Why cross-border collaboration just makes sense for weather radar data applications

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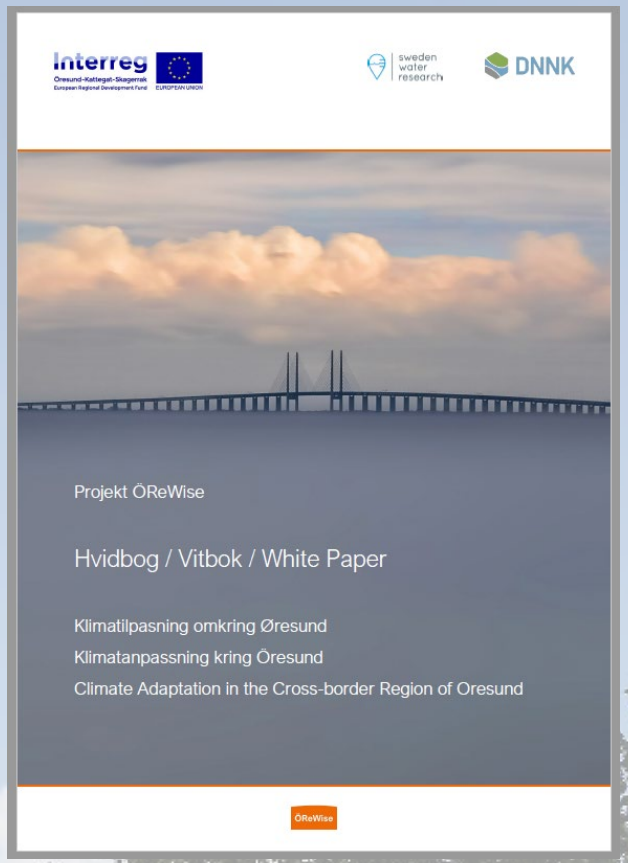
Collaboration across boundaries

“Water knows no boundaries. Nor the border between Denmark and Sweden…”

Project OReWise

Likewise,
- Weather don’t know our administrative boundaries…
- Neither does our climate challenges…

... To solve our challenges. Knowledge and talents needs to flow across boundaries as well. The VeVa association working towards this goal for weather data.



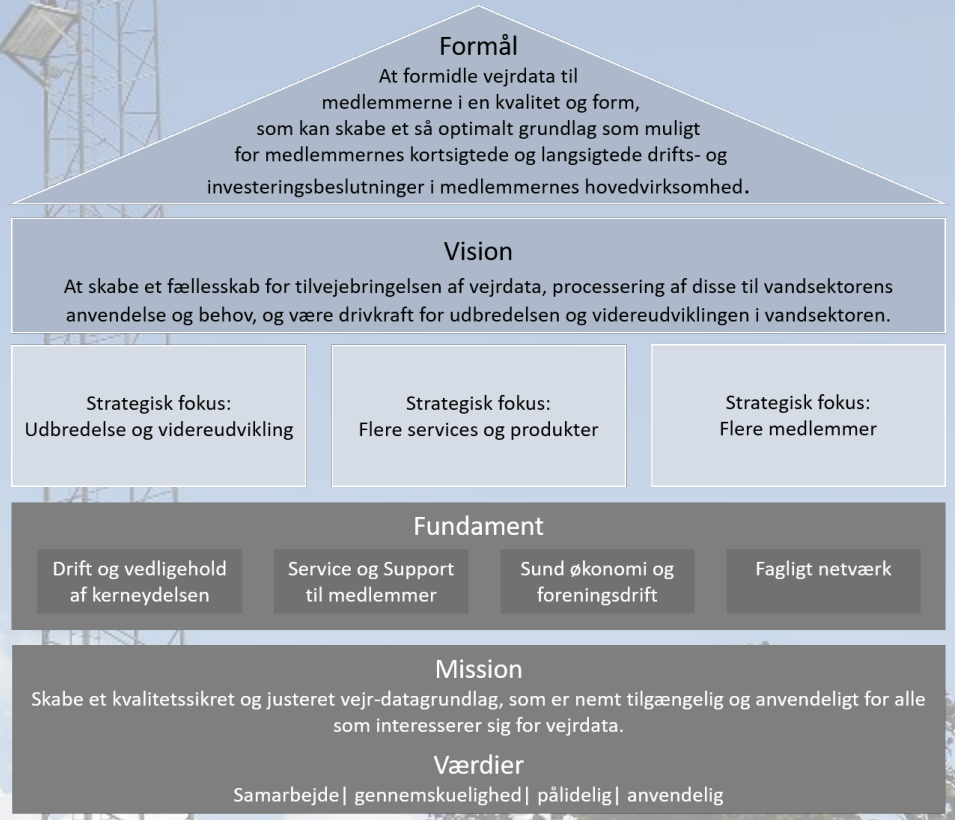
VeVa – Weather data in the water sector

Why VeVa?

The two last decades have brought numerous development and demonstration projects for applying weather radar data in the water sector.

Wide adoption of the technology has failed due to both operational and application complexity.

