

FinEst Centre
for Smart Cities

Andmepõhine sisekliima hindamine

Martin Thalfeldt, Tuule Mall Parts, Lauri Vihman,
Hans Kristjan Aljas, Tanel Heinsoo, Jaan Raik

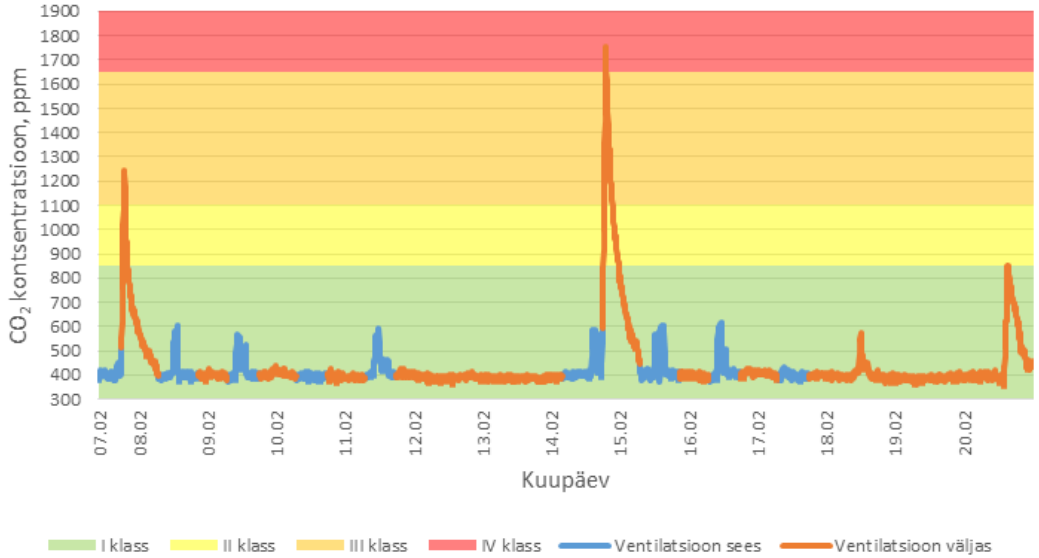
TTÜ, Ehituse ja arhitektuuri instituut,
Arvutisüsteemide instituut

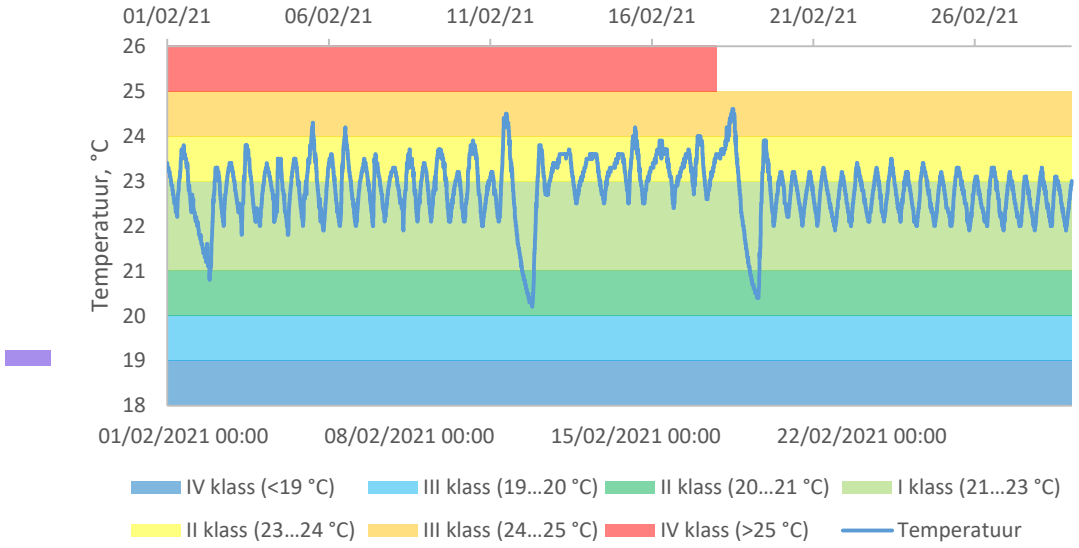
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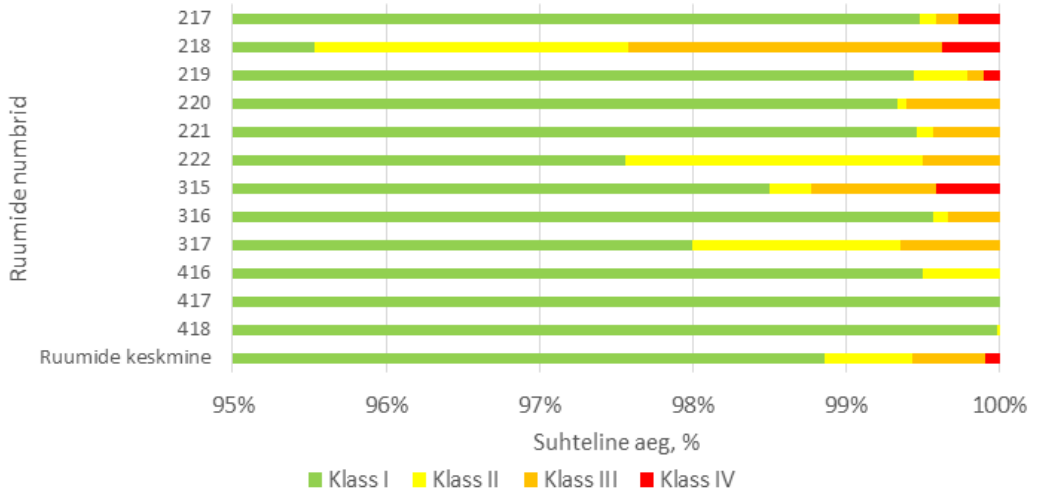
FinEst Twins project is funded by two grants: the European Union´s Horizon 2020 Research and Innovation Programme, under the grant agreement No. 856602, and the European Regional Development Fund, co-funded by the Estonian Ministry of Education and Research, under grant agreement No 2014-2020.4.01.20-0289.

Andmepõhine sisekliima hindamine

- EPBD andurite paigaldamise ettepanek
- Digiaudit
- Automaatne sisekliimamärgis
  - Ruumide temperatuur ja CO_2 tase
  - Toorandmete töötlemine
  - Kasutusaja hindamine

