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MNWC-Nowcasting
MSG cloud-ingest

David Schönach & Erik Gregow
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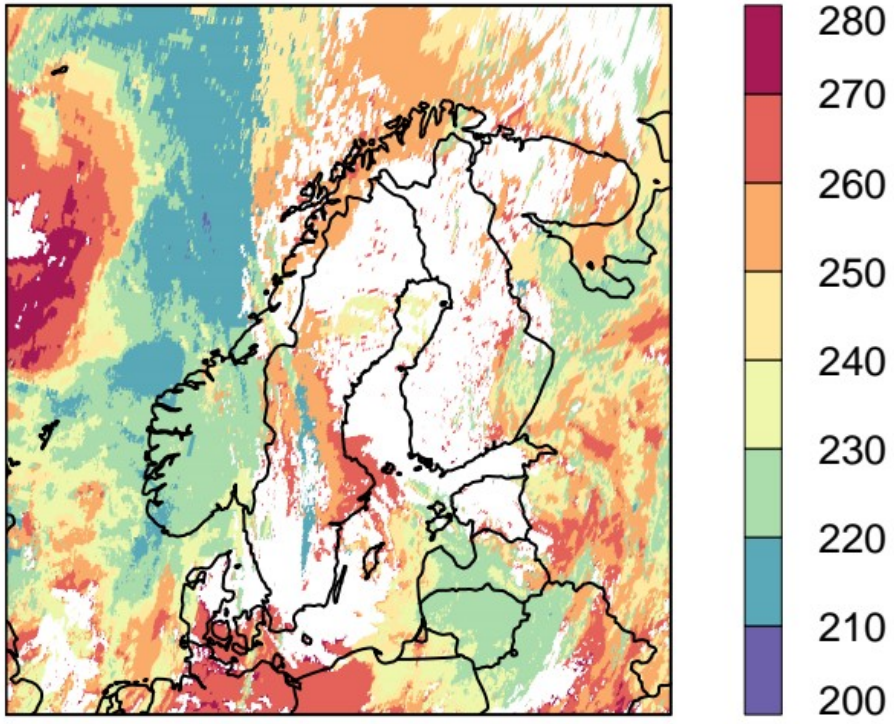
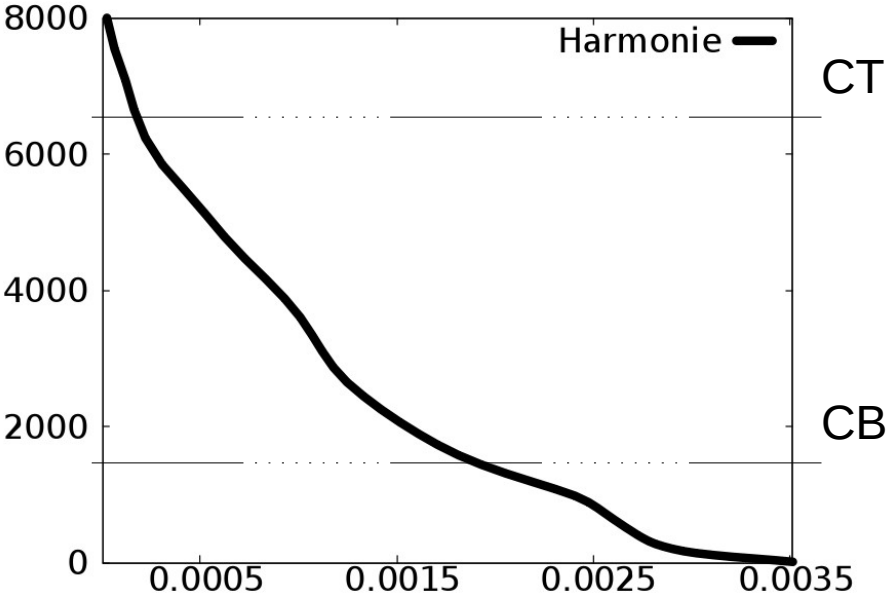
Introduction: Cloud-Ingest in MNWC-Nowcasting

- Use observations (satellite and/or ground-based) to find cloud-placement.
  → Critical for forecast-quality in many variables

Cloud-Top is well measured by satellites. Correct **Cloud-Base** is more difficult.