It is a part of VeVa mission to lower this complexity and widen adaptation by creating an operational framework for weather data which are easy applicable and accessible for non-weather-data experts in the water sector.



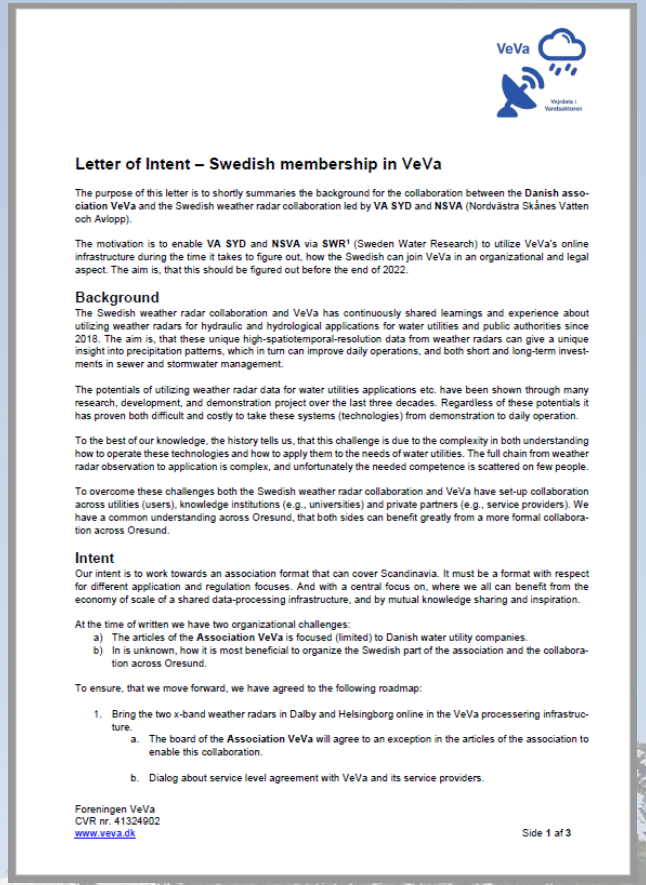
VeVa – Weather data in the water sector

Why VeVa?

We want to obtain our mission through a collaboration approach.

We started in Denmark, and today we are celebrating the growth of the VeVa association to Sweden.

Later we sign the Letter-of-Intent, which formalize the growth of our collaboration.



VeVa

Vejrdata i Vandsektoren

Letter of Intent – Swedish membership in VeVa

The purpose of this letter is to shortly summaries the background for the collaboration between the **Danish association VeVa** and the Swedish weather radar collaboration led by **VA SYD** and **NSVA** (Nordvästra Skånes Vatten och Avlopp).

The motivation is to enable **VA SYD** and **NSVA** via **SWR**[1] (Sweden Water Research) to utilize VeVa's online infrastructure during the time it takes to figure out, how the Swedish can join VeVa in an organizational and legal aspect. The aim is, that this should be figured out before the end of 2022.

Background

The Swedish weather radar collaboration and VeVa has continuously shared learnings and experience about utilizing weather radars for hydraulic and hydrological applications for water utilities and public authorities since 2018. The aim is, that these unique high-spatiotemporal-resolution data from weather radars can give a unique insight into precipitation patterns, which in turn can improve daily operations, and both short and long-term investments in sewer and stormwater management.

The potentials of utilizing weather radar data for water utilities applications etc. have been shown through many research, development, and demonstration project over the last three decades. Regardless of these potentials it has proven both difficult and costly to take these systems (technologies) from demonstration to daily operation.

To the best of our knowledge, the history tells us, that this challenge is due to the complexity in both understanding how to operate these technologies and how to apply them to the needs of water utilities. The full chain from weather radar observation to application is complex, and unfortunately the needed competence is scattered on few people.

To overcome these challenges both the Swedish weather radar collaboration and VeVa have set-up collaboration across utilities (users), knowledge institutions (e.g., universities) and private partners (e.g., service providers). We have a common understanding across Oresund, that both sides can benefit greatly from a more formal collaboration across Oresund.

Intent

Our intent is to work towards an association format that can cover Scandinavia. It must be a format with respect for different application and regulation focuses. And with a central focus on, where we all can benefit from the economy of scale of a shared data-processing infrastructure, and by mutual knowledge sharing and inspiration.

At the time of written we have two organizational challenges:

a) The articles of the **Association VeVa** is focused (limited) to Danish water utility companies.
b) In is unknown, how it is most beneficial to organize the Swedish part of the association and the collaboration across Oresund.

To ensure, that we move forward, we have agreed to the following roadmap:

1. Bring the two x-band weather radars in Dalby and Helsingborg online in the VeVa processering infrastructure.
   a. The board of the **Association VeVa** will agree to an exception in the articles of the association to enable this collaboration.
   b. Dialog about service level agreement with VeVa and its service providers.

Foreningen VeVa
CVR nr. 41324902
www.veva.dk

Side **1** af **3**

Agenda for the session

The potential value of a cross-border warning system for cloud bursts.