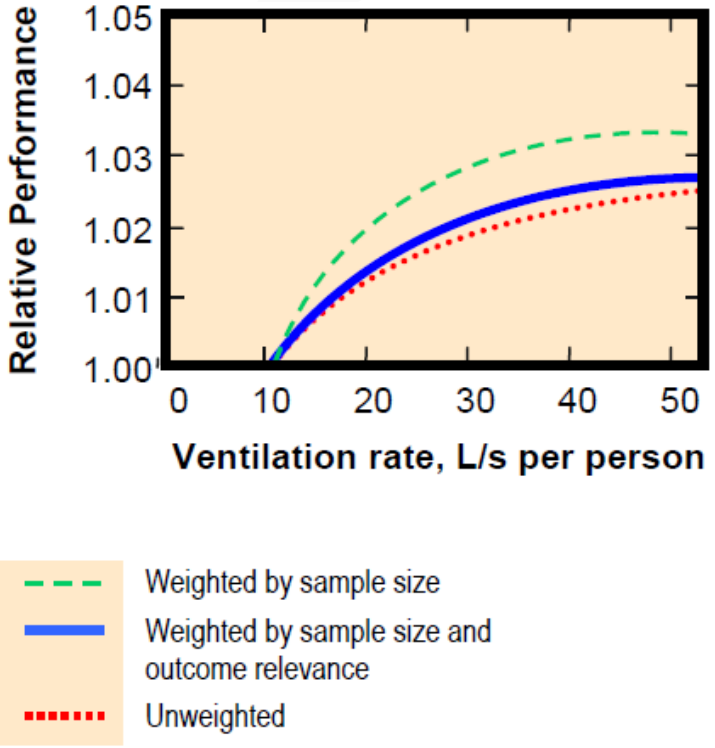


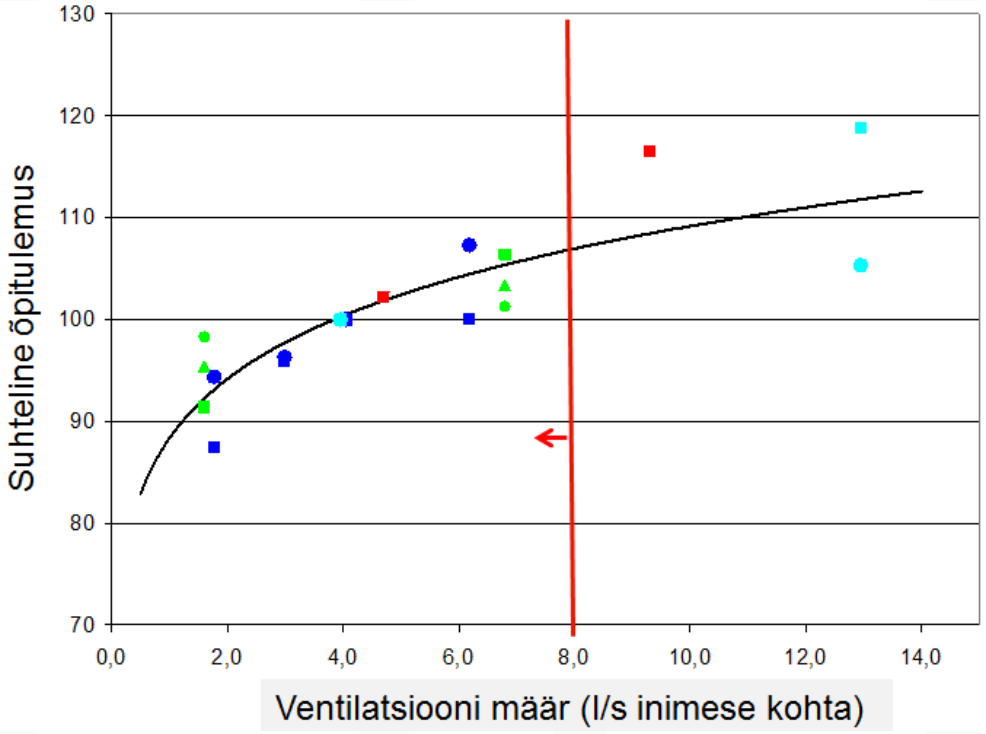




Sisekliima hindamise rakendused ja mõjud (1)

