



# The benefit of more observations in forecasting winter road conditions?

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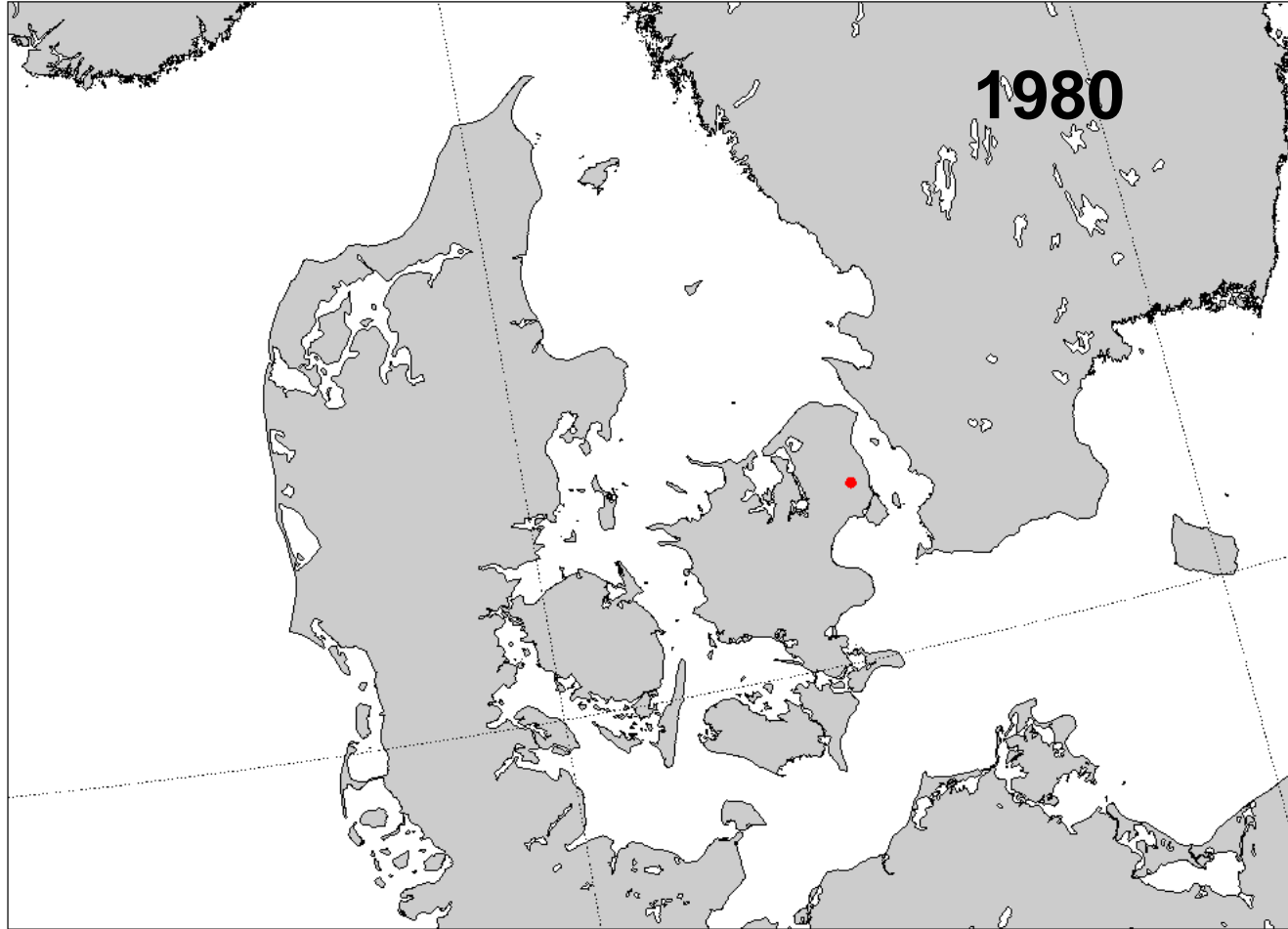


# How many observations do we actually need?

- Do we have observations enough?
- Can we have too many observations?
- How can we use observations to improve forecasts?
- What kind of observations do we need?



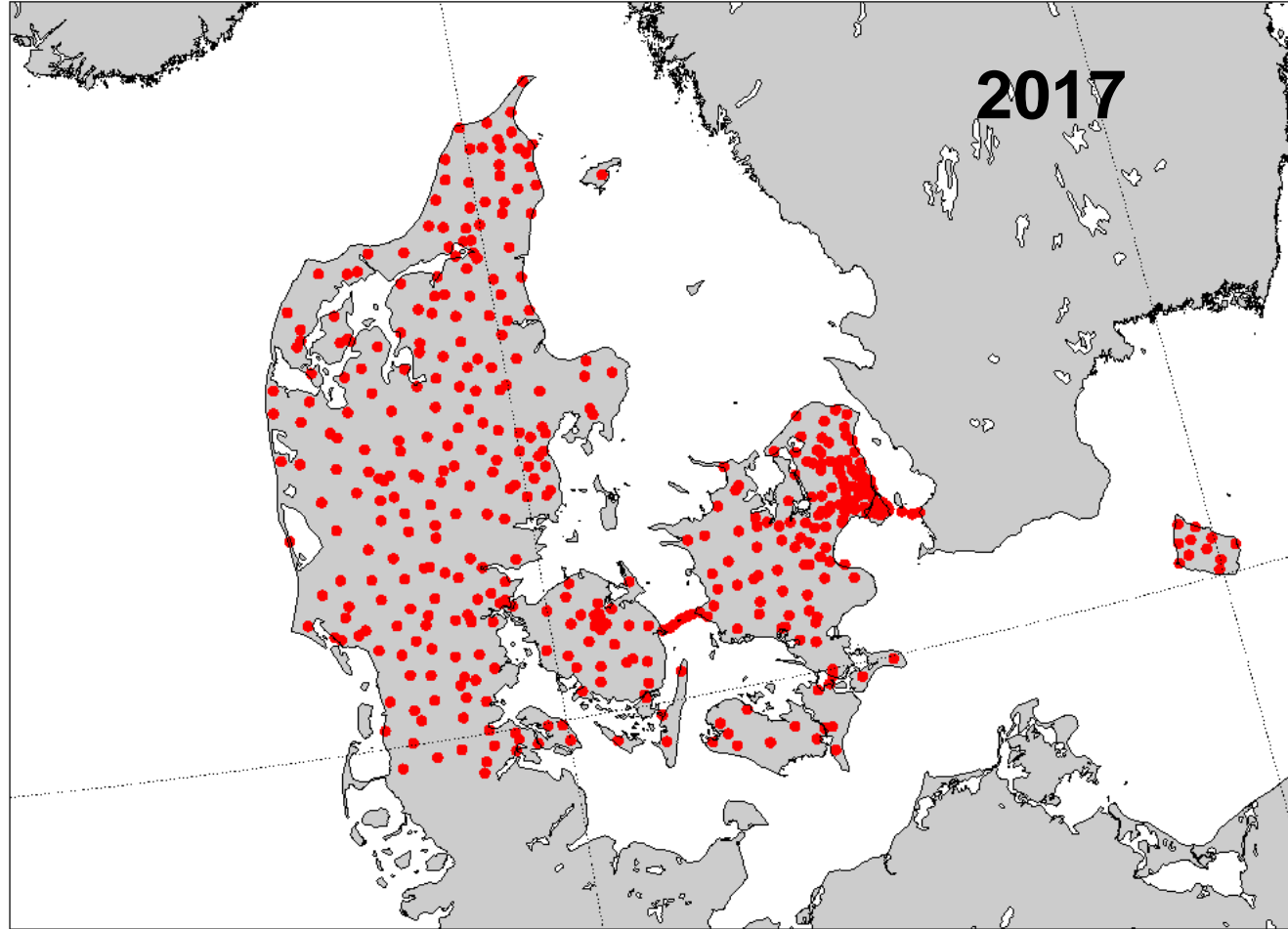
# It all started with just one observation



● 2024050809 (752)