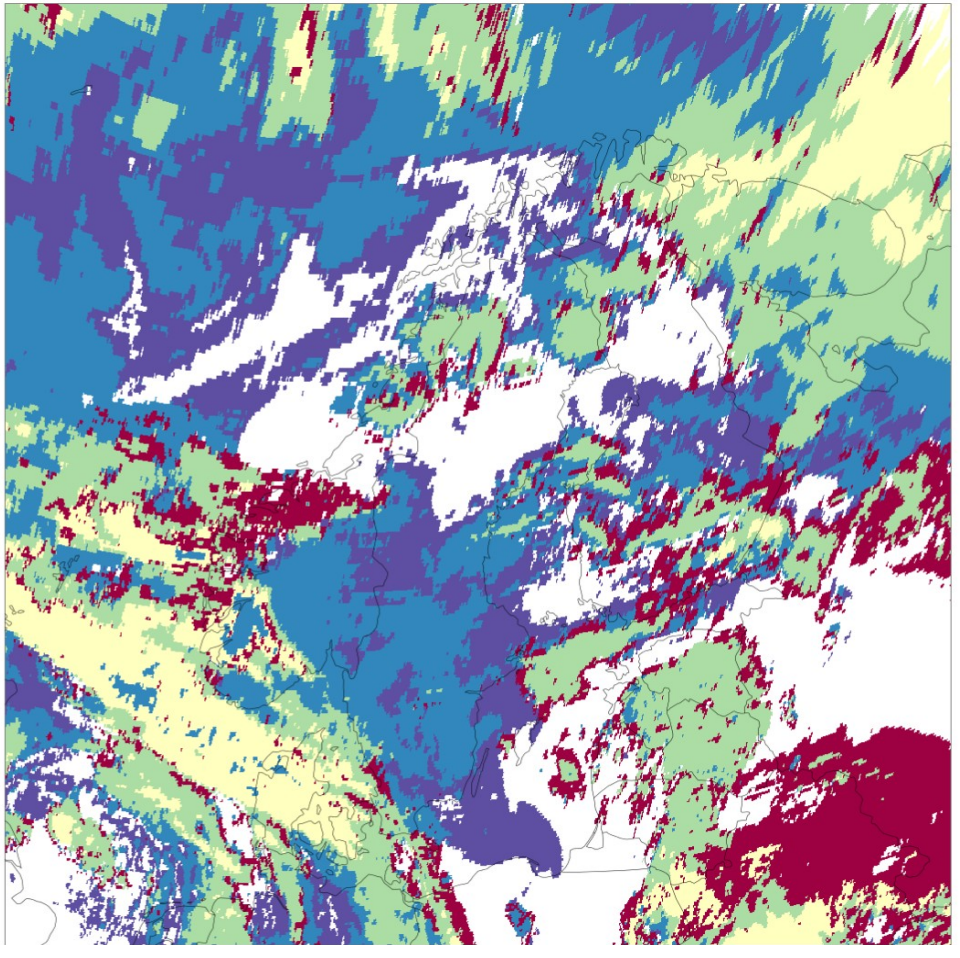


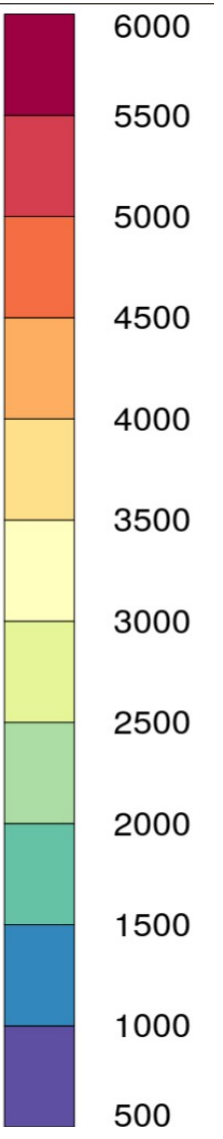
- Change relative humidity with CT/CB
  → New Input for MNWC



Goal: Improving Cloud-Base in MNWC-Nowcasting

Climatology Method – in preop mode





Satellite gives Cloud-Type and Cloud-Top

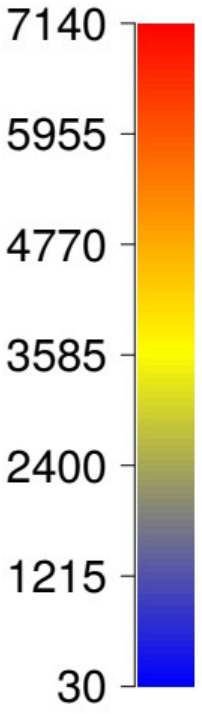
Works pretty good for single cloud layer!

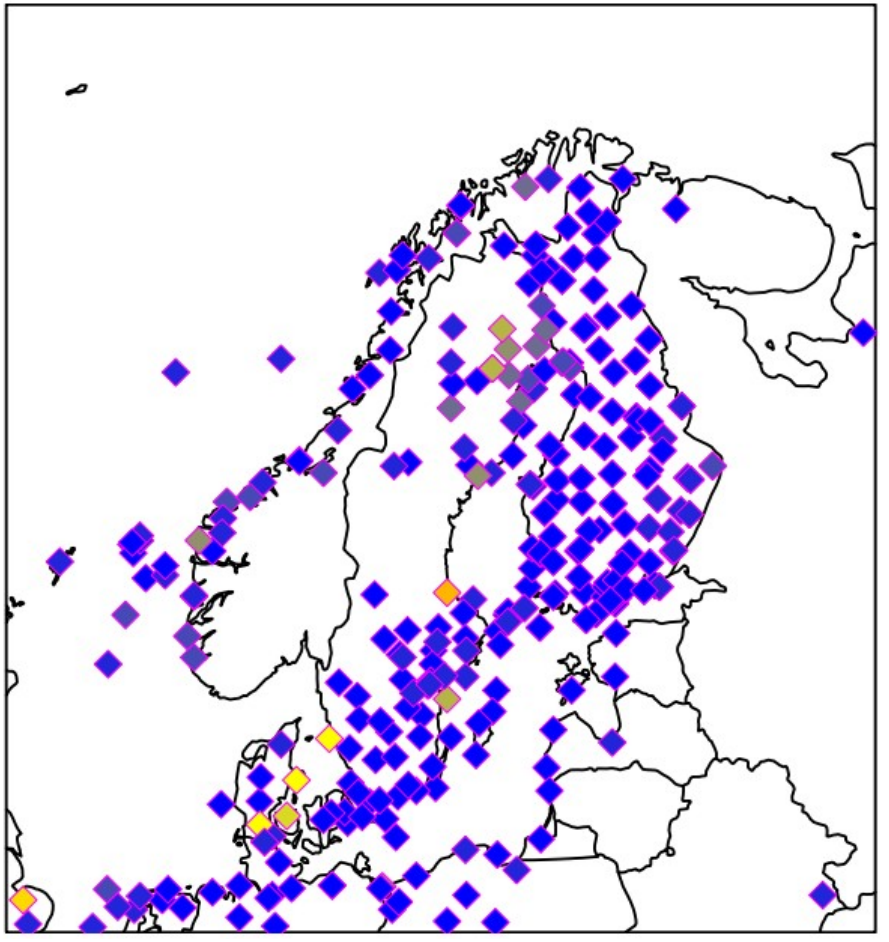
Problem 1: Does not see possible cloud below

Problem 2: Only few values, e.g. at 550 m, 1230 m, 1470 m, 2215 m, 3015 m and 5595 m elevation only.