- Töö- ja õpivõime

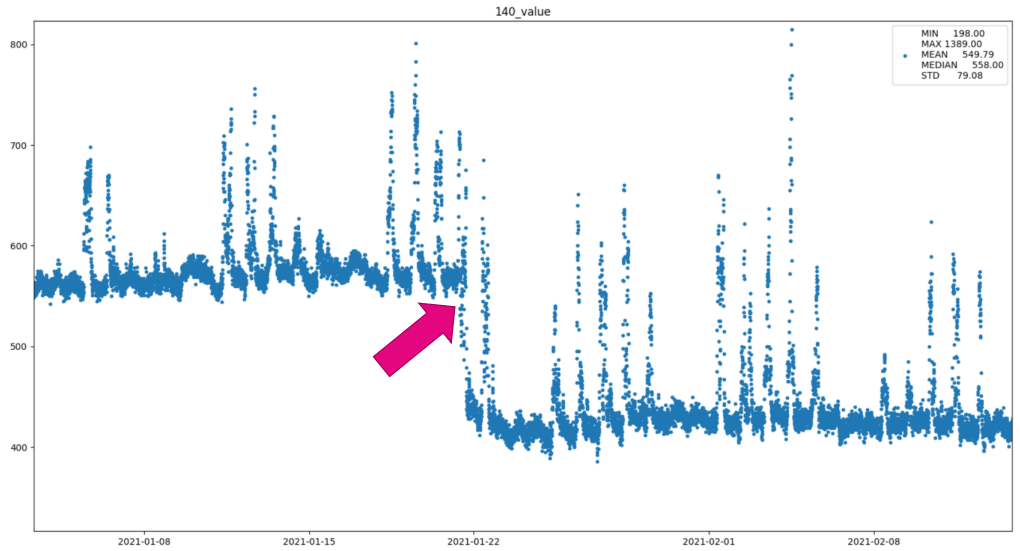


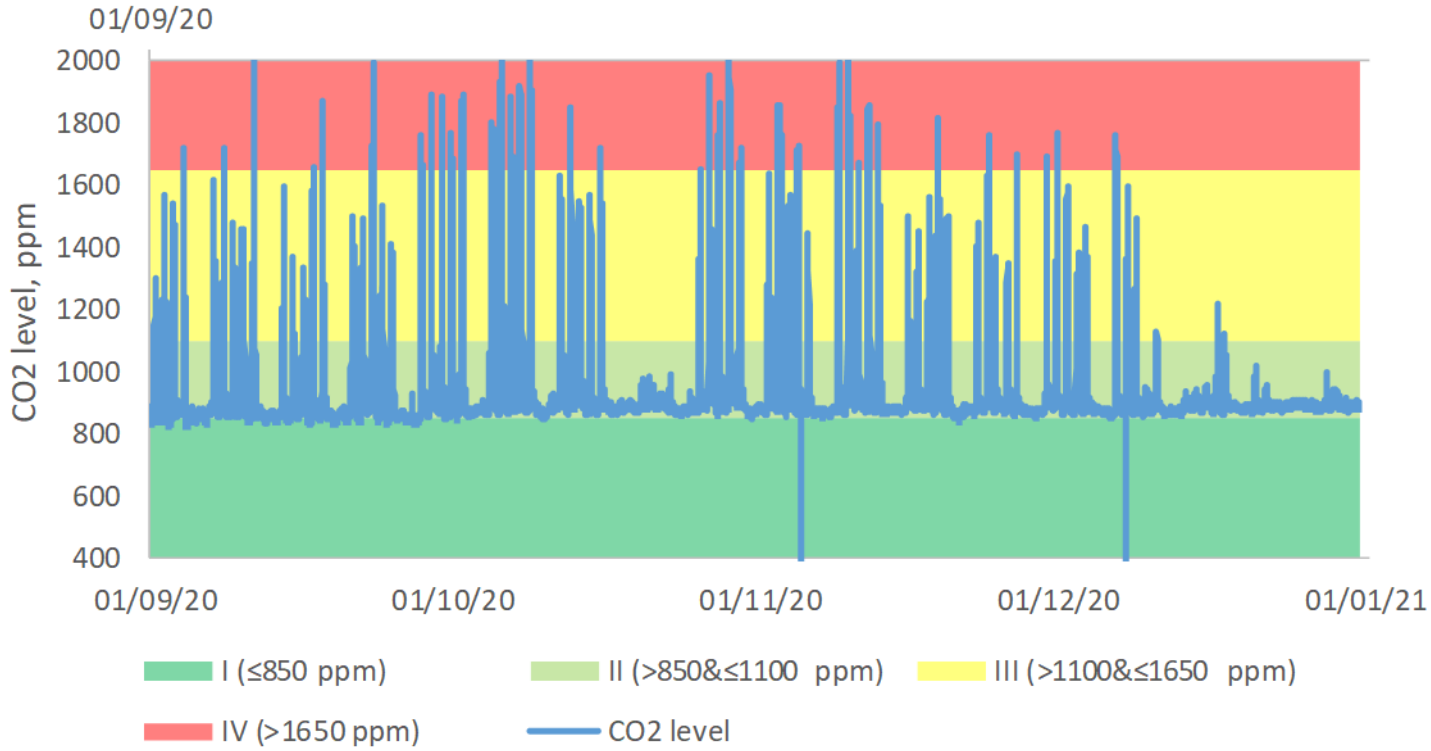


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Sisekliima hindamise rakendused ja mõjud (2)

- Töö- ja õpivõime
- COVID-19 leviku piiramine

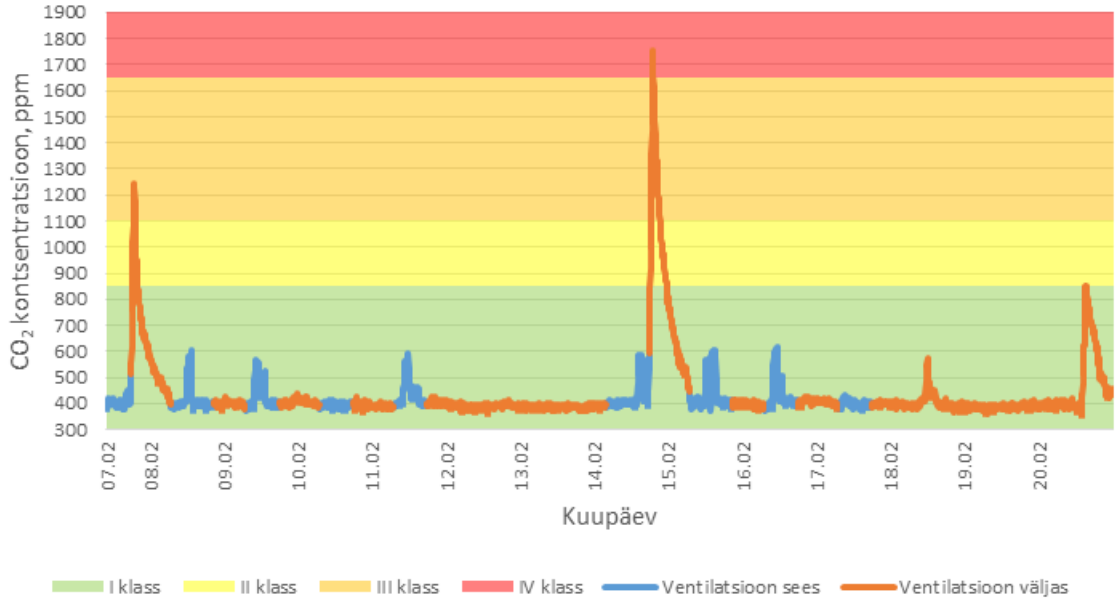




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Sisekliima hindamise rakendused ja mõjud (3)

- Töö- ja õpivõime
- COVID-19 levik
- Ventilatsiooni töögraafiku korrigeerimine



Kellaaeg	Ruumide hõivatus, %							Ventilatsiooni töögraafik						
	E	T	K	N	R	L	P	E	T	K	N	R	L	P
4:00	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
5:00	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
6:00	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	1	0	0	0	0	0	0
7:00	0%	0%	0%	0%	0%	0%	0%	1	1	1	1	1	0	0
	0%	0%	0%	0%	0%	0%	0%	1	1	1	1	1	0	0
	0%	0%	0%	0%	0%	0%	0%	1	1	1	1	1	0	0
	0%	0%	0%	0%	0%	0%	0%	1	1	1	1	1	0	0
8:00	0%	8%	0%	0%	8%	0%	0%	1	1	1	1	1	0	0
	0%	8%	0%	17%	8%	0%	0%	1	1	1	1	1	0	0
	0%	17%	0%	17%	17%	0%	0%	1	1	1	1	1	0	0
	0%	17%	0%	17%	17%	0%	0%	1	1	1	1	1	0	0
9:00	0%	17%	17%	17%	17%	0%	0%	1	1	1	1	1	0	0
	0%	25%	17%	17%	17%	0%	0%	1	1	1	1	1	0	0
	0%	17%	17%	25%	8%	0%	0%	1	1	1	1	1	0	0
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10:00	25%	42%	58%	58%	17%	8%	0%	1	1	1	1	1	0	0
	25%	42%	58%	67%	33%	8%	0%	1	1	1	1	1	0	0
	25%	42%	58%	67%	25%	8%	0%	1	1	1	1	1	0	0
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	25%	8%	17%	8%	17%	8%	0%	1	1	1	1	1	0	0
12:00	25%	17%	58%	75%	25%	8%	0%	1	1	1	1	1	0	0
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	33%	17%	17%	8%	17%	0%	0%	1	1	1	1	1	0	0
	58%	50%	58%	33%	33%	0%	0%	1	1	1	1	1	0	0
16:00	50%	50%	50%	42%	33%	0%	0%	1	1	1	1	1	0	0
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21:00	0%	0%	0%	0%	0%	0%	0%	0	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%	0%	0	0	0	0	0	0	0
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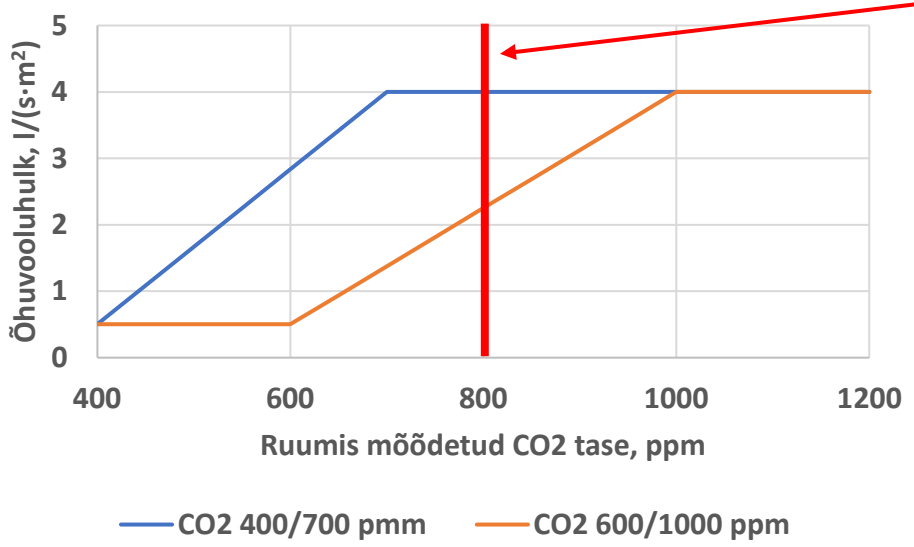
Ruumide hõivatus, %										
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