- *Why cross-border collaboration just makes sense for weather radar data applications (**Ole Neerup-Jensen**)*
- The VeVa technology and our collaborative approach to improve adaptation of weather data applications in the water sector collectively (**Malte Ahm**)
- Why do we need weather radar and why do we need to collaborate? (**Sven Bengtsson** and **Andreas Bengtsson**)
- Utilizing distributed precipitation data in urban stormwater management and planning, and for predictive real-time control of wastewater treatment plants (**Toke Illeris**)
- A look on the VeVa's ecosystem from a 3. party supplier – why does it makes sense? (**Peter Rasch**)
- Signing of VeVa collaboration agreement (**Henrik Aspegren**)
- Question and sum-up (**Henrik Aspegren**)

VeVa technology and our collaborative approach to improve adaptation of weather data applications in the water sector

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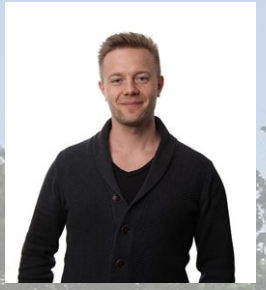


Why – The "technical" need / motivation for VeVa

Holistic water management and operation

Design and dimensioning
- We need a good statistical basis for the load on our systems.
- We need a good empirical and historical basis for, how our systems respond to a given load.

Analysis of existing systems (and future systems)
- In situations where our systems are overloaded or respond differently than anticipated it is essential to have good representative measurements of both the load and response of the system to be able to identify cause and consequences.

Real time control
- Enables better overall utilisation of the system capacity according to the political agenda:
  - Reduction of damage-costs from potential flooding.
  - Prioritisation of critical infrastructure during severe rainfall.
  - Reducing environmental impact → improved bathing water and water environment quality.

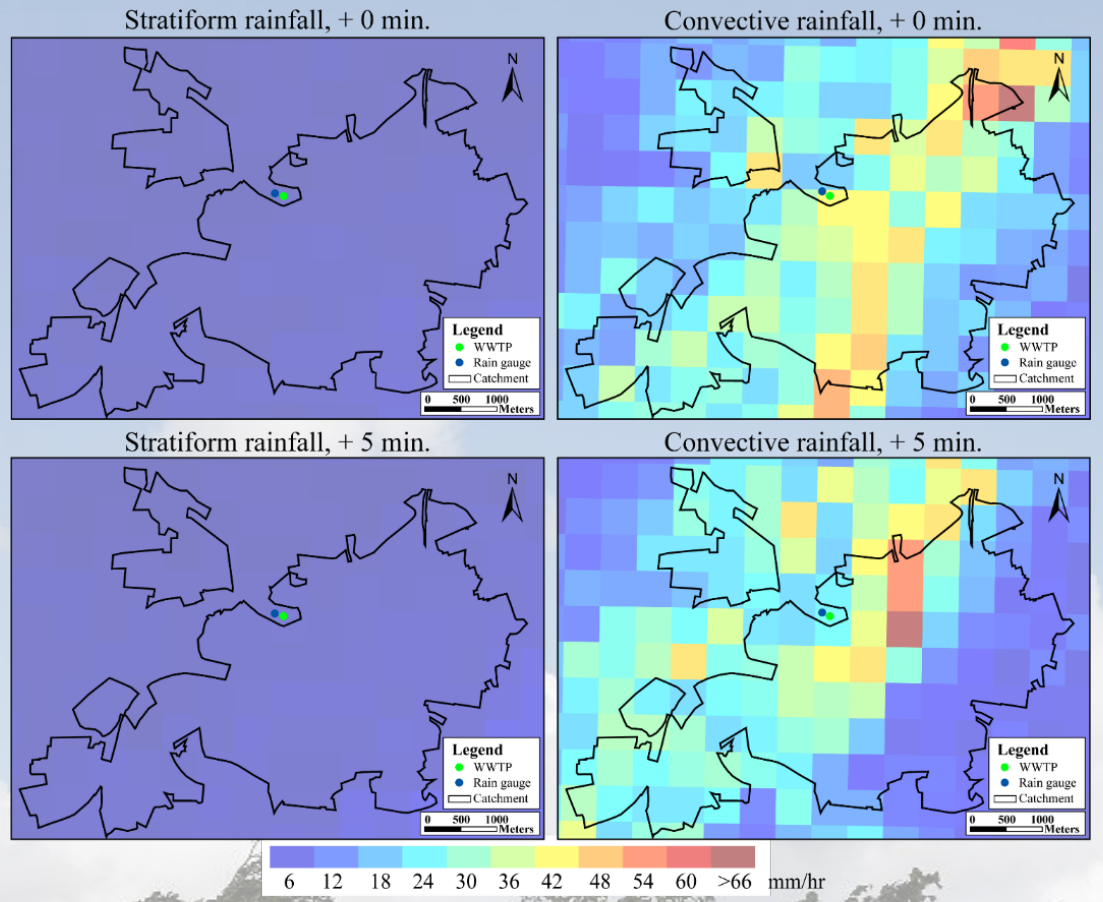
Real time modelling
- Enables integrated system supervision including all sensors and model performance.
  - Is the model results realistic compared to sensor observations?
  - Is the sensor observations realistic when compared internally and to the overall model results.
  - Automatic evaluation, validation and advanced error detection → increased trust from operation staff.

