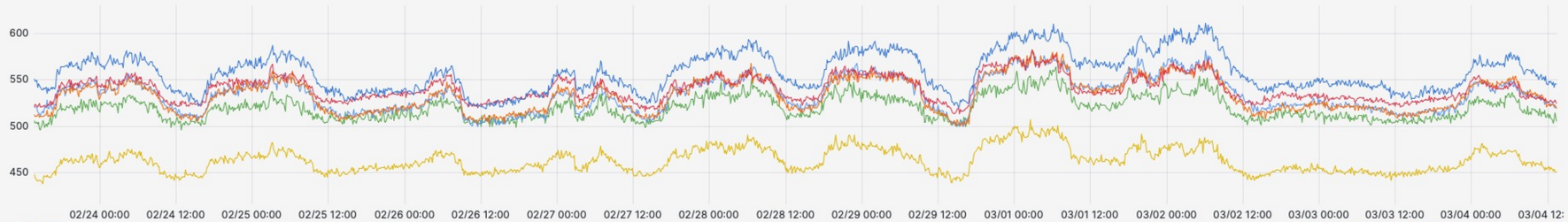
Monitoring with Grafana

INSTALLATION All VARIABLE A_T-mean-10 Minutes-degC-NA + A_CO2_CONC-mean-10 Minutes...

Panel Title

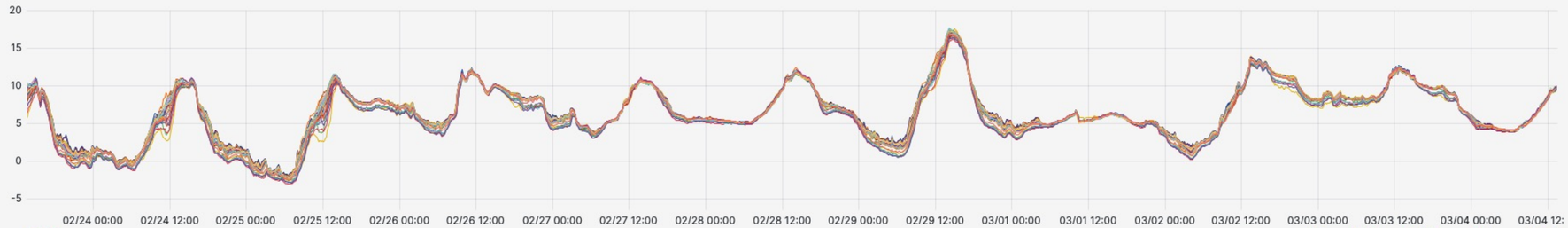
PROJECT_NAME	INSTALLATION_ID	INSTALLATION_N	MESSVAR_ID	VARIABLE_ID	VARNAME_NAME	IMP_NAME	MESSVAR_NAME	VARFREQ_NAME	VARUNIT_SYMBO	VARAGGR_SNAM	VARMETHOD_NA
Pfynwald irrigation	506	Pfynwald TW 6	157	30	Air temperature	TA_ic_Avg	TA_ic_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	506	Pfynwald TW 6	158	30	Air temperature	TA_2m_Avg	TA_2m_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	508	Pfynwald TW 8	103	30	Air temperature	TA_oc_Avg	TA_oc_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	508	Pfynwald TW 8	104	30	Air temperature	TA_ic_Avg	TA_ic_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	508	Pfynwald TW 8	105	30	Air temperature	TA_uc_Avg	TA_uc_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	508	Pfynwald TW 8	106	30	Air temperature	TA_2m_Avg	TA_2m_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	520	PFY_SC14	5553	30	Air temperature	TA_ic_ce_Avg	TA_ic_ce_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	520	PFY_SC14	5556	30	Air temperature	TA_ic_fl_Avg	TA_ic_fl_Avg	10 Minutes	degC	mean	Not defined
Pfynwald irrigation	520	PFY_SC14	5559	30	Air temperature	TA_ic_fr_Avg	TA_ic_fr_Avg	10 Minutes	degC	mean	Not defined