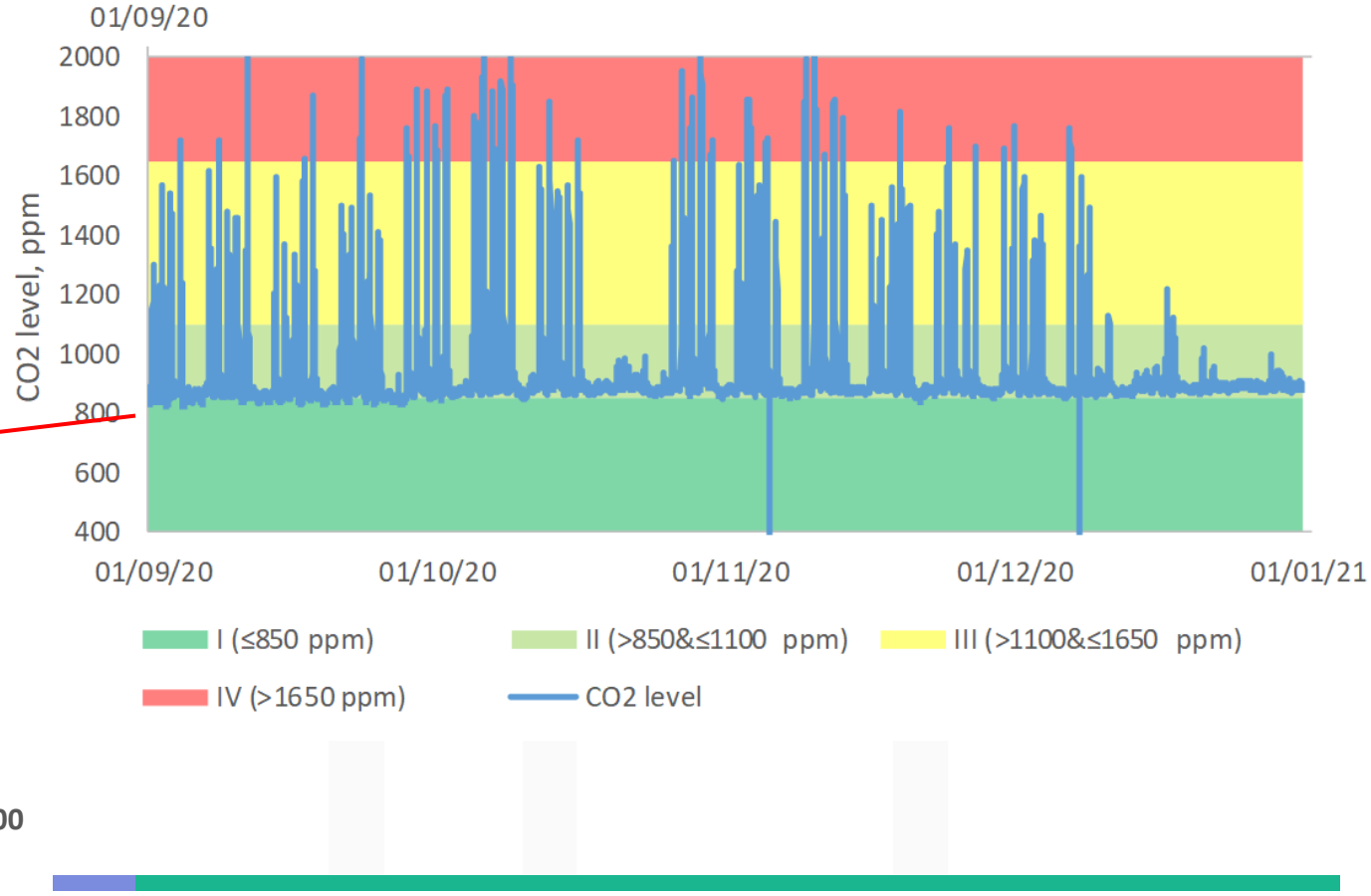
Ventilatsiooni töörežiim	
Sees	Väljas
1	0

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Sisekliima hindamise rakendused ja mõjud (4)

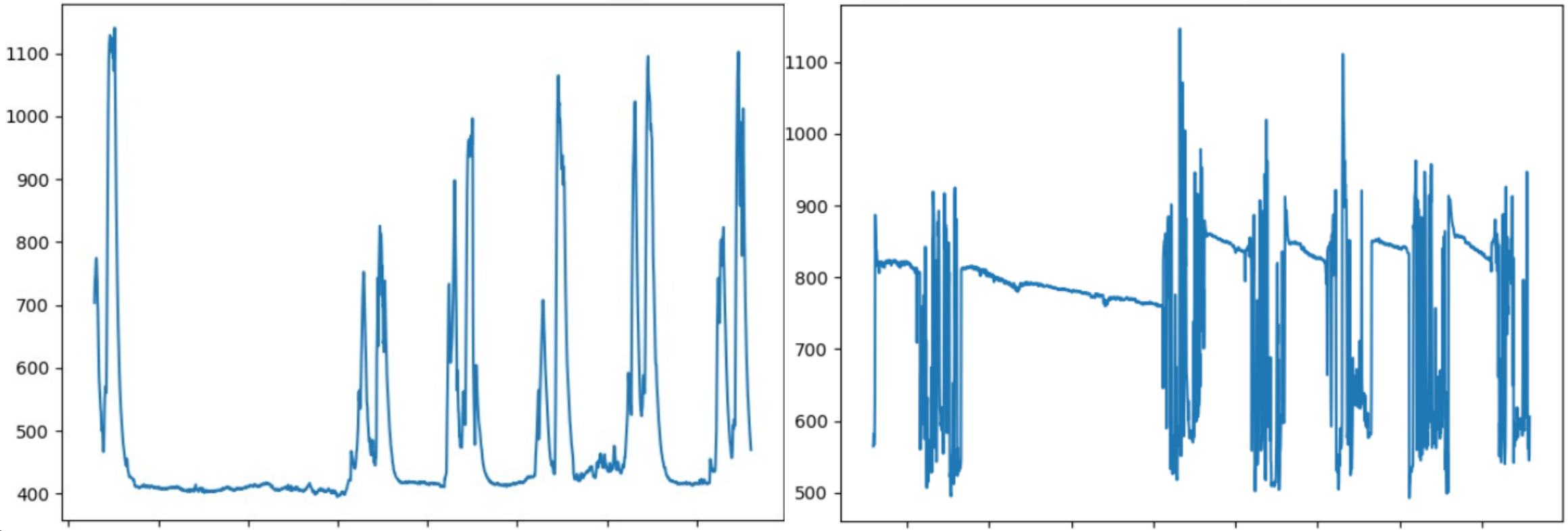
- Töö- ja õpivõime
- COVID-19 levik
- Ventilatsiooni töögraafik
- Õhuvooluhulkade juhtimine





