Enabling the comparison of high-resolution precipitation observations with NWP model simulations at every model time-step

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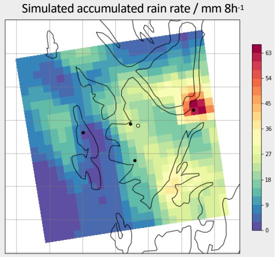
1. Motivation

Precipitation is uncertain in NWP models due to the short time and spatial scale of the processes.
Observations are available at a high time resolution, still model validation is normally performed with accumulated model output.
Here we try to enable comparison at the time resolution of the measurements.



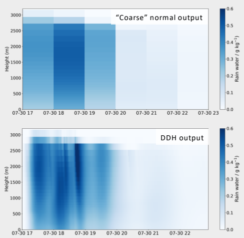
2. Method

Case study

Intense precipitation event over Western Norway, Bergen (60.38°N, 5.33°E, 12 m a.s.l), 30th July 2019 (yellow circle)

How to get time-step resolution model output:

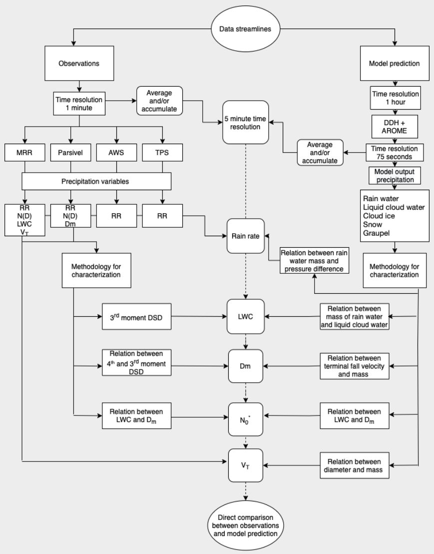
- Model AROME-MetCoOp (Müller et al., 2017)
- Tool: Diagnostics par Domaines Horizontaux (DDH) (Météo-France, 2019)



Prognostic variables on time-step resolution for every grid point over a chosen sub-domain

Characterise through five parameters

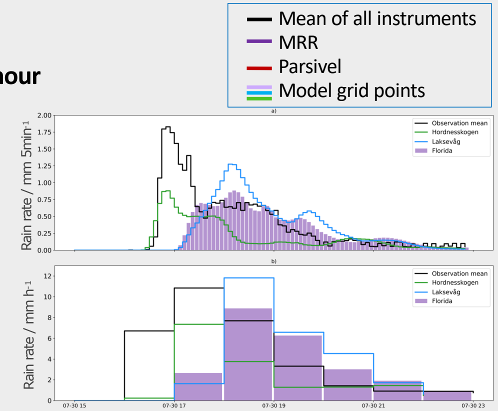
1. Rain rate
2. Liquid water content (LWC)
3. Mean volume diameter
4. Normalized intercept parameter
5. Terminal fall velocity



3. Comparison

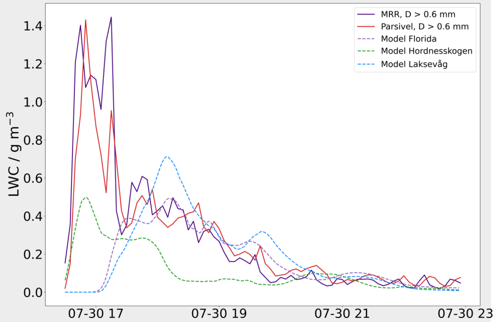
Rain rate minute vs hour

- High-resolution model output shows a high-intensity peak which is only captured in some grid points
- Hourly data is smoothed
- Shift in maximum intensity for some grid points



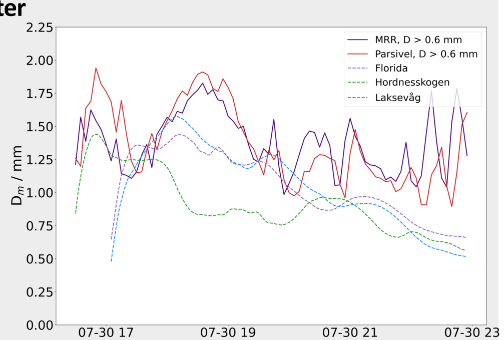
Liquid water content

- Location important in the model
- Individual grid points capture different features of the observed event



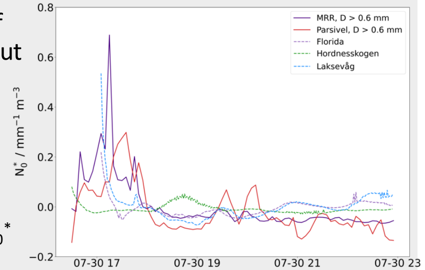
Mean volume diameter

- Periods of good match
- Generally underestimated
- More uncertainty in terms of model calculations



Normalized intercept parameter

- Within the range of the observations, but show a lot of variation
- More uncertainty connected to the calculation and interpretation of N_0^*



4. Conclusion

Comparison between high-resolution precipitation observations and time step model output provides additional insight into intensity, timing, and evolution of precipitation events and thus their representation in model microphysics schemes. Especially the high-intensity peak gain information from the higher time resolution.

5. Outlook

- Case study of extreme precipitation event in Western Norway including both convective and stratiform periods of precipitation.
- Combine high-resolution model comparison with individual tendency output to investigate the contribution of each parameterization scheme (Kähnert et al. 2021).
- Further investigate the uncertainty of using different metrics and instruments.

References

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Météo-France (2019). *Météo-France*, pages 1–75. https://www.umr-cnrm.fr/gmapdoc/spip.php?article19
Müller, M., M. Homleid, K.I. Ivarsson, M.A.Ø. Køltzow, M. Lindskog, K.H. Midtbø, U. Andrae, T. Aspelien, L. Berggren, D. Bjørge, P. Dahlgren, J. Kristiansen, R. Randriamampianina, M. Ridal, and O. Vignes., 2017. doi: https://doi.org/10.1175/WAF-D-16-0099.1.

Abstract