Documentation
- It is important to be able to document the effect and value creation of our asset investments to keep the political capital. Therefore, it is necessary with long-term strategies for critical observation nodes to be able to document system load and responses.

Customer service
- Ability to give a quick and precise customer service in e.g. flooding cases. Who is responsible for the problem?

	Tørvejr	Daglig regn	Kraftig regn	Ekstrem regn under kontrol	Ekstrem regn udenfor kontrol
Real time control	L	M	H	H	M
Real time modelling	M	H	H	H	H
Customer service	M	L	M	H	H
Analysis and business support	H	M	H	H	H
Planning (design / dimensioning)	L	L	H	H	M
Documentation	M	H	H	H	M

Why – The art of measuring rainfall



Ahm, M. (2016) Ph.D. Thesis: Adjustment of rainfall estimates from weather radars using in-situ stormwater drainge sensors, Department of Civil Engineering, Aalborg University.

To meet our application needs (motivations), we need to have easy and reliable access to precipitation data which a good representativeness of the spatiotemporal variation of the weather for both historical analysis, real-time modelling and predictive real-time control etc.

Required resolution for urban drainage applications:

Temporal: 1-5 min.

Spatial: < 25 ha (500 x 500 m)

Referencer:

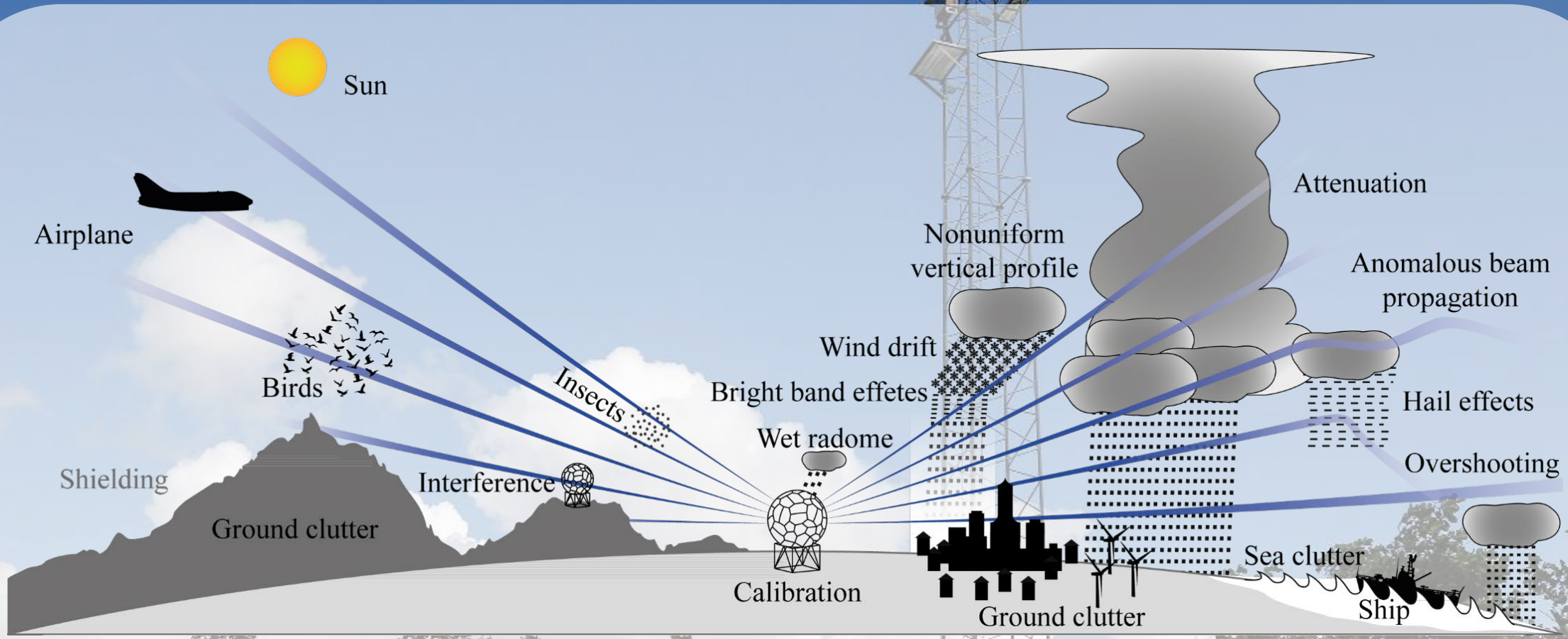
*Schilling, W. (1991) Rainfall data for urban hydrology: what do we need? Atmospheric Research, **27**(1–3), 5–21. DOI: http://dx.doi.org/10.1016/0169-8095(91)90003-F.*