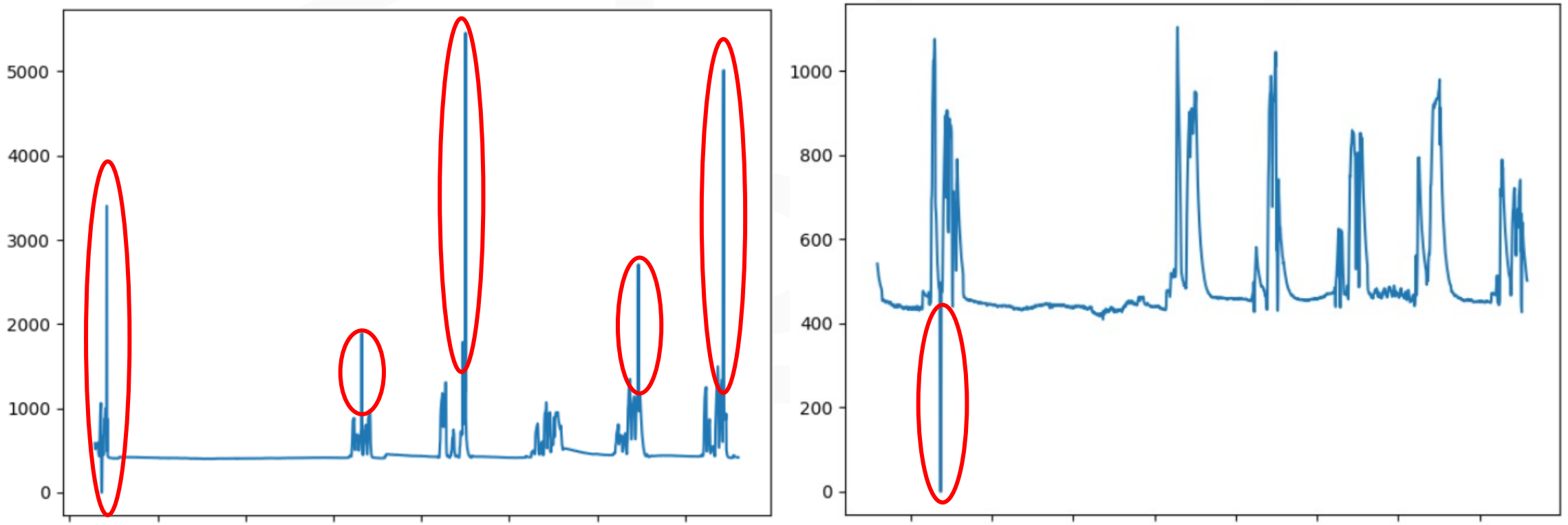
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CO_2 mõõteandmed hooneautomaatikast



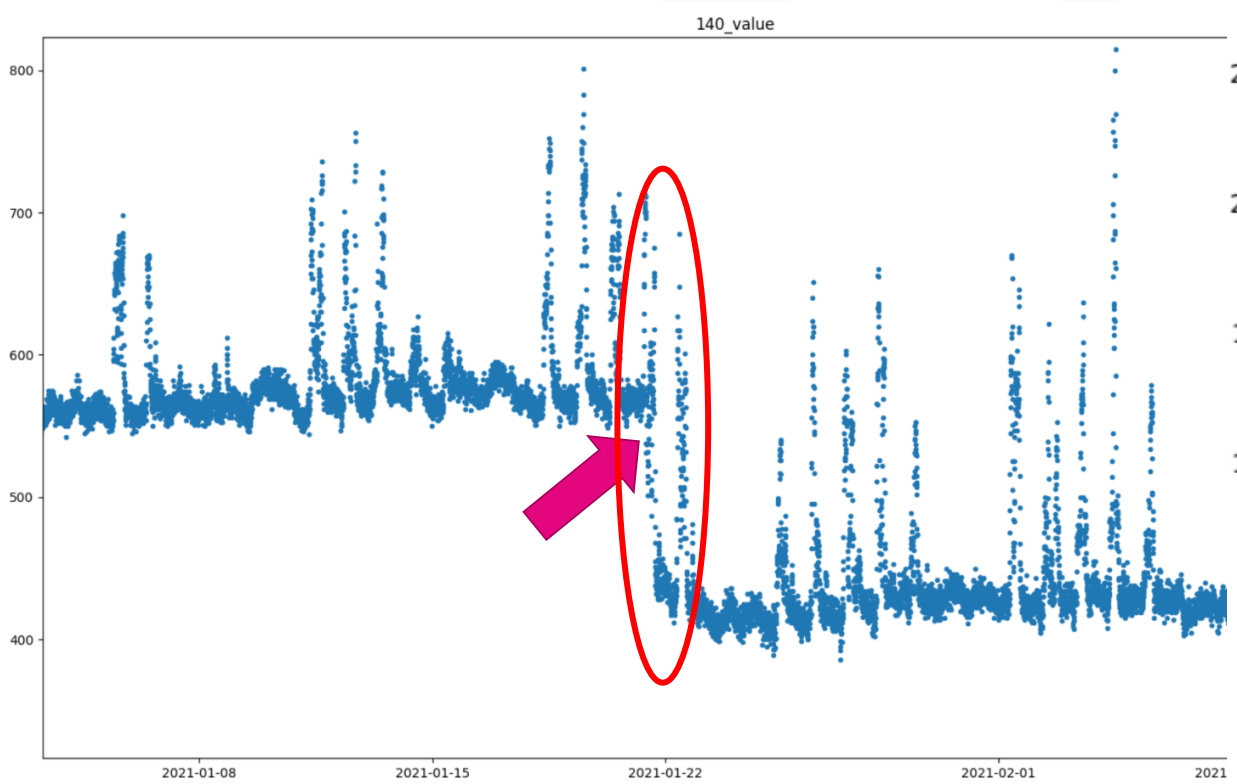
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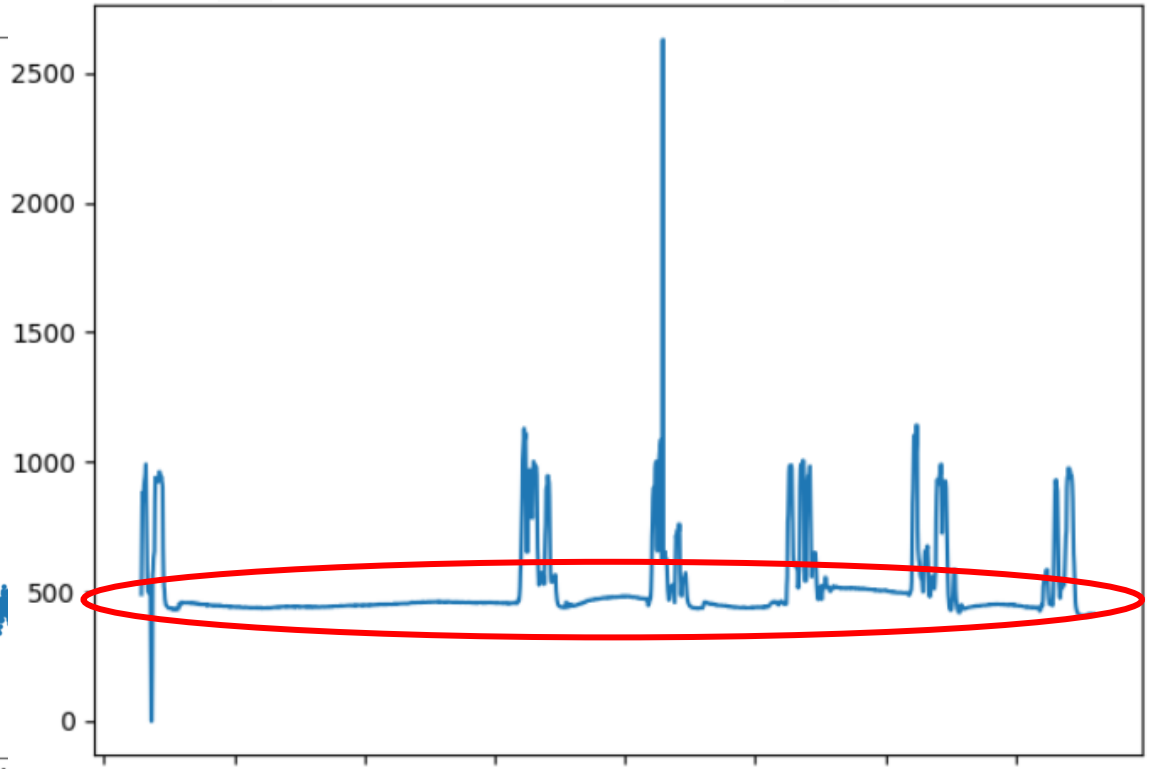
Toorandmete töötlemine – ebarealistlikud väärtused



