Forecasting solar PV yield
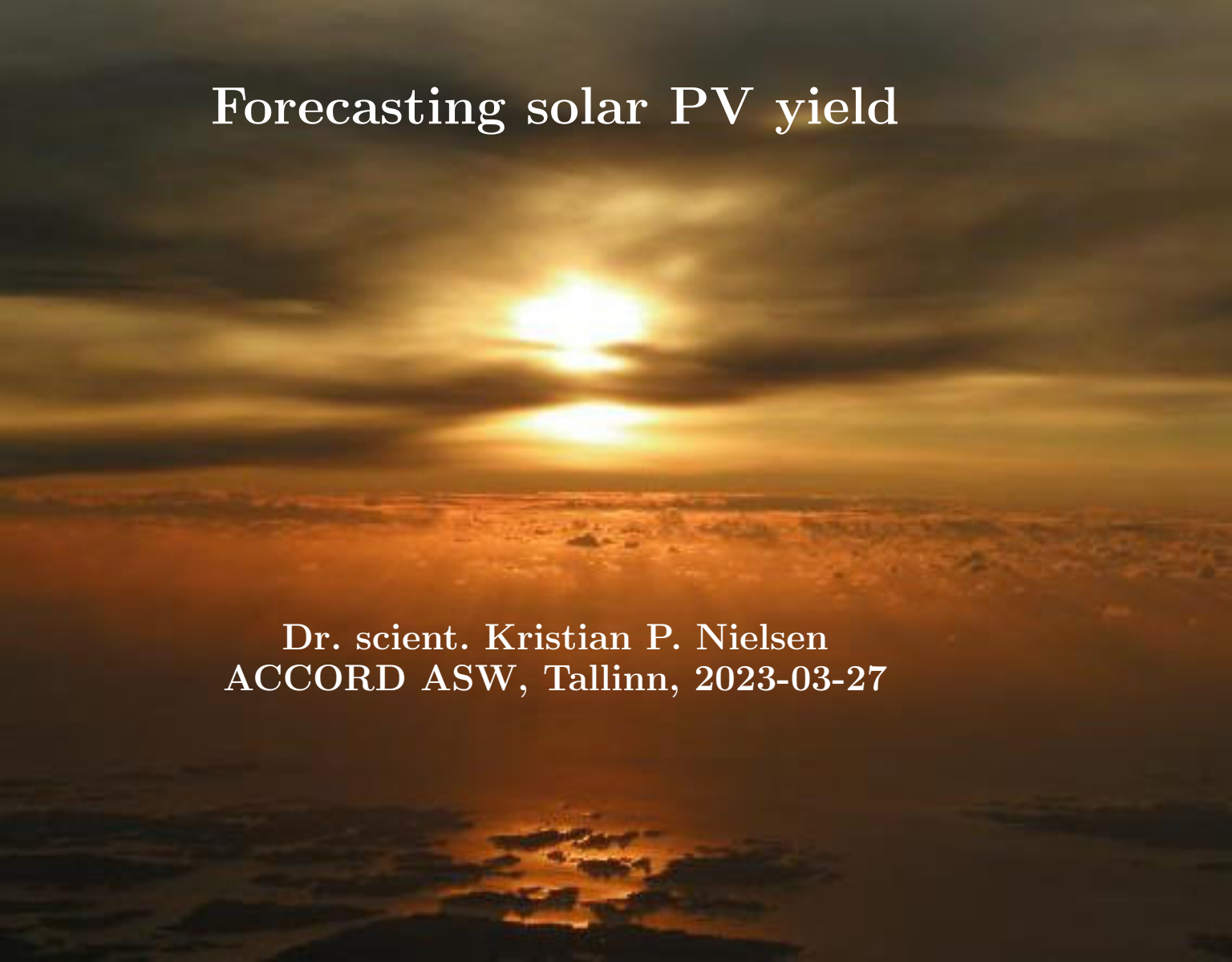
Dr. scient. Kristian P. Nielsen
ACCORD ASW, Tallinn, 2023-03-27