Goal: Improving Cloud-Base in MNWC-Nowcasting

- Using Observations to get a better estimate where the real Cloud-Base is.
  → METAR aviation observations at airports



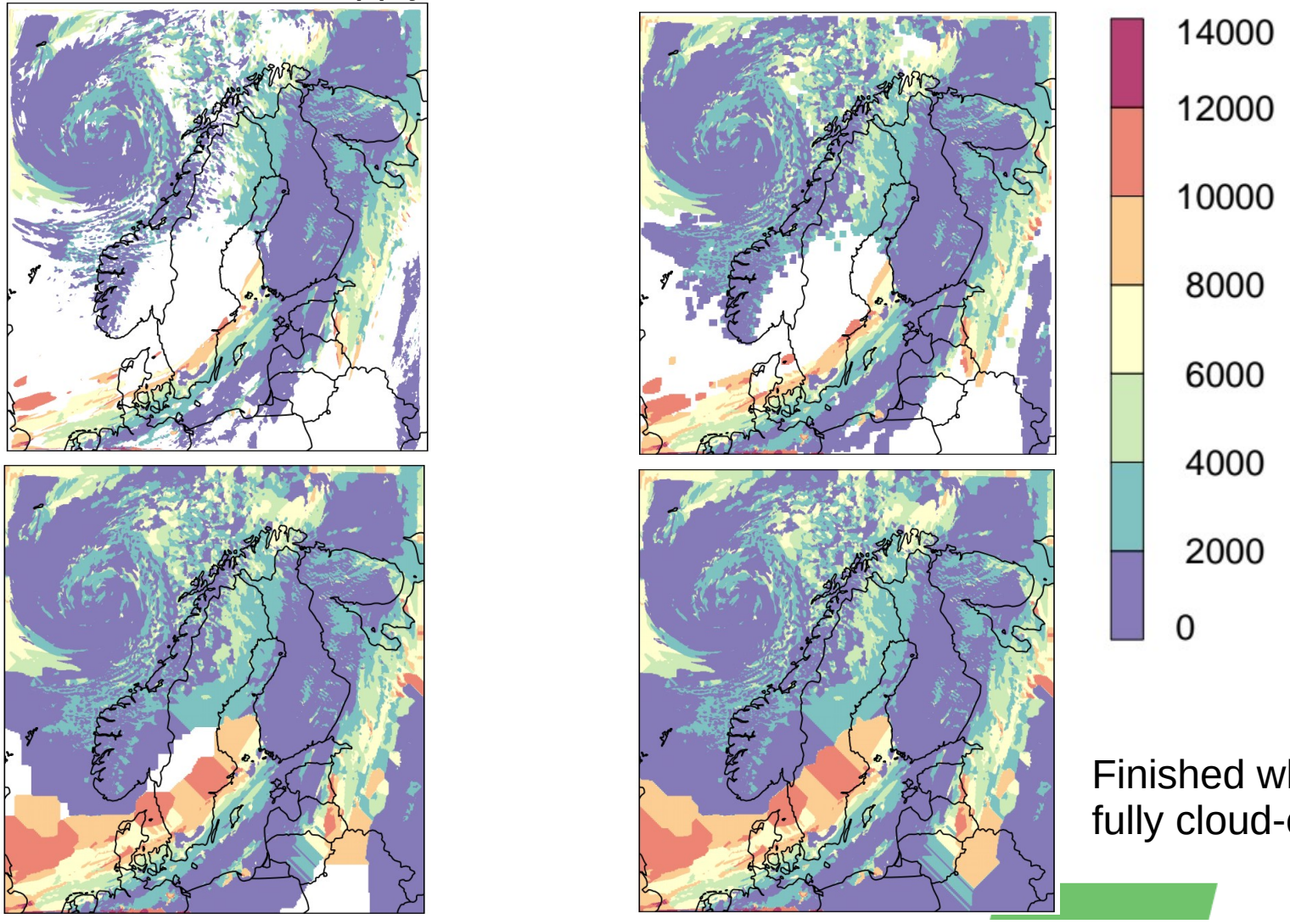


→ SYNOP observations

SYNOP CODE 03535 41470 82312 10077 20064 40007 58012 72165 8682

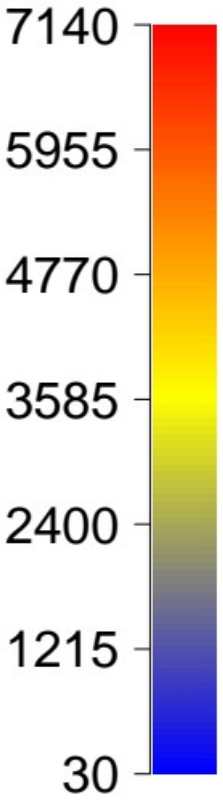
Question 1: Which First Guess field should we use?

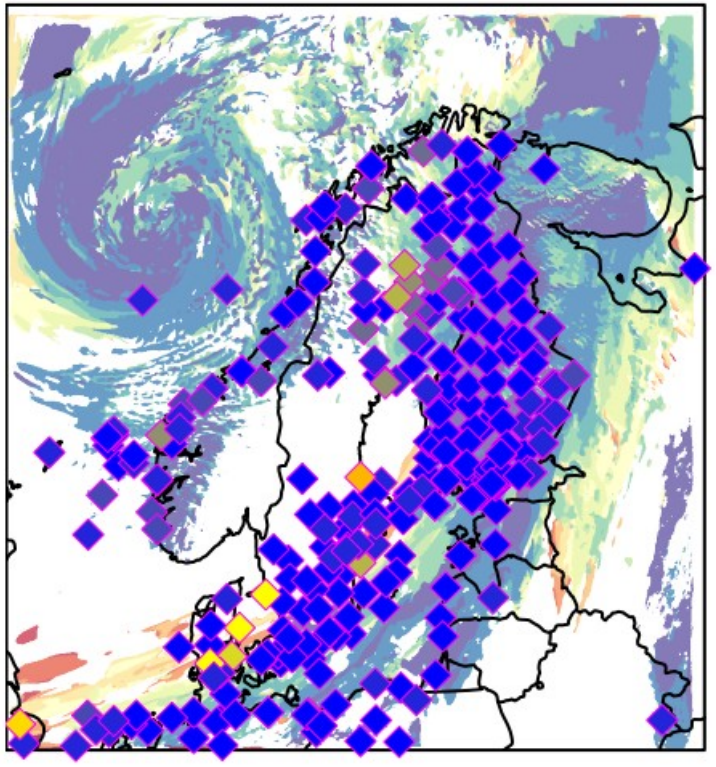
→ “Spreaded” Field of Cloud-Bases of Harmonie-Arome, bc.
- 1. Computational reasons.
- 2. Can then also apply ‘real’ cloud-mask from satellite