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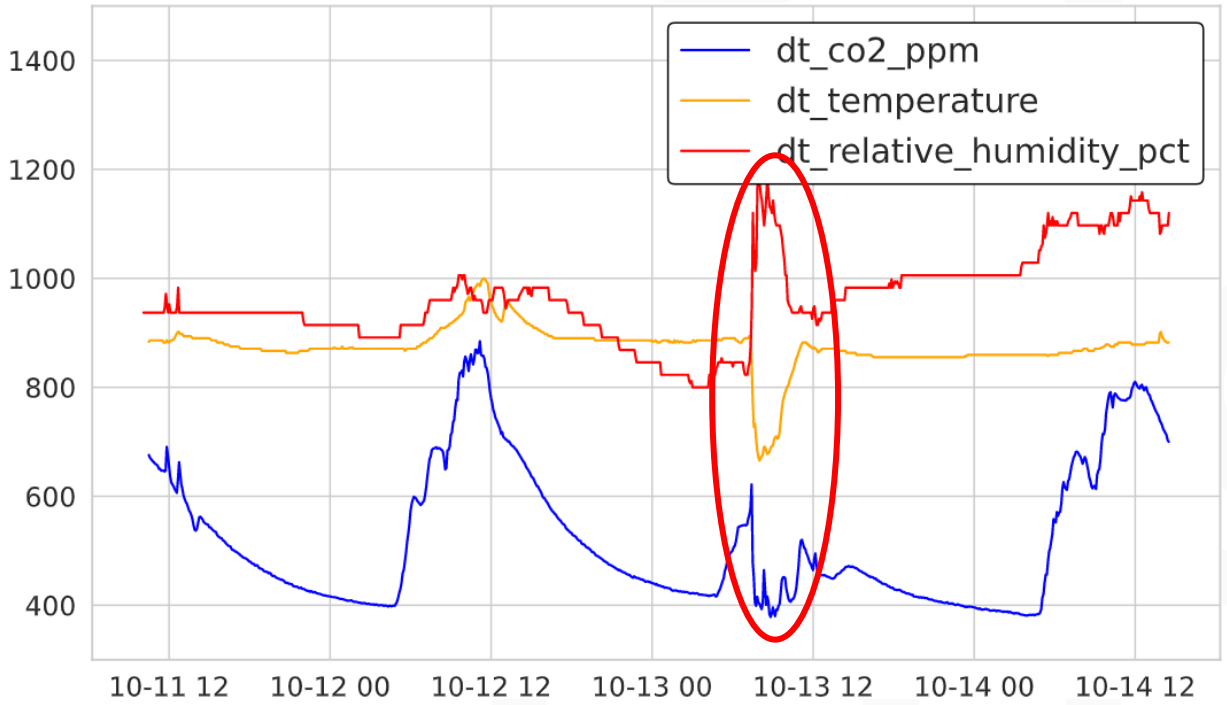
Toorandmete töötlemine – baasjoone korrigeerimine