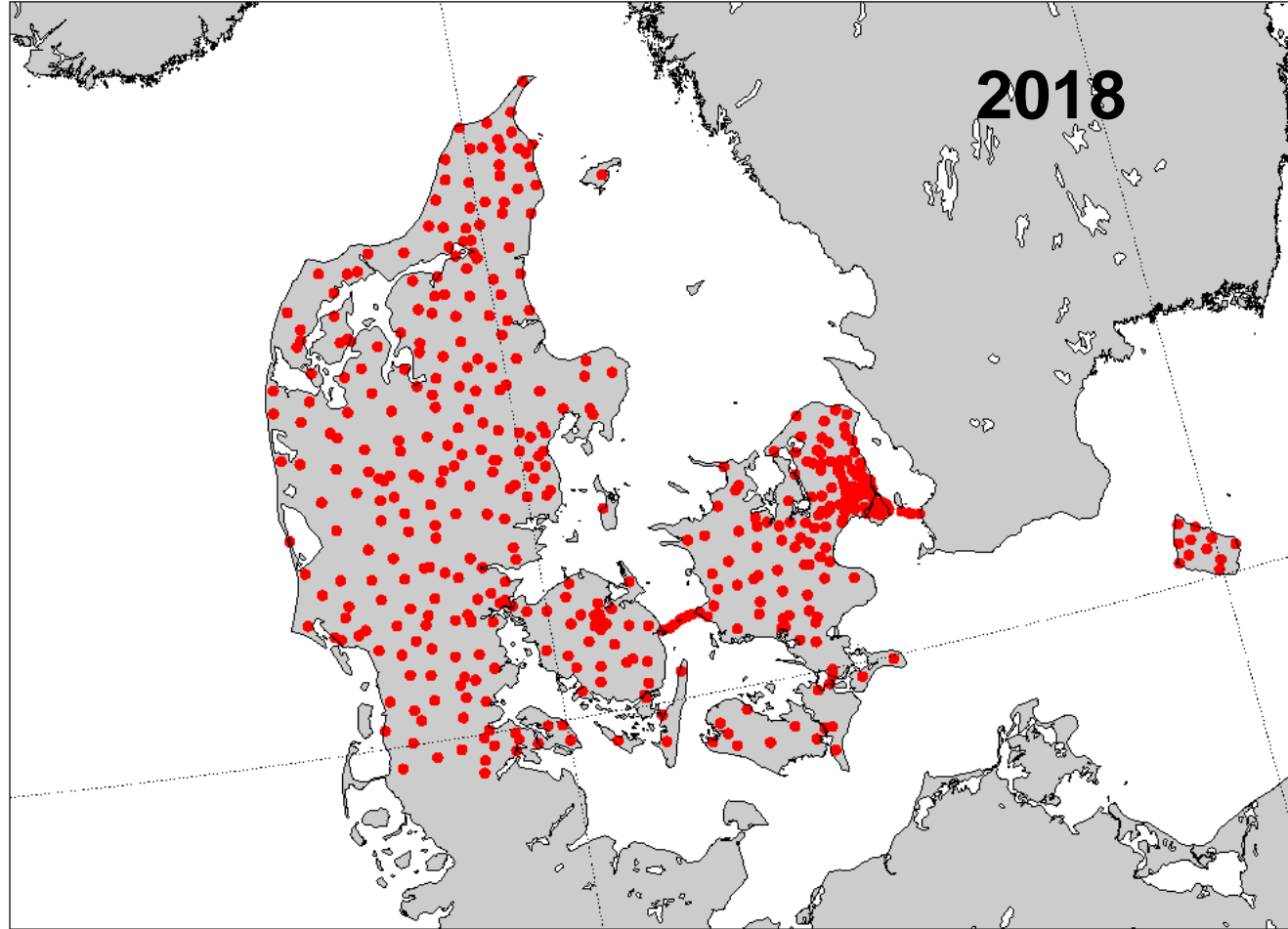
# And then ....



● 2017010210 (463)



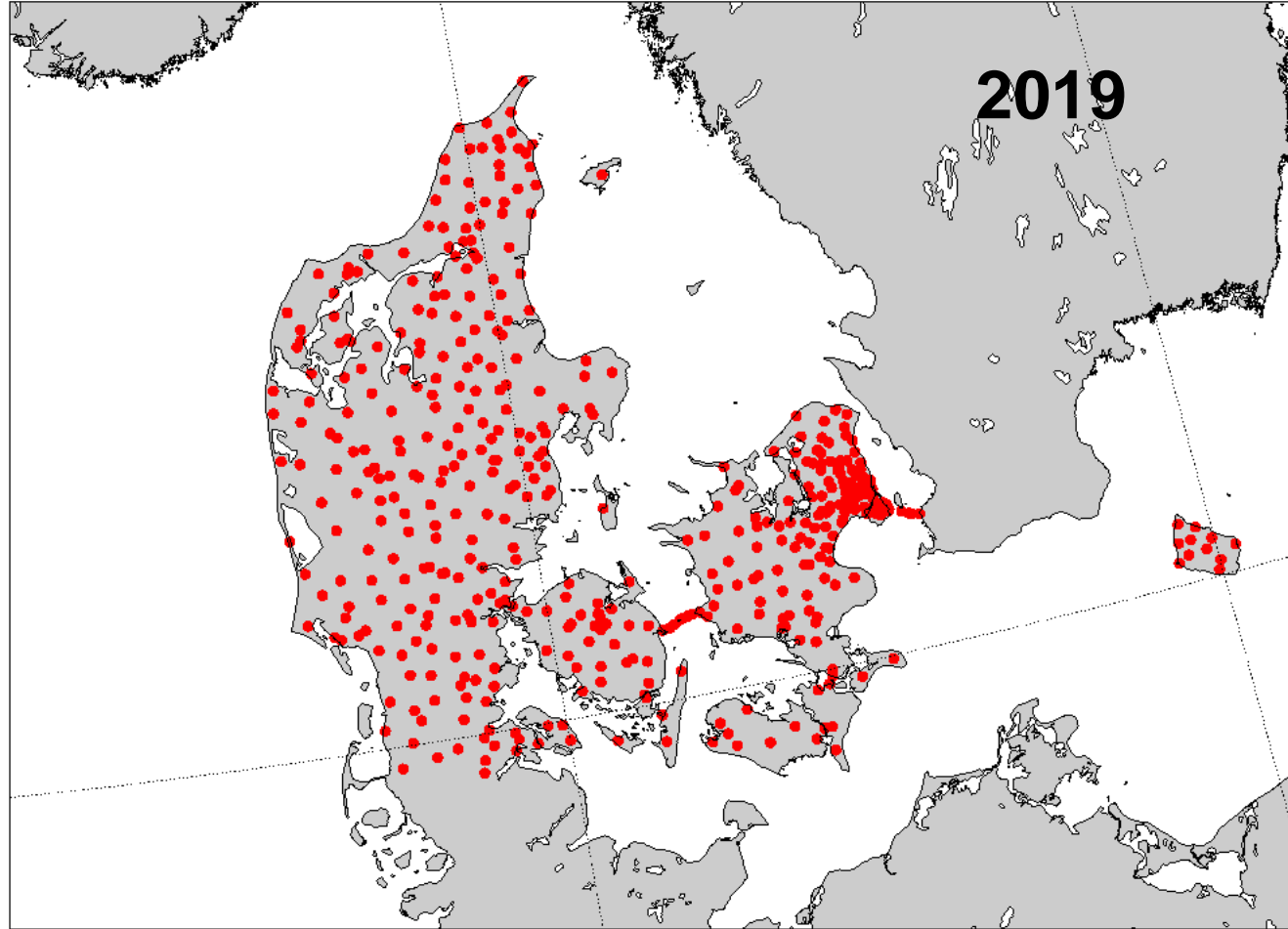
# And then ....