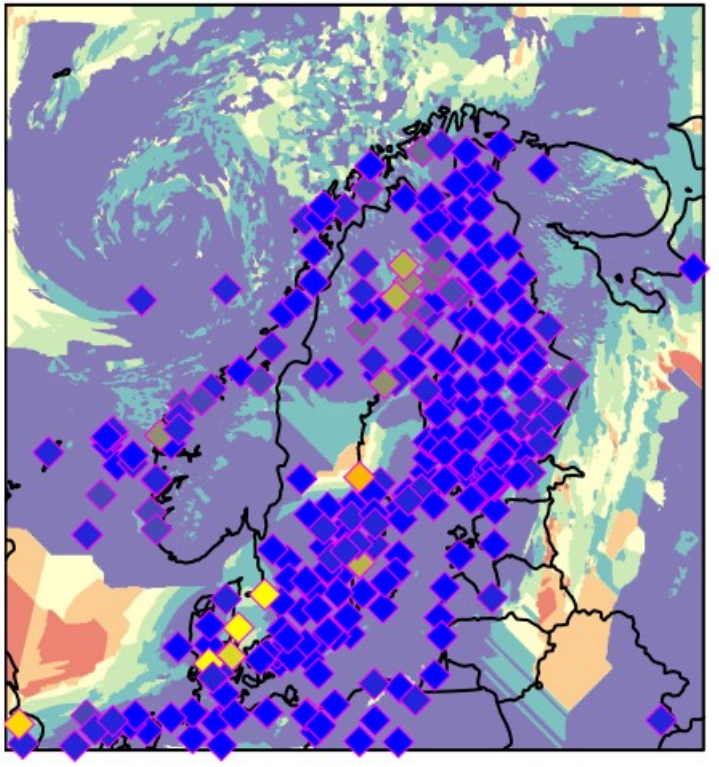
Finished when domain is fully cloud-covered!

Optimally interpolate observations on First-Guess
→ with Software GridPP (https://github.com/metno/gridpp)

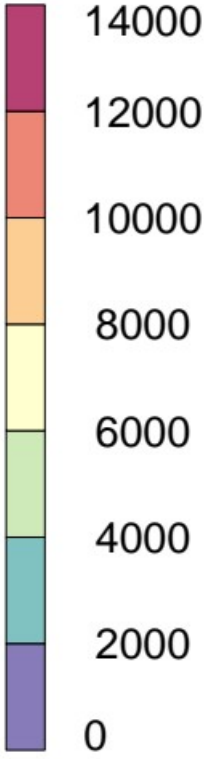




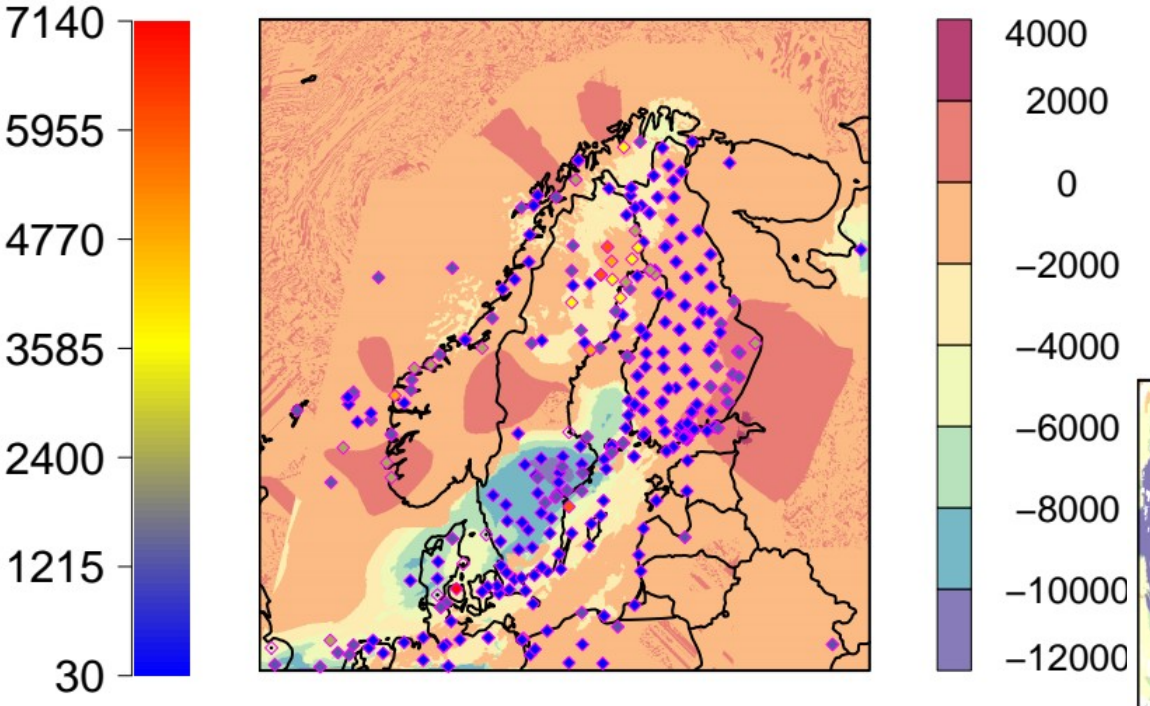
Harmonie-Arome + obs



Firstguess after interpolation
with obs = Analysis (unmasked)