A_CO2_CONC-mean-10 Minutes-ppm-NA



Name	Min	Max	Mean	Total	Count
PFY_SC1-5787-ACO2avg_1m_Avg	496	564	520	748121	1439
PFY_SC11-7725-ACO2avg_1m_Avg	438	507	463	666668	1439
PFY_SC13-7905-ACO2avg_1m_Avg	499	582	534	768901	1439
PFY_SC17-8085-ACO2avg_1m_Avg	500	582	534	768005	1439
PFY_SC18-8715-ACO2avg_1m_Avg	513	582	540	777728	1439

A_T-mean-10 Minutes-degC-NA



Name	Min	Max	Mean	Total	Count
PFY_SC1-5784-TA_ic_ce_Avg	-2.56	16.9	6.31	9077	1439
PFY_SC1-5791-AT_1m_Avg	-2.54	17.6	5.81	8361	1439
PFY_SC10-7312-TA_ic_ce_Avg	-2.06	16.9	6.51	9362	1438
PFY_SC11-7722-TA_ic_ce_Avg	-2.46	17.3	6.58	9465	1439
PFY_SC11-7729-AT_1m_Avg	-3.04	16.2	5.74	8260	1439

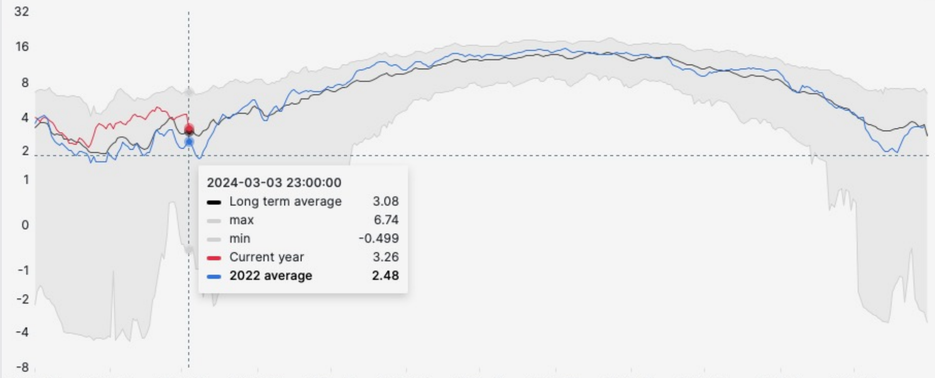
Monitoring with Grafana

Current Soil Temperature and Water Potentia

Overview

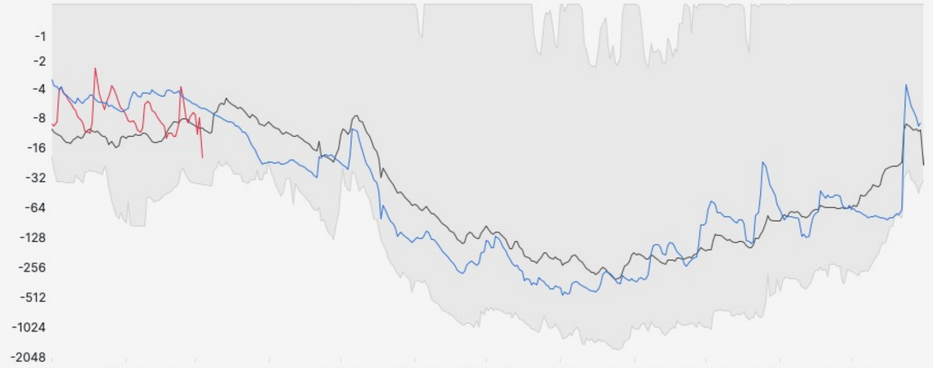
This is an overview of the current and historical Soil Temperature and Water Content. For the more details please expand the respective tabs below

Temperature Topsoil (All sites)