● 2018011913 (479)



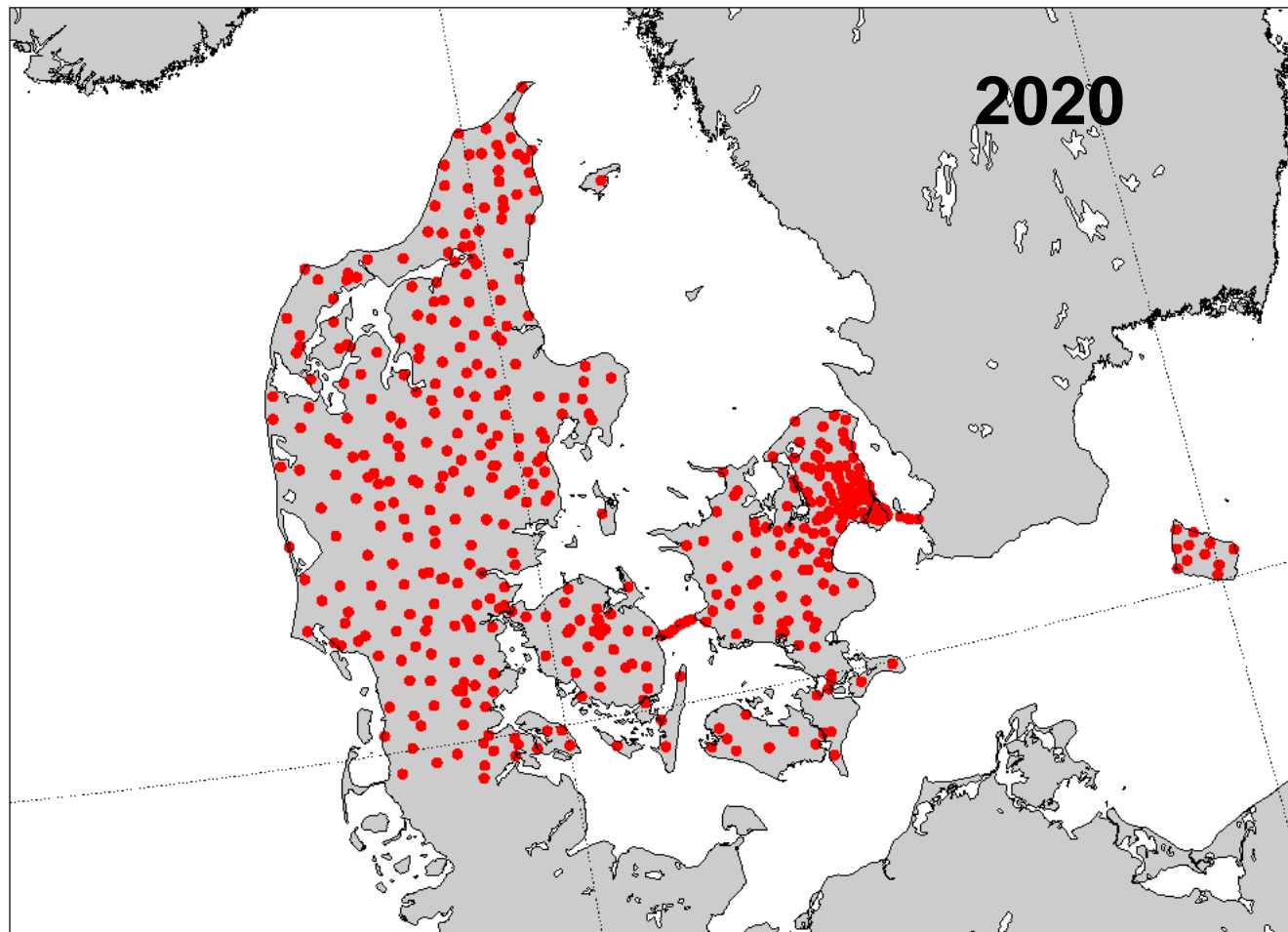
# And then ....



● 2019011610 (495)



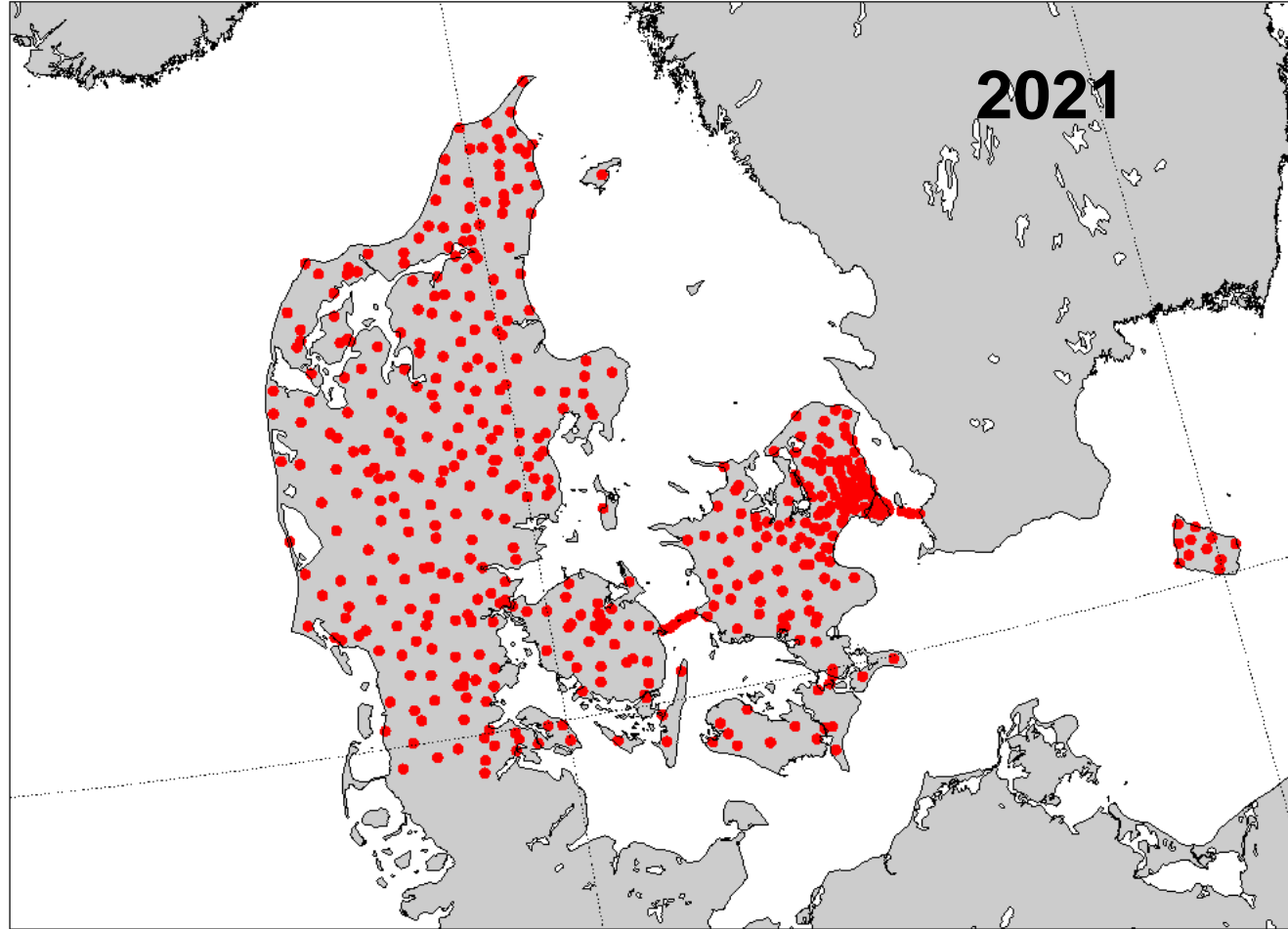
# And then ....