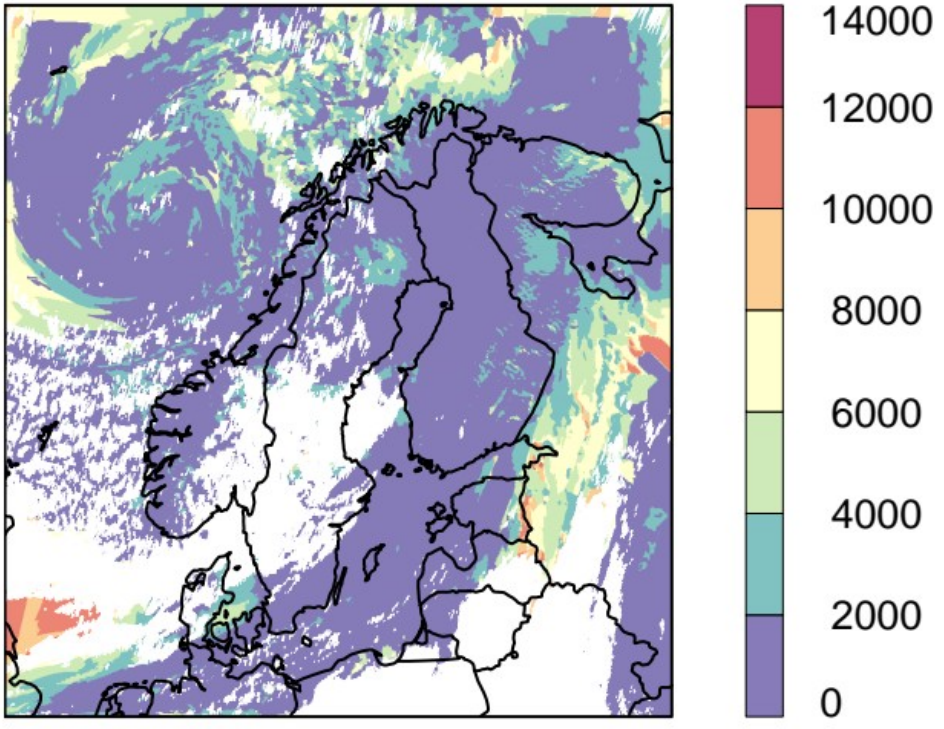


Optimally interpolate observations on First-Guess → with Software GridPP



Increments = Analysis - Firstguess

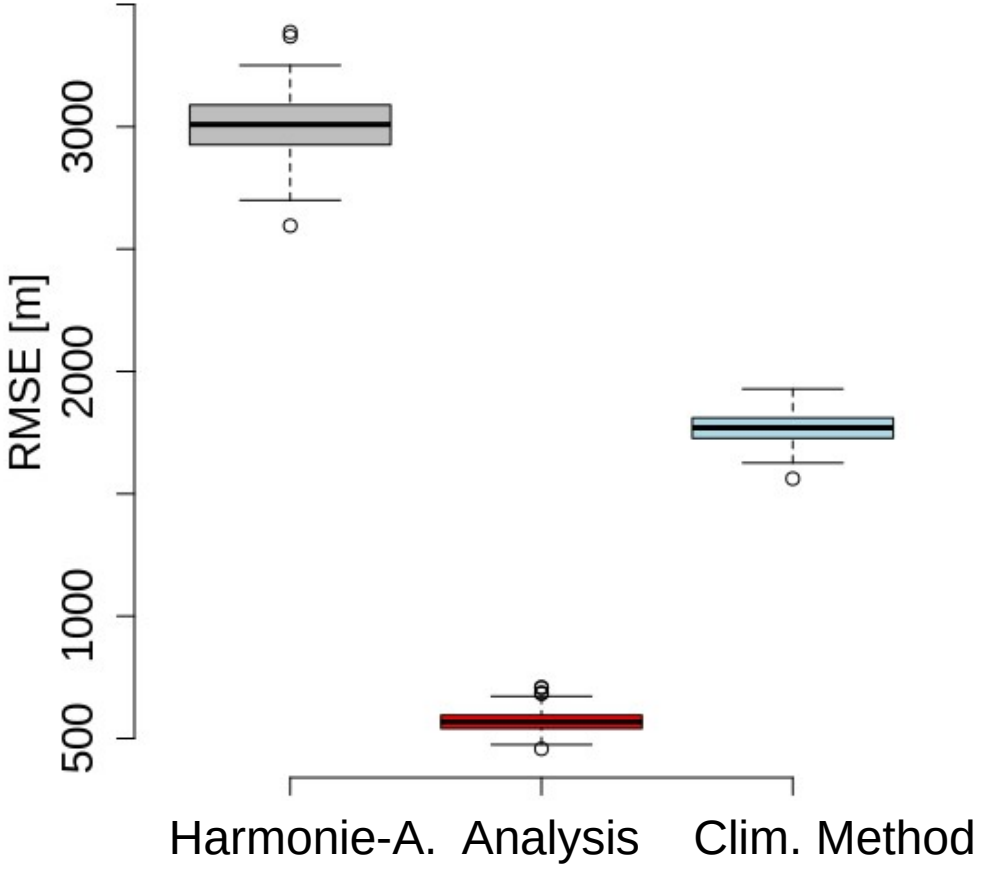
Analysis, after applying satellite's cloud-mask