*Berne, A., Delrieu, G., Creutin, J.-D., Obled, C. (2004) Temporal and spatial resolution of rainfall measurements required for urban hydrology. Journal of Hydrology, **299**(3–4), 166–179. DOI: http://dx.doi.org/10.1016/j.jhydrol.2004.08.002.*

*Einfalt, T., Arnbjerg-Nielsen, K., Golz, C., Jensen, N.-E., Quirmbach, M., Vaes, G., Vieux, B. (2004) Towards a roadmap for use of radar rainfall data in urban drainage. Journal of Hydrology, **299**(3–4), 186–202. DOI: http://dx.doi.org/10.1016/j.jhydrol.2004.08.004.*

Thorndahl, S., Einfalt, T., Willems, P., Nielsen, J. E., Veldhuts, M.-C., Arnbjerg-Nielsen, K., Rasmussen, M. R., Molnar, P. (2017) Weather radar rainfall data in urban hydrology.

Why – The art of measuring rainfall



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Why – The art of measuring rainfall

Rain gauge (tipping bucket):

Direct point-measurement of the rainfall.
Simple and known measurement principle based on many years of experience.

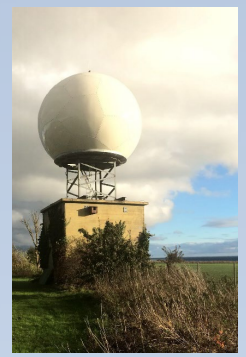
Disdrometer:

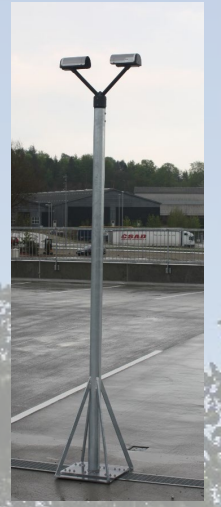
In-direct point-measurement of the rainfall.
Advanced measurement principle which also provide precipitation classification.

Weather radar:

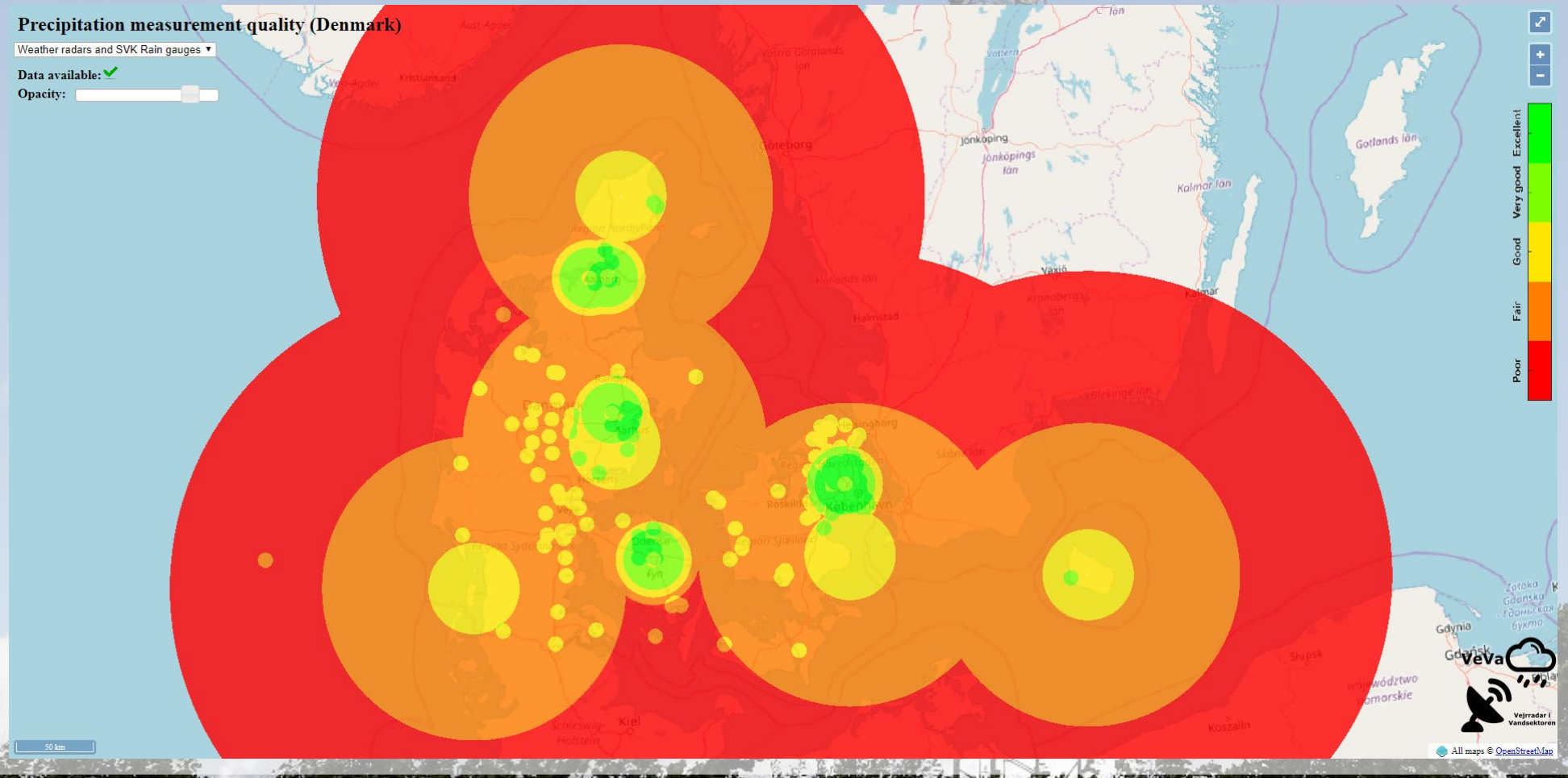
In-direct "area-measurement" of the rainfall in the atmosphere.
Advanced measurement principle which enables estimation of the relative spatiotemporal distribution of precipitation over a larger area.