● 2020010810 (506)



# And then ....

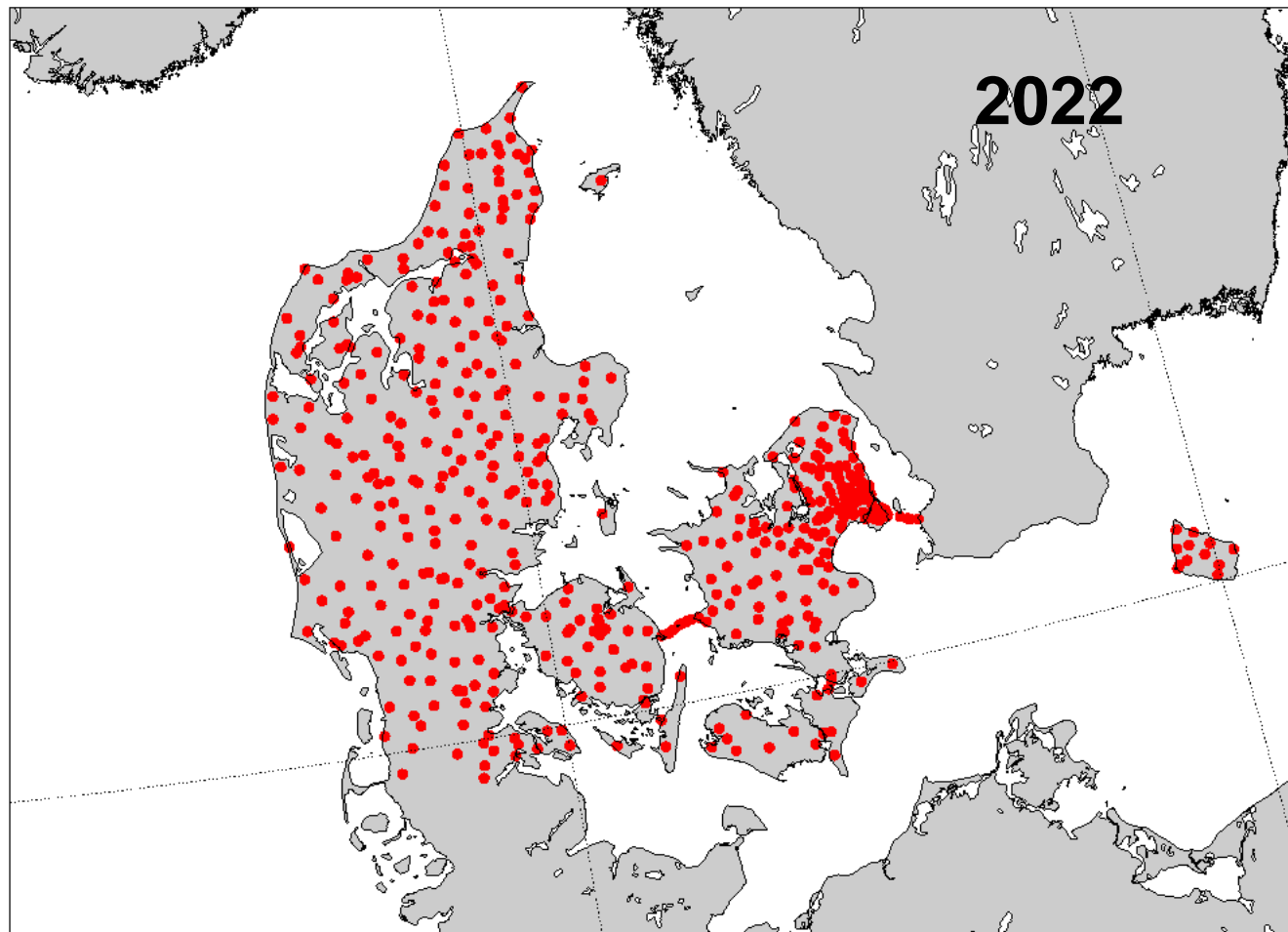


● 2021010809 (512)





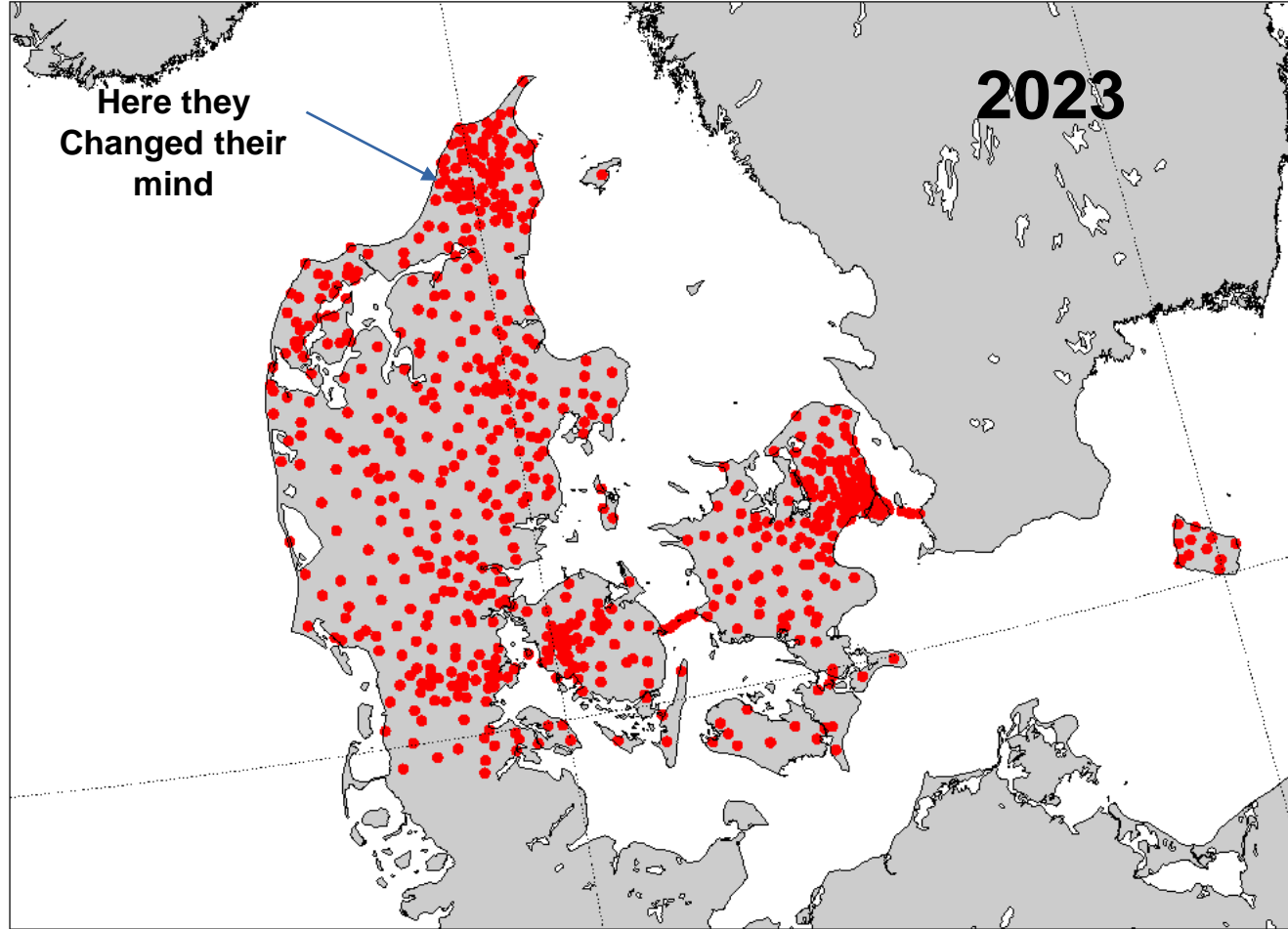
# And then ....