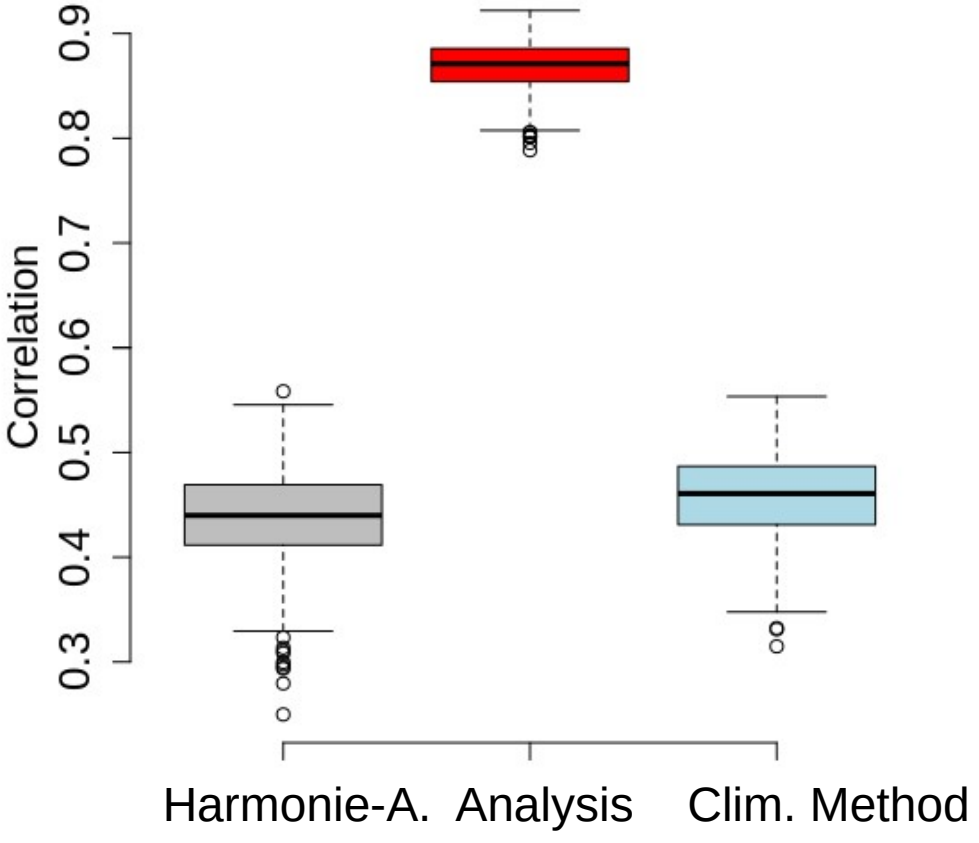
Results from the Optimal Interpolation

Root Mean Square Error (RMSE) and Correlation Coefficient as measurements

5-CrossValidation and bootstrapped to also estimate uncertainty

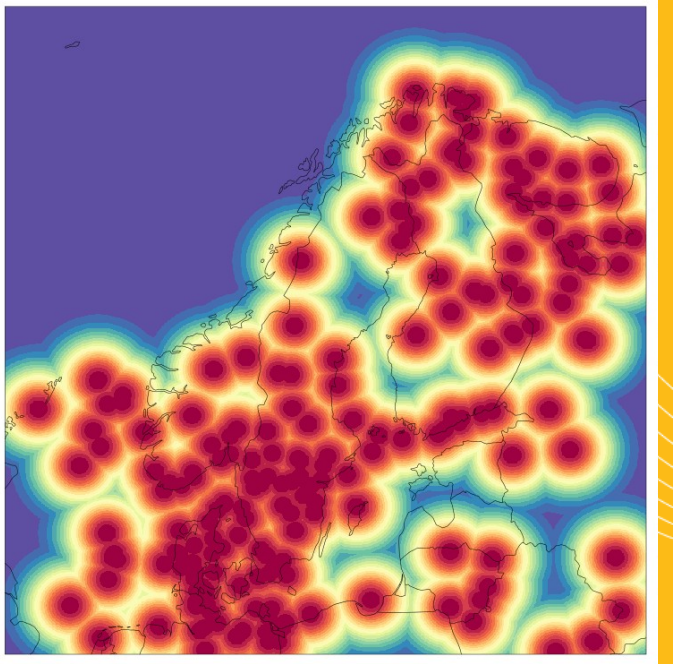


smaller = better



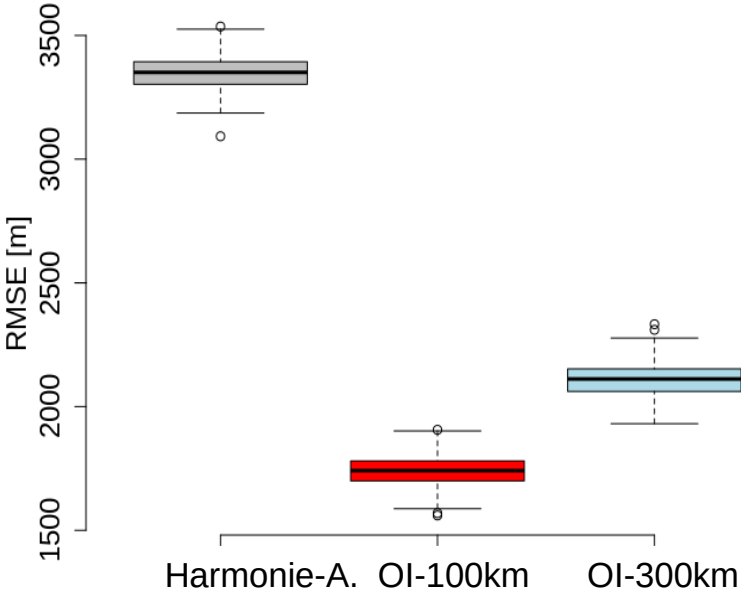
higher = better

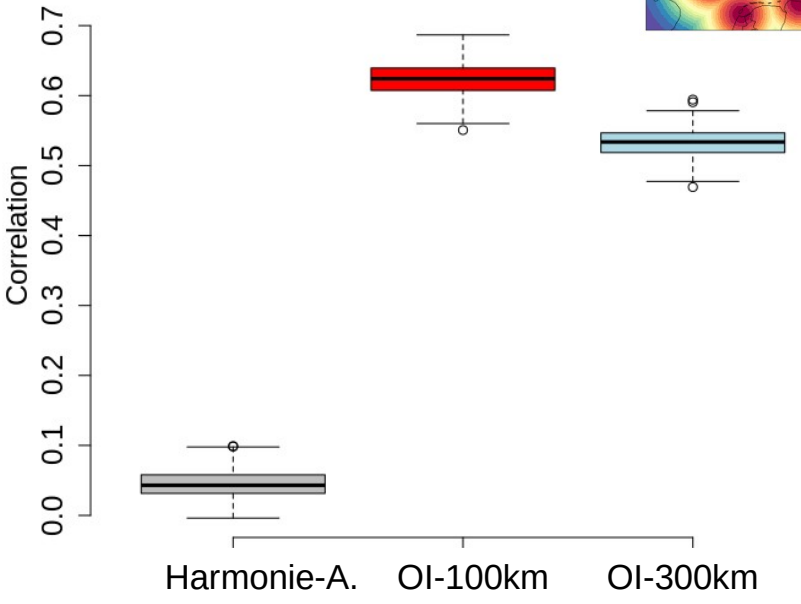
Results from the Optimal Interpolation



Which value for d?

d~100km = average dist. to the 5th nearest observation (thanks to Cristian Lussana (MetNorway))