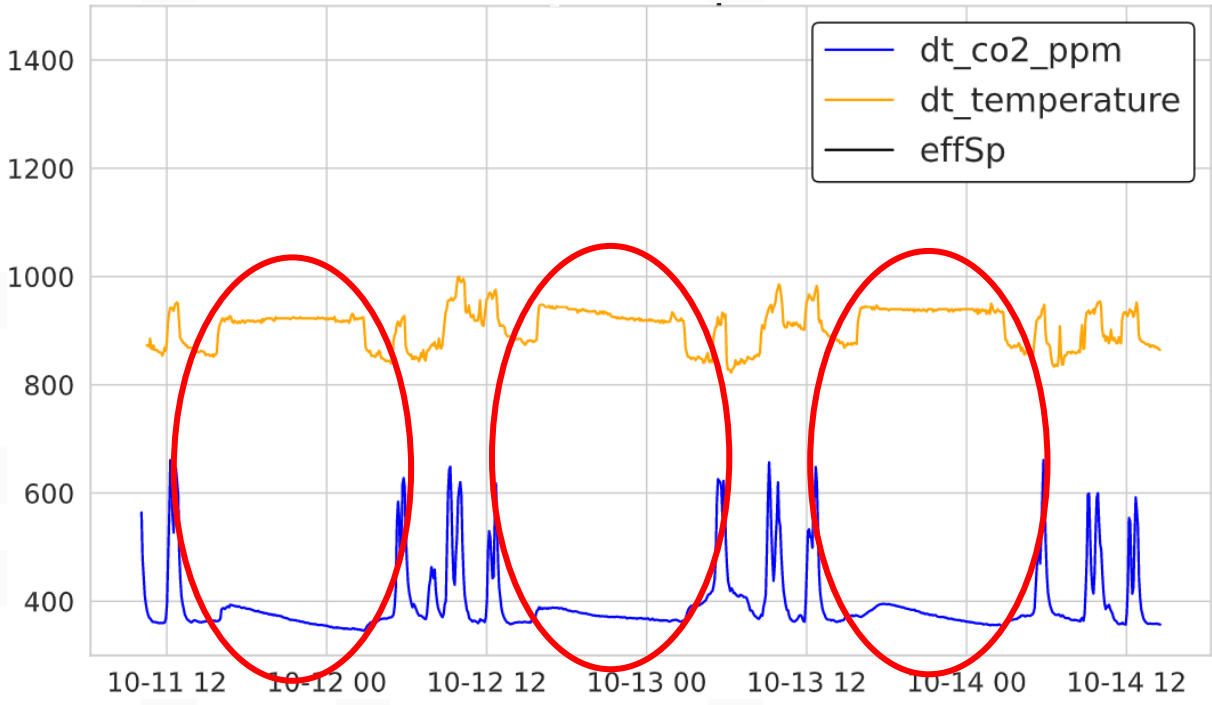




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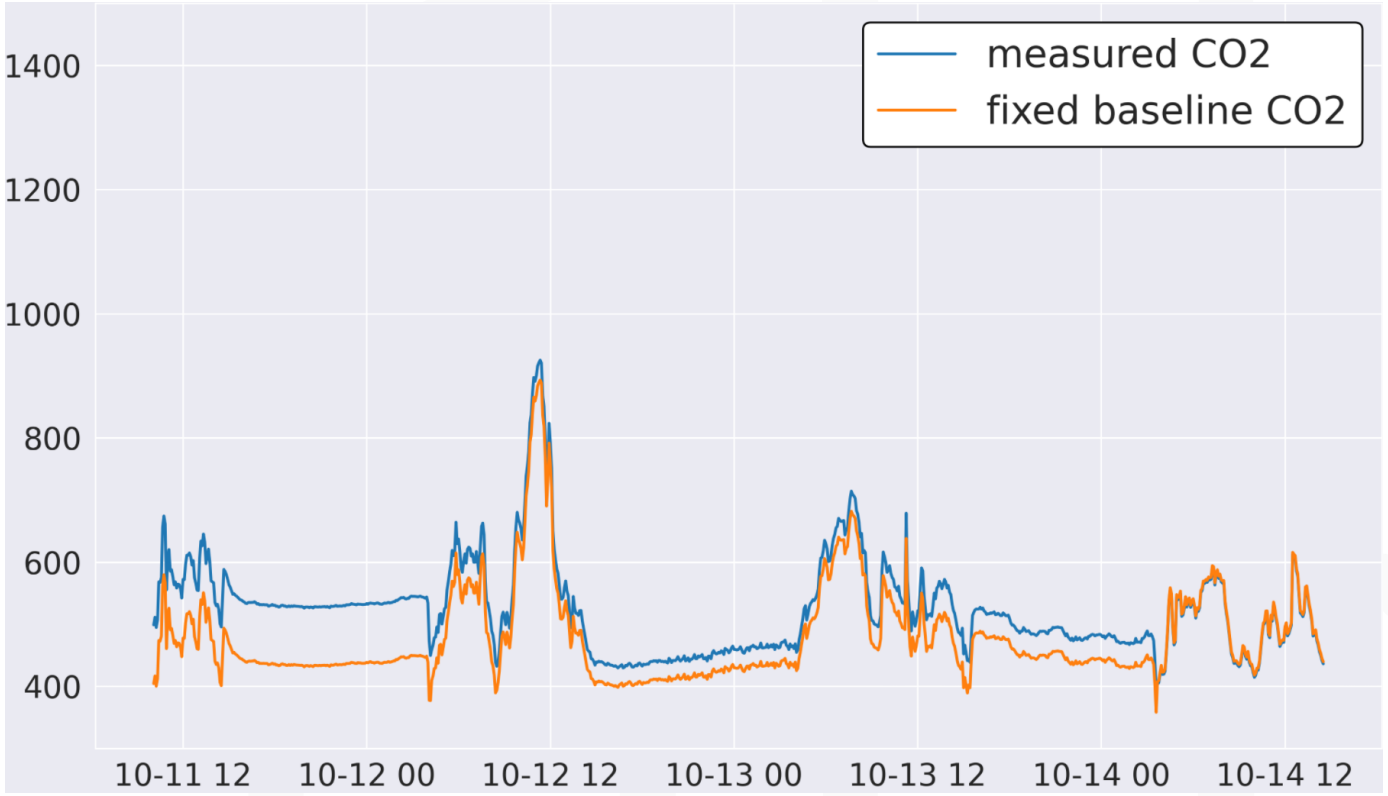
Toorandmete töötlemine – temperatuurisõltuvus?





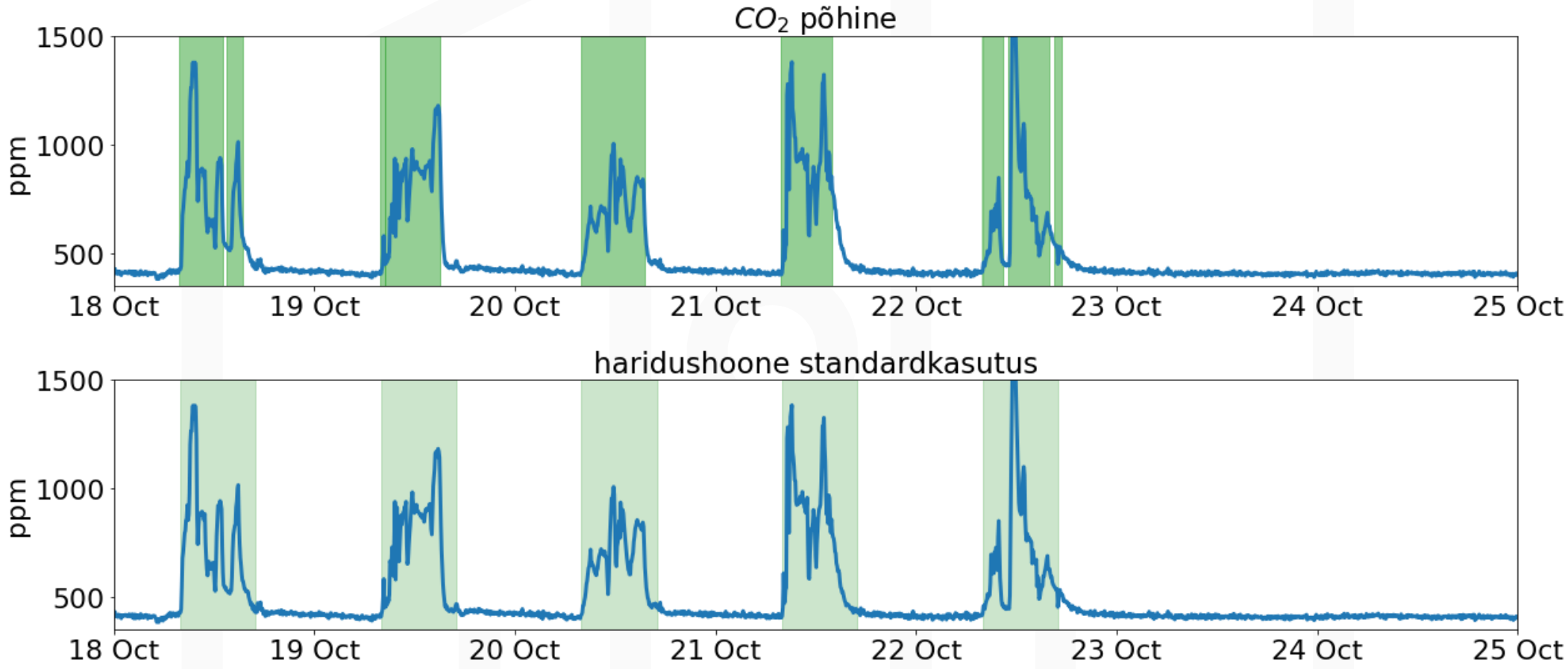
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Korrigeeritud mõõteandmed