● 2022011412 (516)



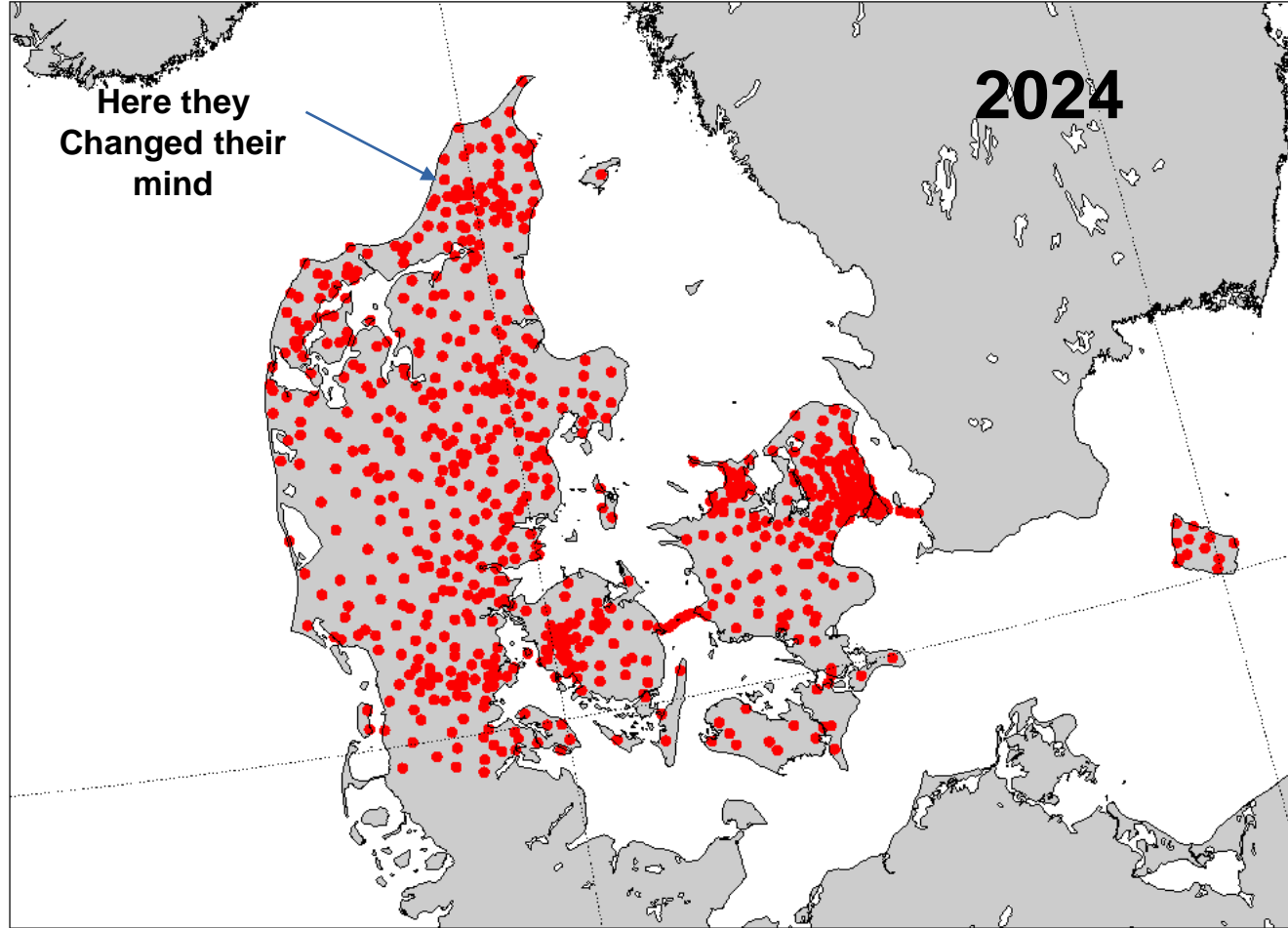
# And then suddenly a lot of IOT stations



● 2023010409 (700)



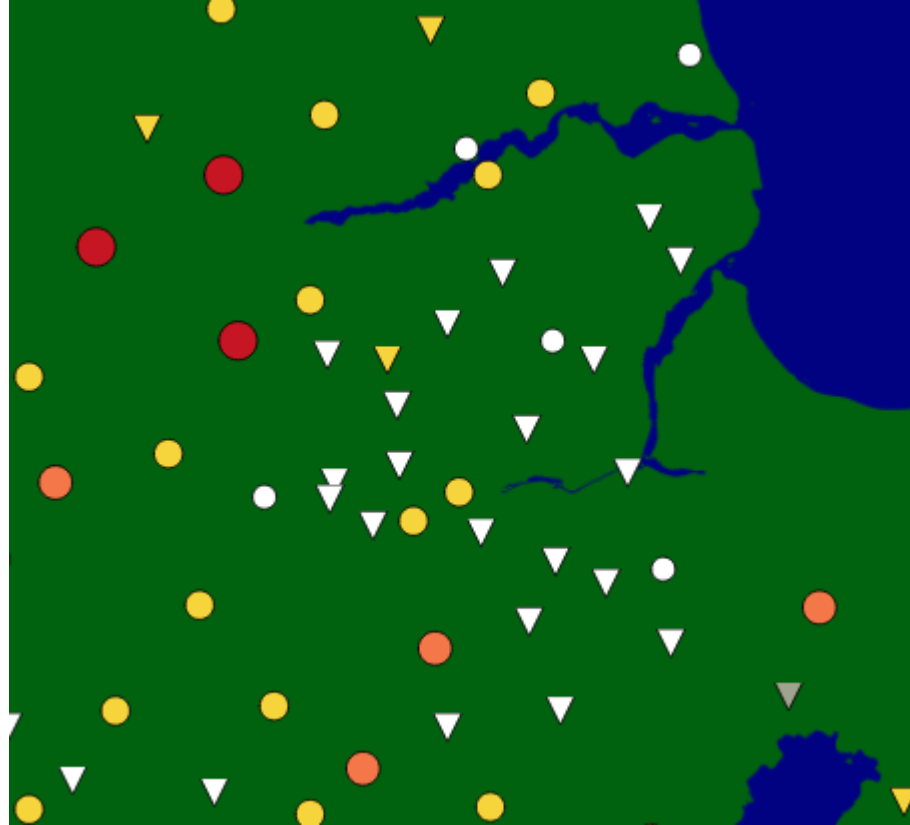
# And then ....



● 2024050809 (752)



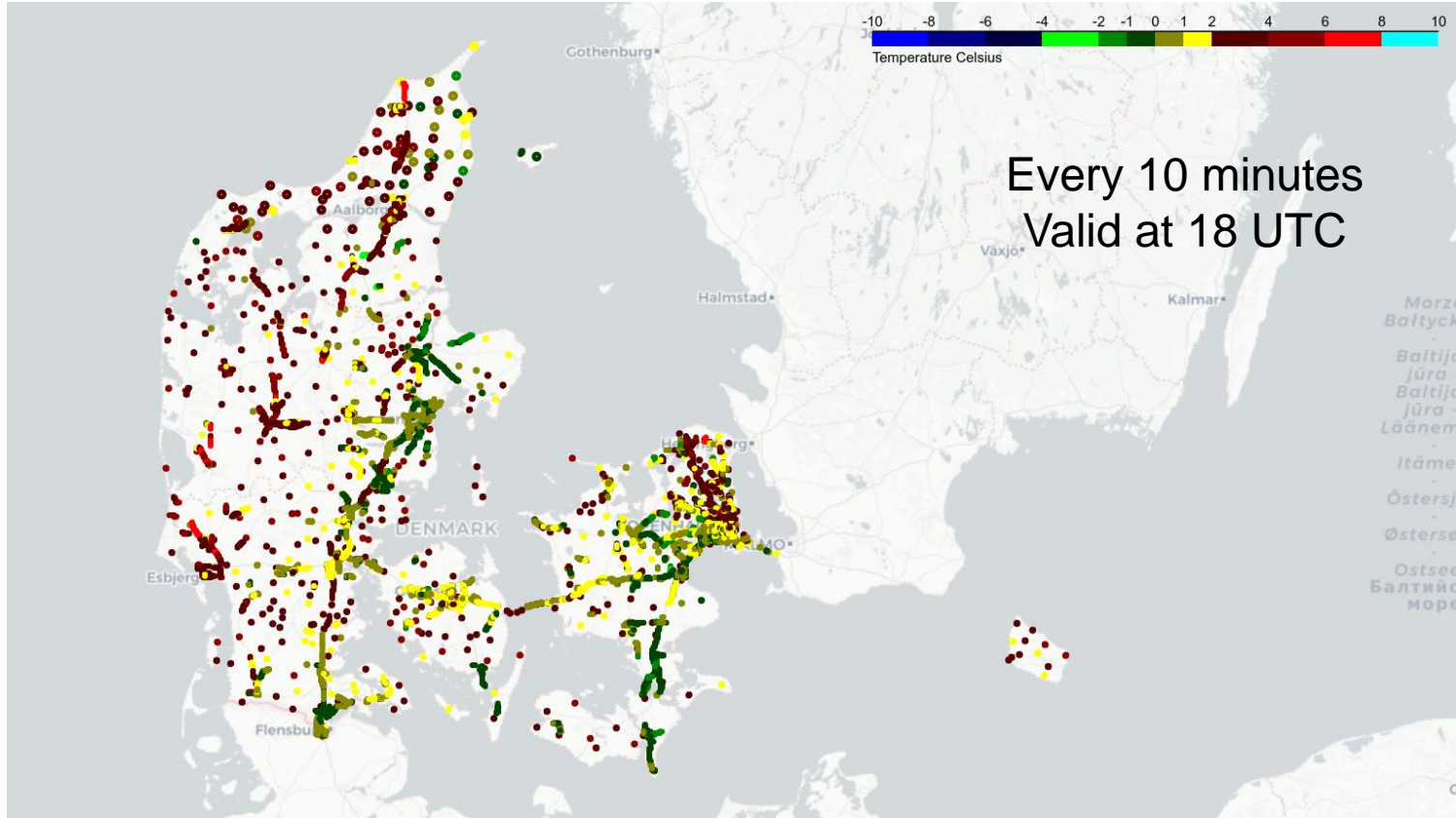
# Tendency that new stations are less extreme?