Good precipitation estimates with a high spatiotemporal resolution can be obtained by combining these observations.



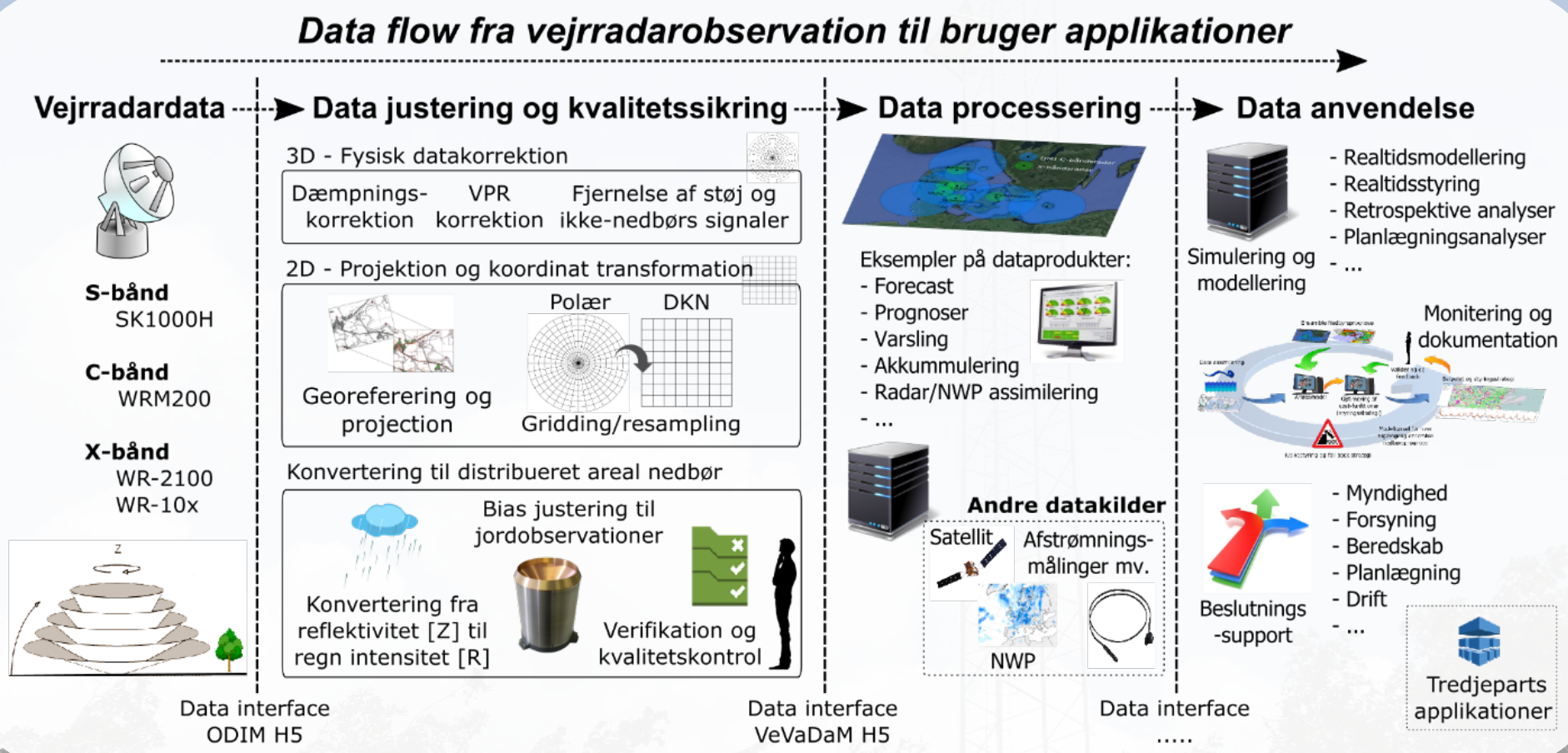


Why – The art of measuring rainfall



Why – The art of measuring rainfall

How – The technical VeVa framework