d= 100 km better than 300 km

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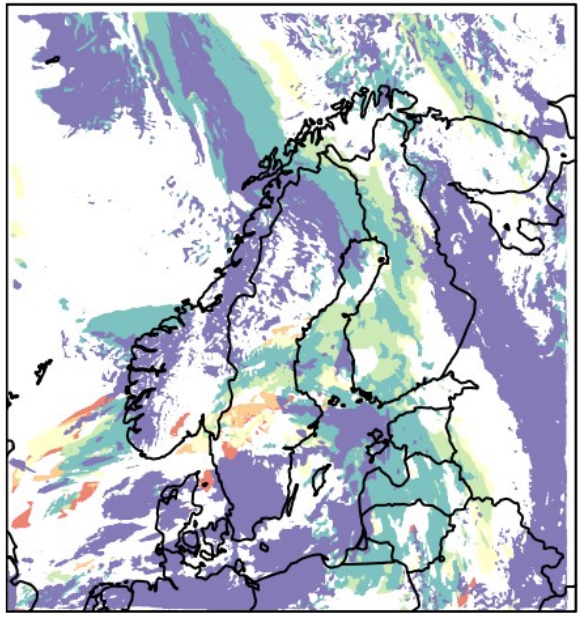
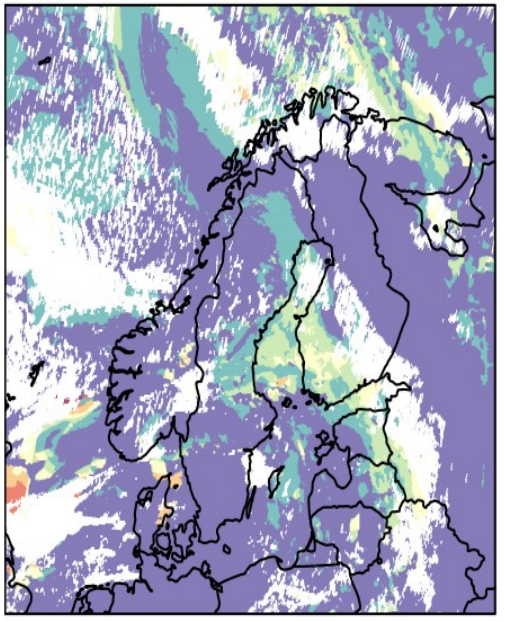
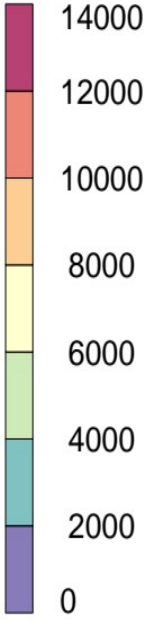
Field-Case1: 2019 03 21 10 UTC