# Another source of data is Floating car data

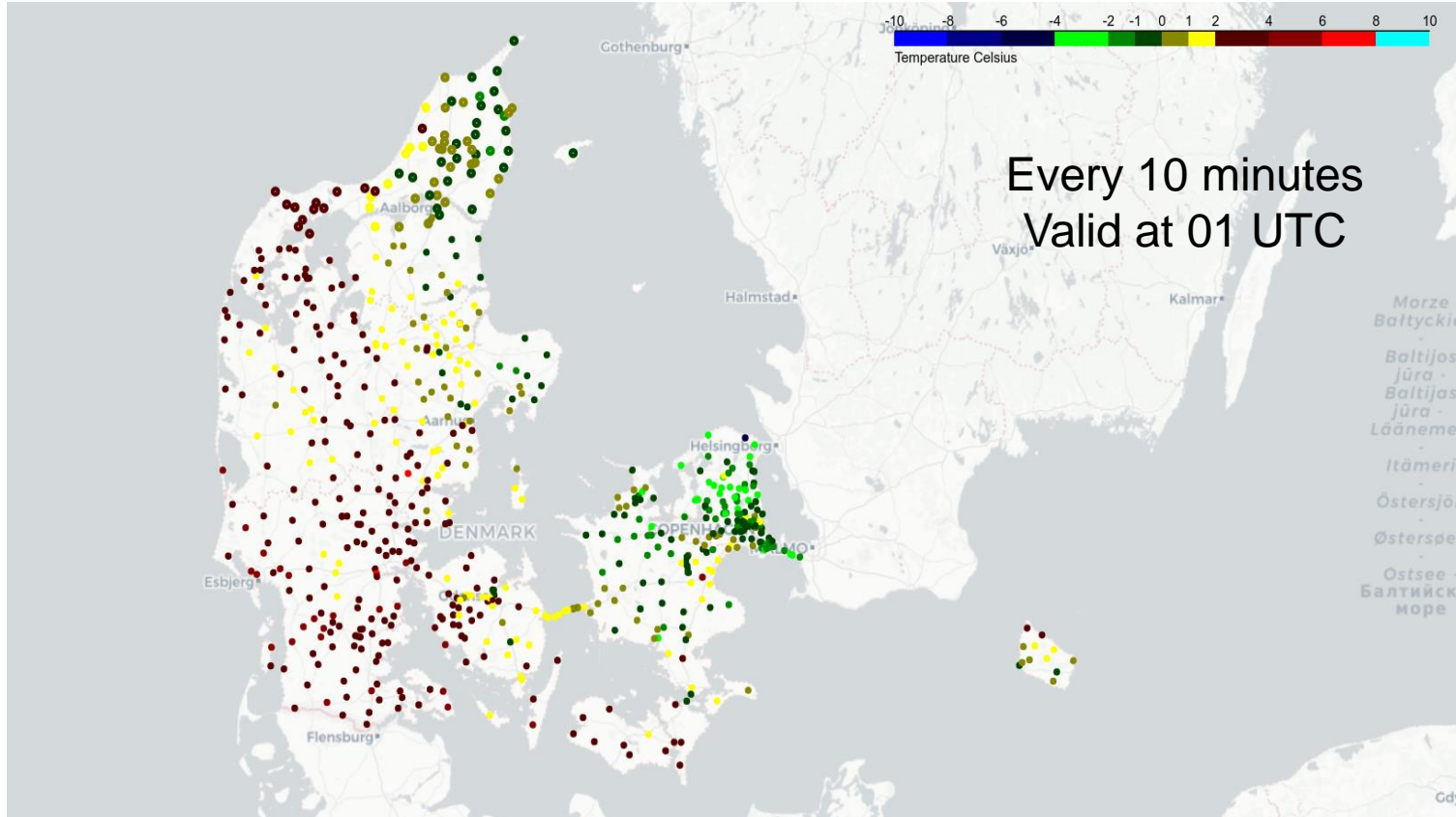
## Data from NIRA dynamics





# Another source of data is Floating car data

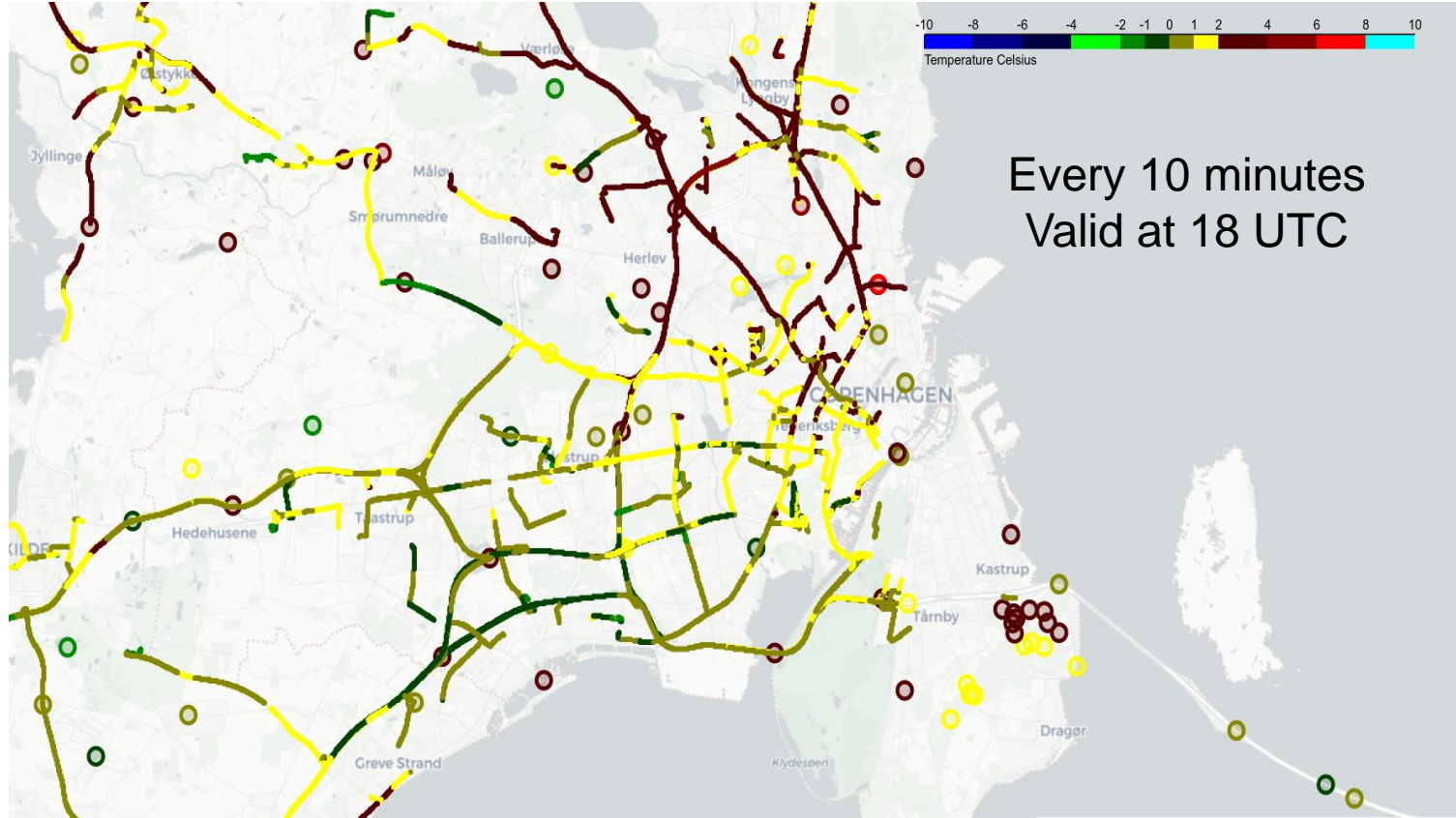
## Data from NIRA dynamics





# Another source of data is Floating car data

## Data from NIRA dynamics



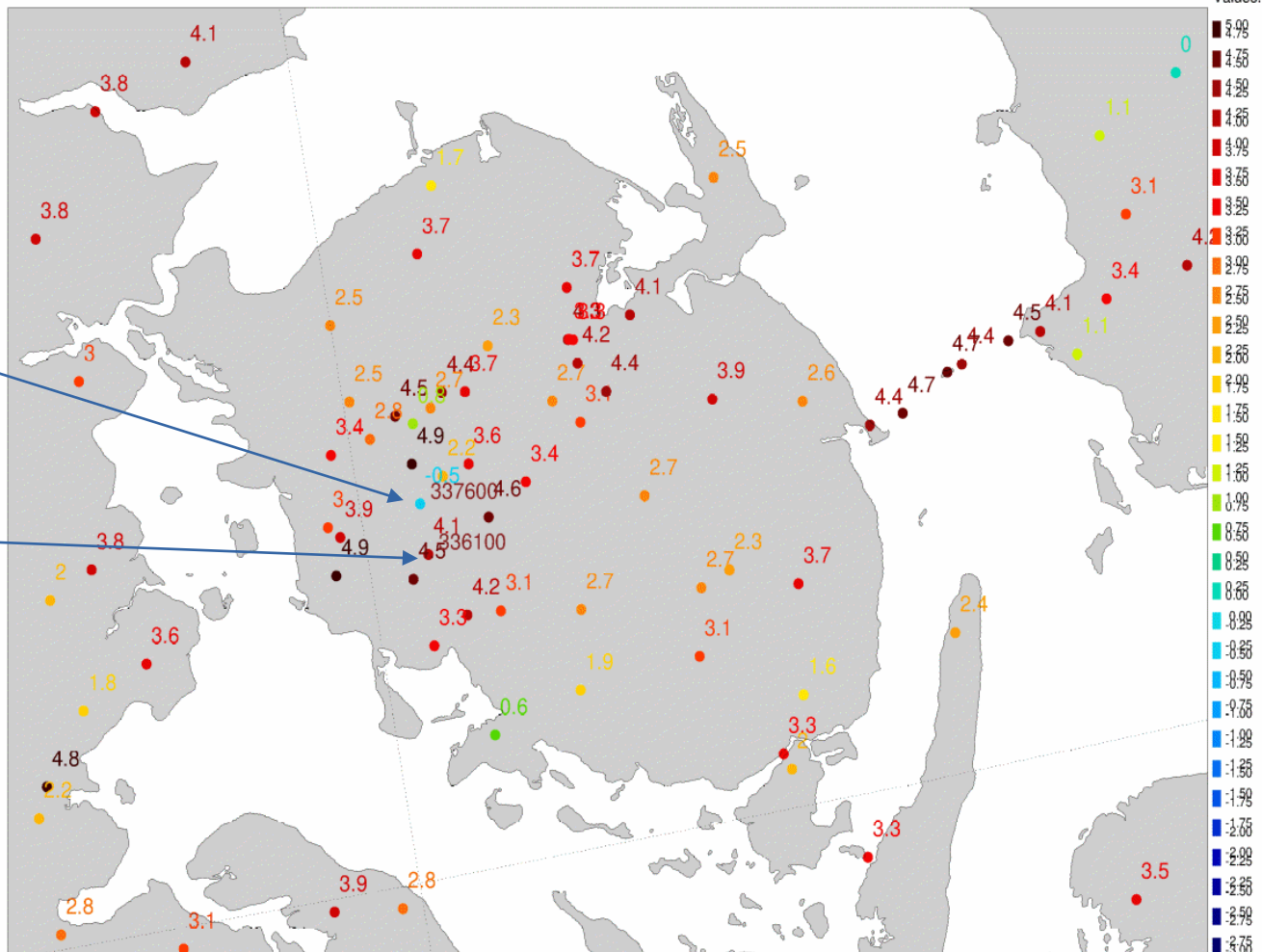