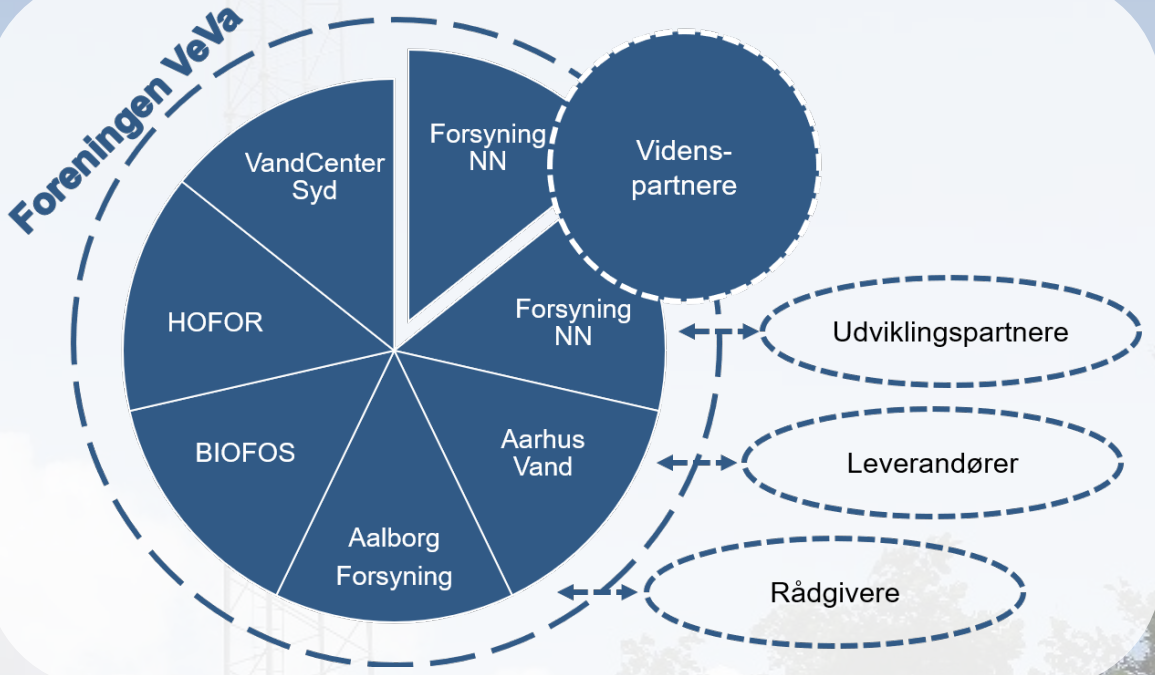


How – The collaborative VeVa framework

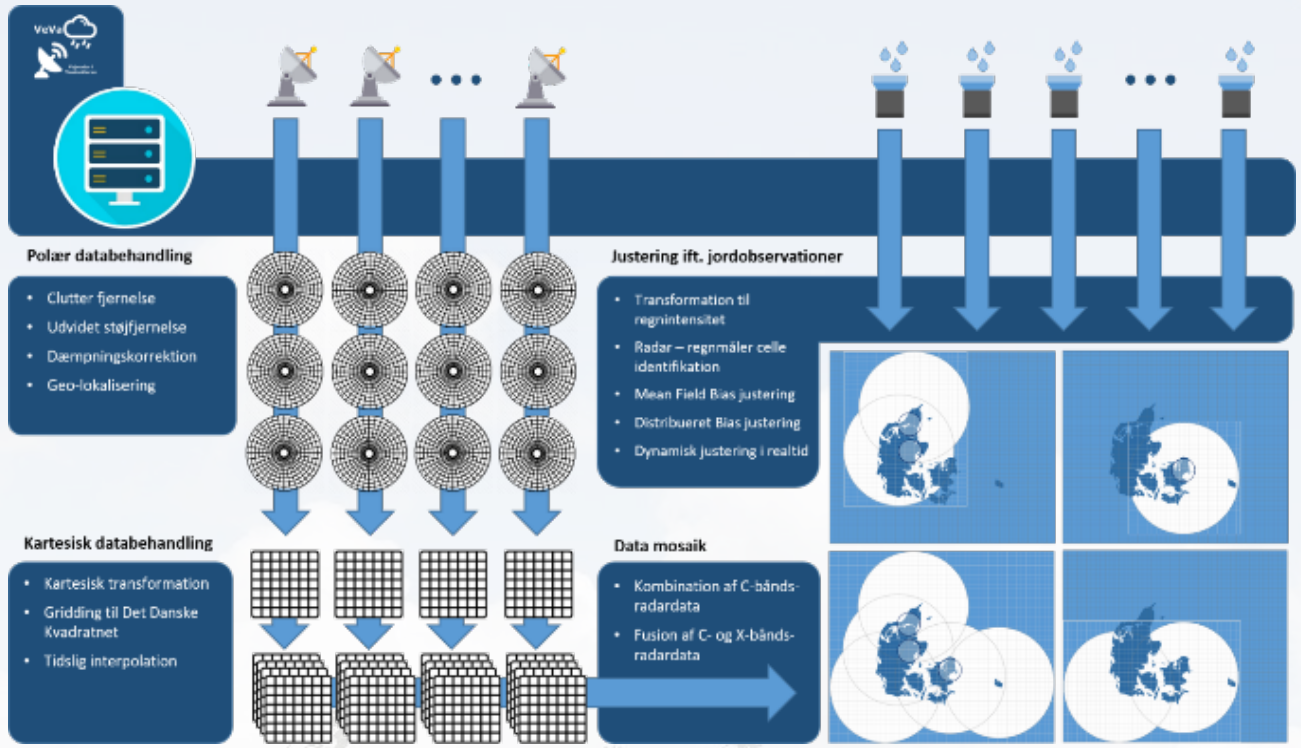
VeVa foreningens mission er at: Skabe et kvalitetssikret og justeret vejr-datagrundlag, som er nemt tilgængelig og anvendeligt for alle som interesserer sig for vejrdata.