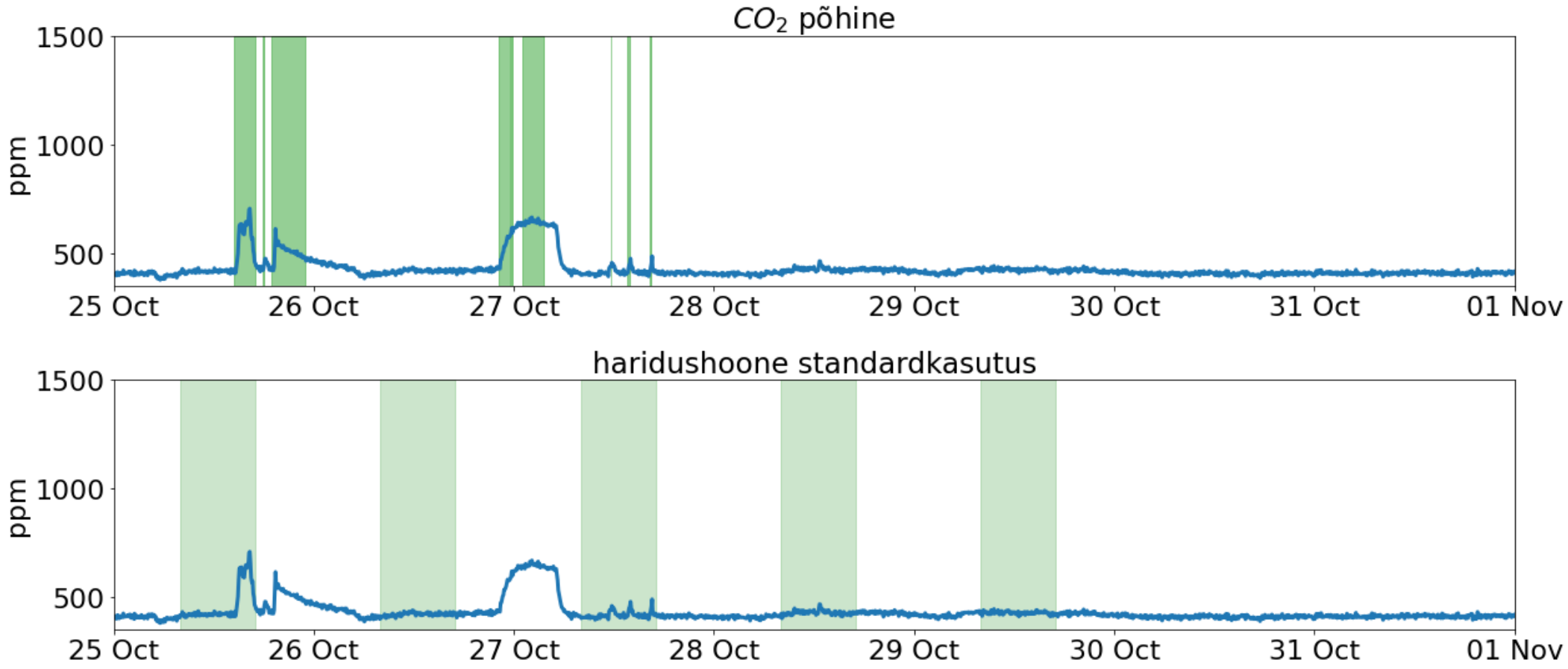
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Kasutusajad – tüüpiline nädal



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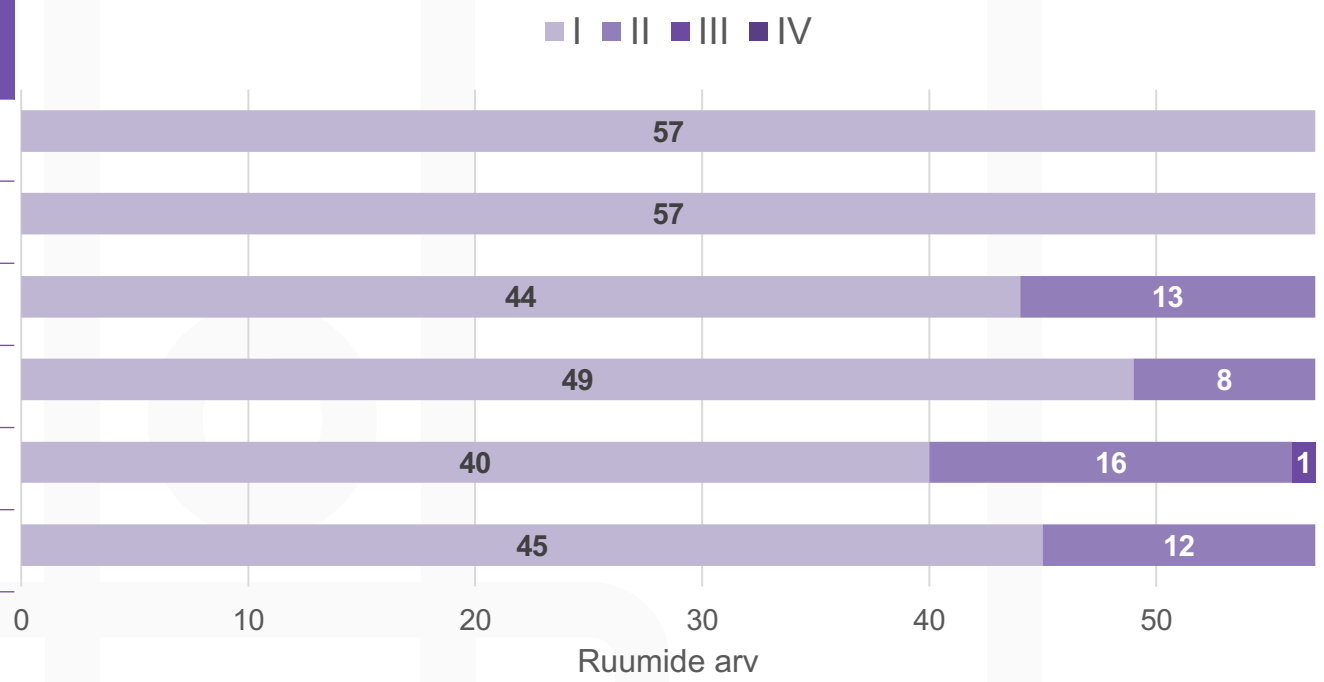
Kasutusajad – anomaalne nädal



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Andmetöötluse ja kasutusaja mõju sisekliimaklassile

CO_2 baastaseme korrektsioon	Kasutusajad
-	-
Jah	-
-	Standard
Jah	Standard
-	CO_2-põhine
Jah	CO_2-põhine



- Kasutusaegade puudulik tuvastamine põhjustab sisekliimaklasside ülehindamist
- Baastaseme korrektsioon aitab üldjuhul tulemusi parandada

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Kokkuvõte

- Andmepõhine sisekliima hindamine võimaldab
  - Hinnata sisekliimat, töö- ja õpivõimet
  - Korrigeerida tehnosüsteemide tööd – sisekliima ja energia
- Väljakutsed
  - Mõõteandmete kogumine
  - Toorandmete järeltöötlus
  - Analüüsi tulemuste rakendamine praktikas

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FinEst Centre
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Tänan!
Küsimusi?

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