# Early warning from dense network

Road  
temperature  
Valid at 18 UTC

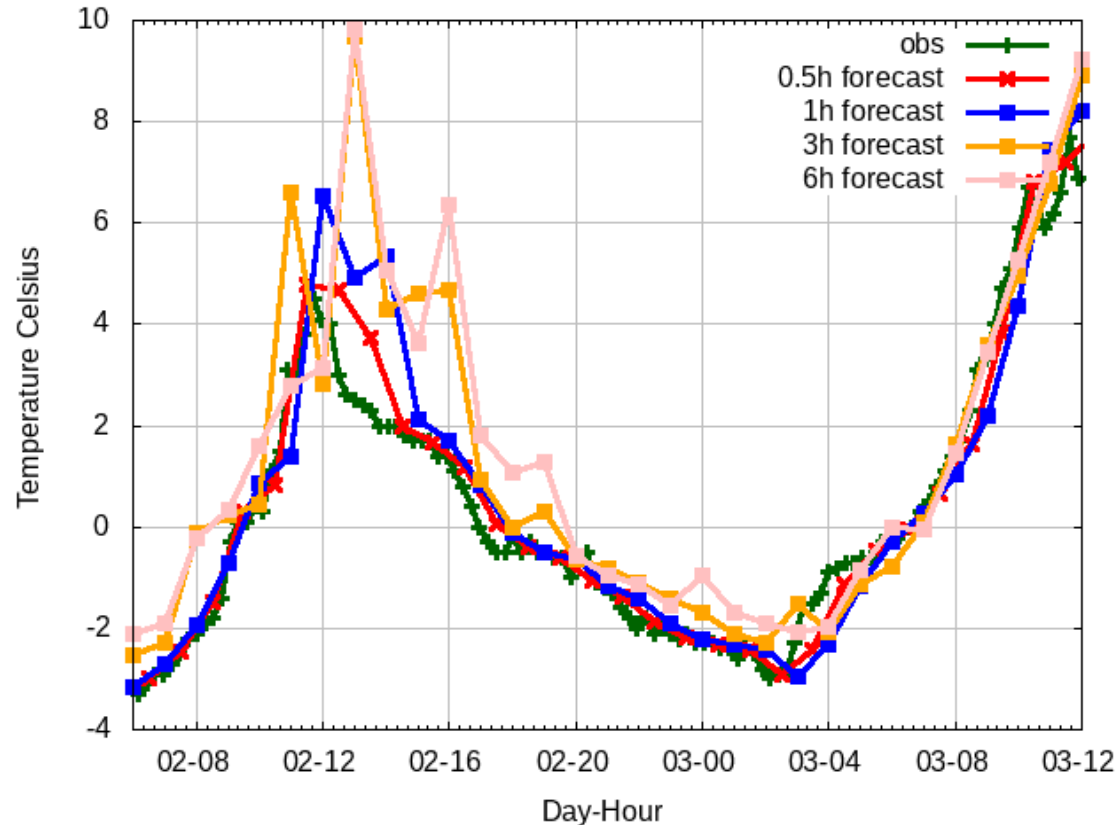
-0.5

4.5





# How was the forecasts for the extreme point (3376)

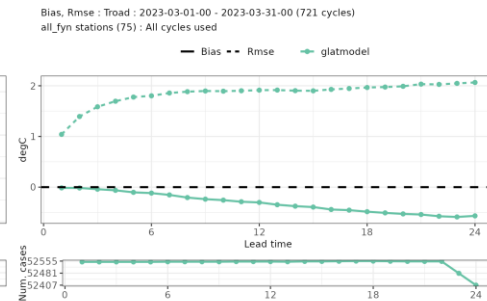
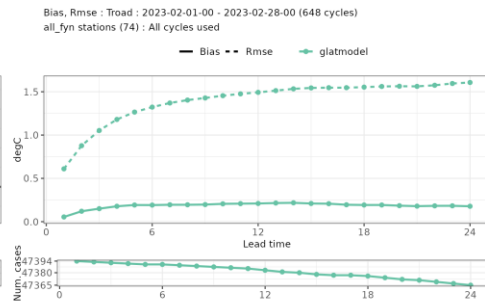
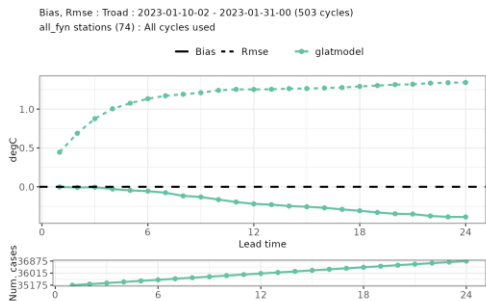