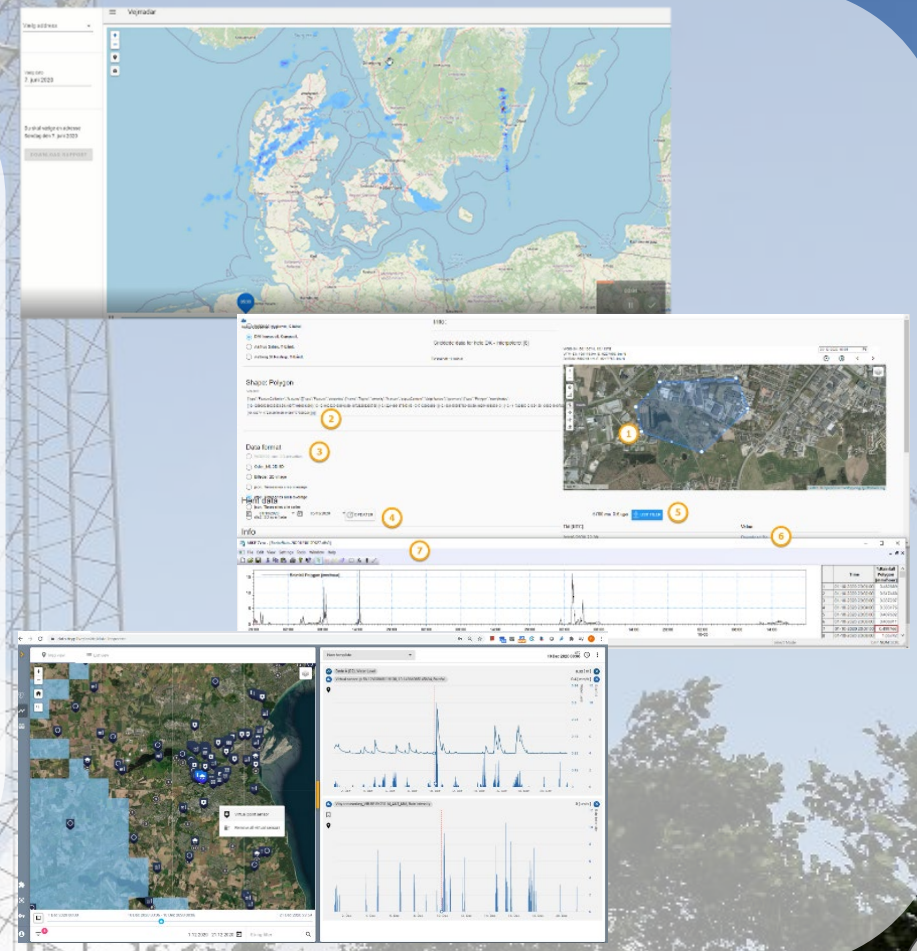
Dette gøres ved at:

- facilitere en åben datastandard for brugen af vejrdata til hydrologiske og hydrauliske formål.
- drive en online data-processeringsplatform med klart definerede datamodeller og datainterfaces (API'er mv.) for at opnå en god sammenhæng mellem dataprocessering, applikationer og anvendelse.
- kombinere nationale og lokale vejrdata for sikre, at medlemmerne har de bedst mulige vejrdata til rådighed for deres anvendelser. Både til retrospektive analyser og realtidsapplikation, herunder både observationer og forudsigelser.
- være videns- og erfaringsbank omkring brugen af vejrradarer til hydrologiske og hydrauliske formål for vandsektoren.
- være en central drivkraft for en forsat forskning og udvikling i anvendelser af vejrdata i vandsektoren.



What – The operational setup of VeVa





What – development and operationalization

2016-2018: Development of data model and initial collaboration

2018-2020: Development of online data processing system and association organisation and governance

2020-2022: Operationalisation of the online data processing system, and formalising the association governance.

2021-2024: Development of operational nowcast, forecast and enhanced data fusion.

2022 … Develop and grow the VeVa association