Harmonie-Arome

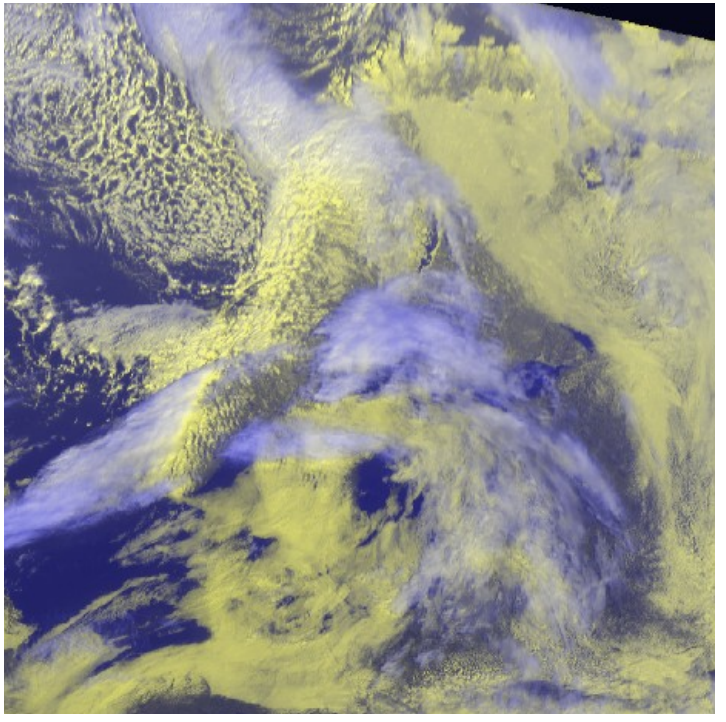


Analysis



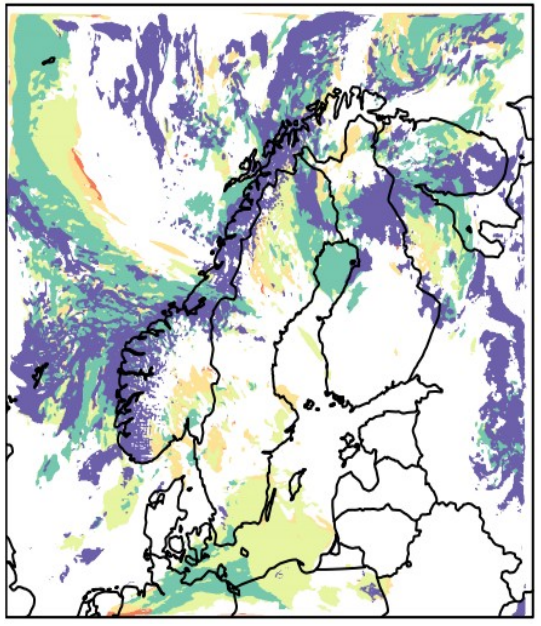


Satellite

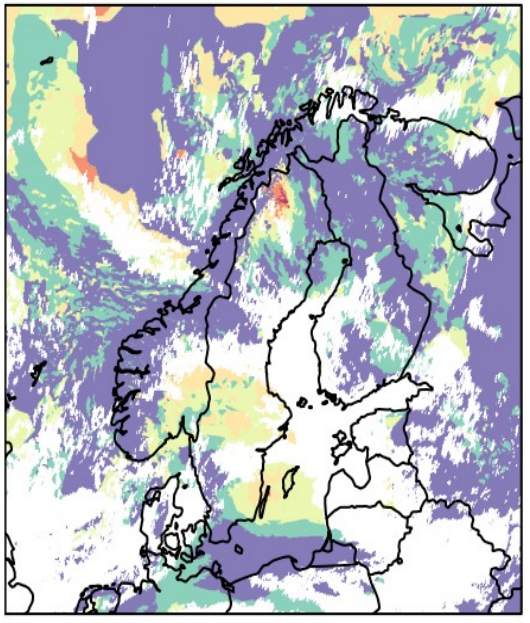


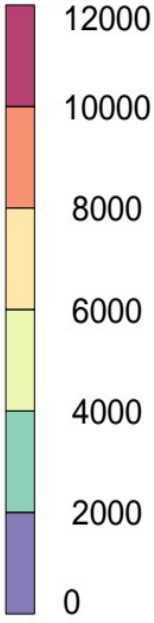
Field-Case2: 2019 03 24 10 UTC

Harmonie-Arome

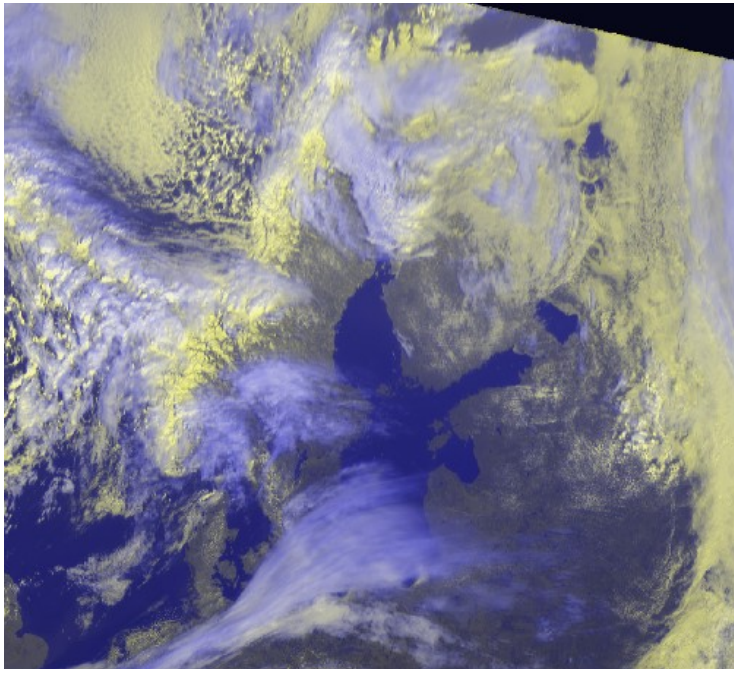


Analysis





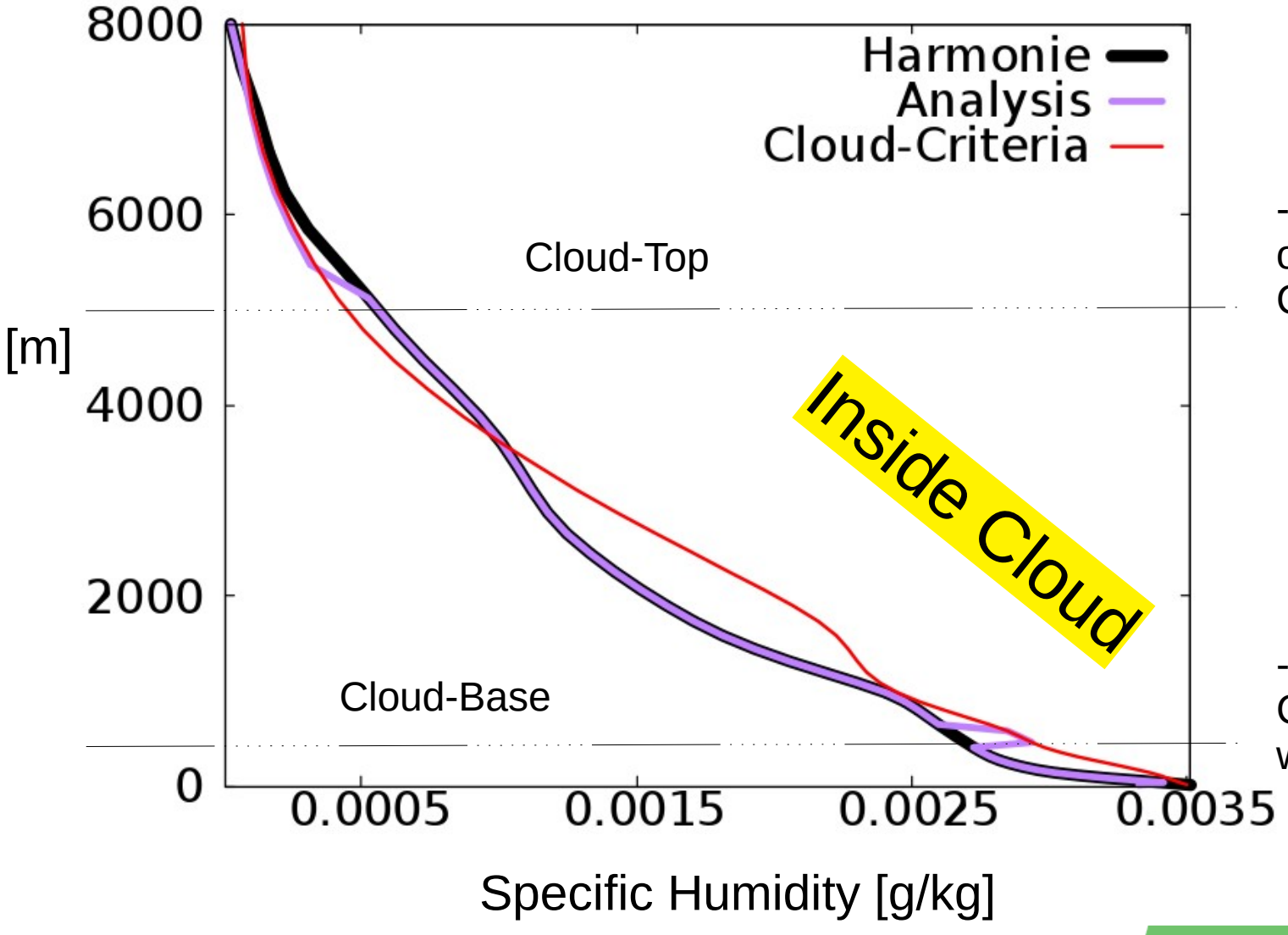
Satellite



Question 2: How to use new Cloud-Information as Input?

1d-approach: Modify moisture-profile for each grid-point!

Station lat: 68.5"
Station longitude: 15.7"



- Remove moisture when outside of “Cloud” and > Cloud_criteria

- Add moisture at Cloud-Top and Base when < Cloud_criteria

Summary and Outlook

- Merge SYNOP and METAR Cloud-Bases with “spreaded” First Guess Field from Harmonie-Arome

- GridPP’s Optimal Interpolation is an appropriate, handy and easy to modify software for that purpose

- Still an important question: **How to modify the Q/T profiles with new cloud-information?**

- At the end: **Feed the MNWC-Model indirectly with the new cloud-information!**