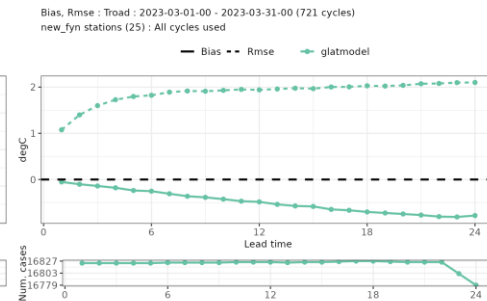
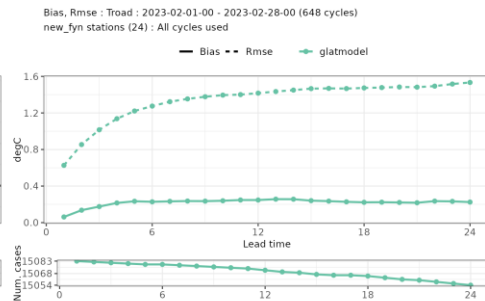
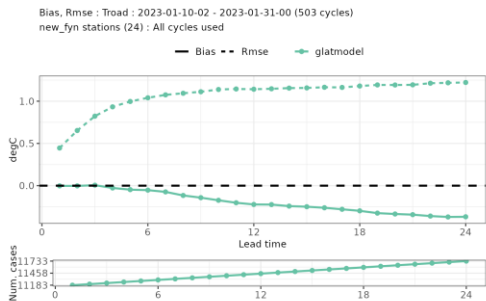
# We did all kind of verification

## RMSE and BIAS (road temperature)

All stations



New stations





# Performance of dense network

- Forecasts for IOT stations and traditional stations were of same quality
- IOT stations tend to be warmer maybe because the strategy has been to get a more uniform distribution rather than setting up stations at extreme locations
- Better chance for early warning
- More observations also bring more of other data into play
- A strategy for where to setup new stations is required

# Using Floating car data

Here focus is on road surface temperature

- Availability is random
- Few data in night time
- Observation can be anywhere
- Many different vendors, car types

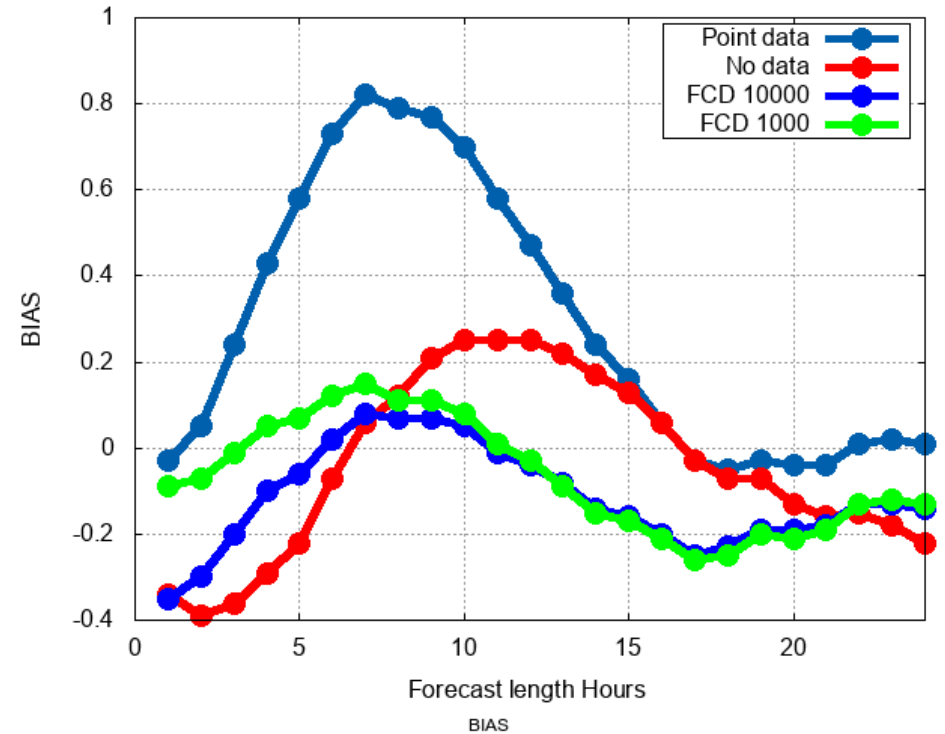
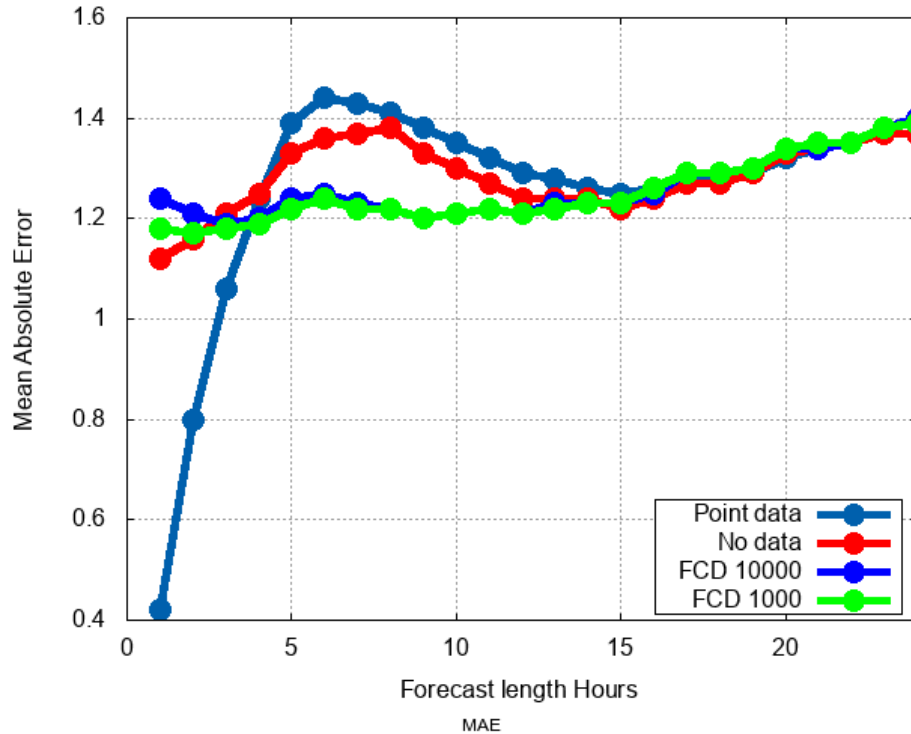
# Test of Floating car data

Here focus is on road surface temperature

- Reference run where only observations from RWIS have been used.
- Run without using observations from RWIS and FCD.
- Run where observations from FCD have been used.
  - FCD observation within 10000 m from RWIS
  - FCD observation within 1000 meter from RWIS

# Use of Floating car data

Here focus is on road surface temperature



# Use of Floating car data

Here focus is on road surface temperature

- FCD did not have impact for the first 4 hours
- FCD had the best performance for 4-10 hours forecast
- Observations had very little impact after 10 hours

**END**

**Questions, remarks?**

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