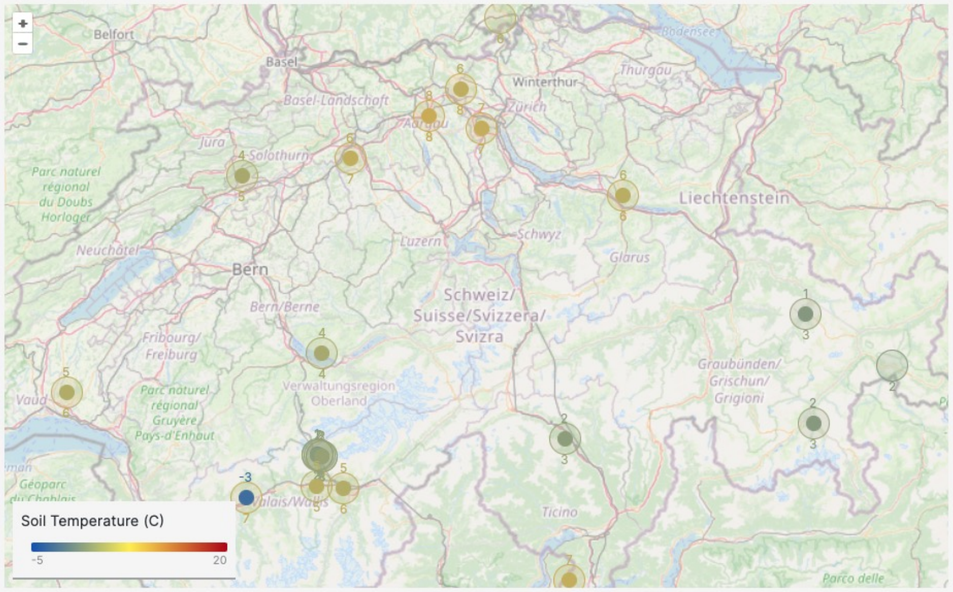
Name	Mean	Min	Max
Long term average	7.80	1.90	14.5
max	11.8	4.15	19.2
min	2.63	-4.72	9.71
Current year	3.62	2.19	4.94
2022 average	8.19	1.57	15.7

Soil Water Matric Potential Topsoil (All sites)

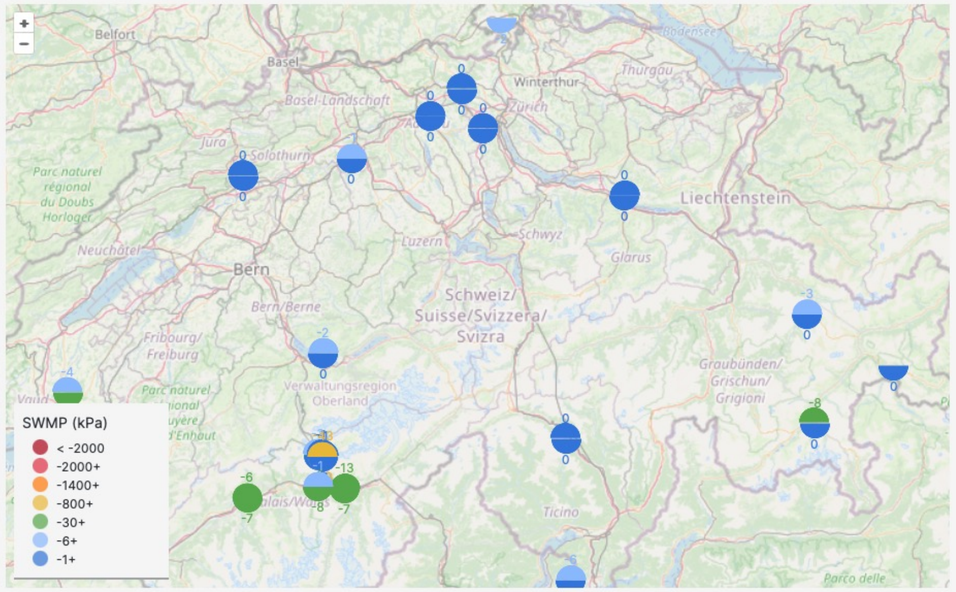


Name	Mean	Min	Max
Long term average	-84.3	-330	-4.90
max	-0.273	-2.28	-0.100
min	-448	-1686	-19.0
Current year	-7.55	-19.7	-2.37
2022 average	-112	-472	-3.13

Soil Temperature



Soil Water Matric Potential



Conclusions

Powerful and well structured PostgreSQL database

Custom build and maintained R package for data access

Ready to use dashboards for Internal and Public data visualization

Thank You

Trotsiuk Volodymyr