INGRID ERONN meteorolog och studievägledare Stockholms universitet
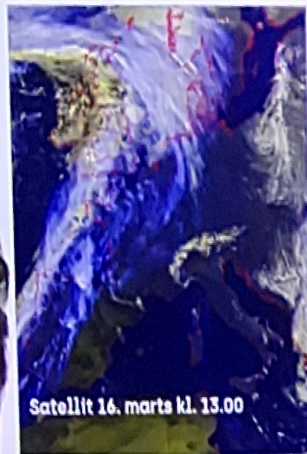
STOR BRIST PÅ METEOROLOGER

SE MER facebook.com/nyhetsmorgon • @nyhetsmorgon på Instagram • nyhetsmorgon@tv4.se
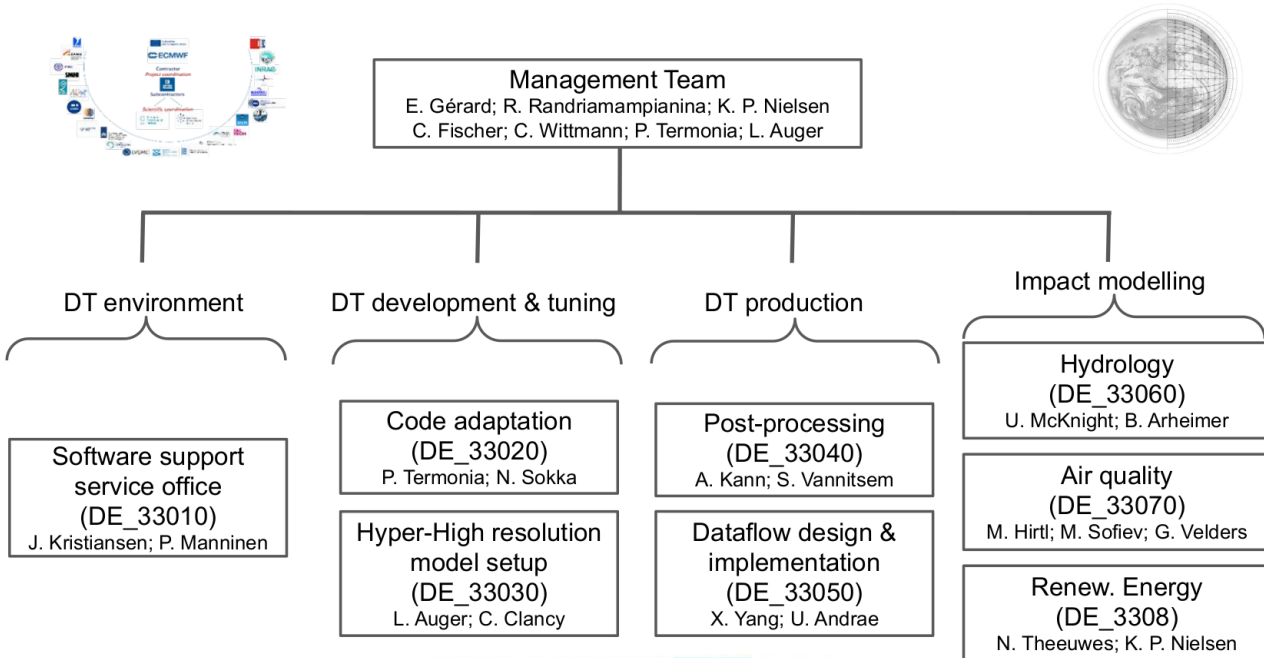
Nyhetsmorgon

Fler branscher efterfrågar meteorologer: Men intresset är svalt, 7 min 17 sek

I takt med klimatförändringarna har allt fler företag kommit att efterfråga prognosmeteorologer i sin dagliga verksamhet som kan förutspå hur vädret
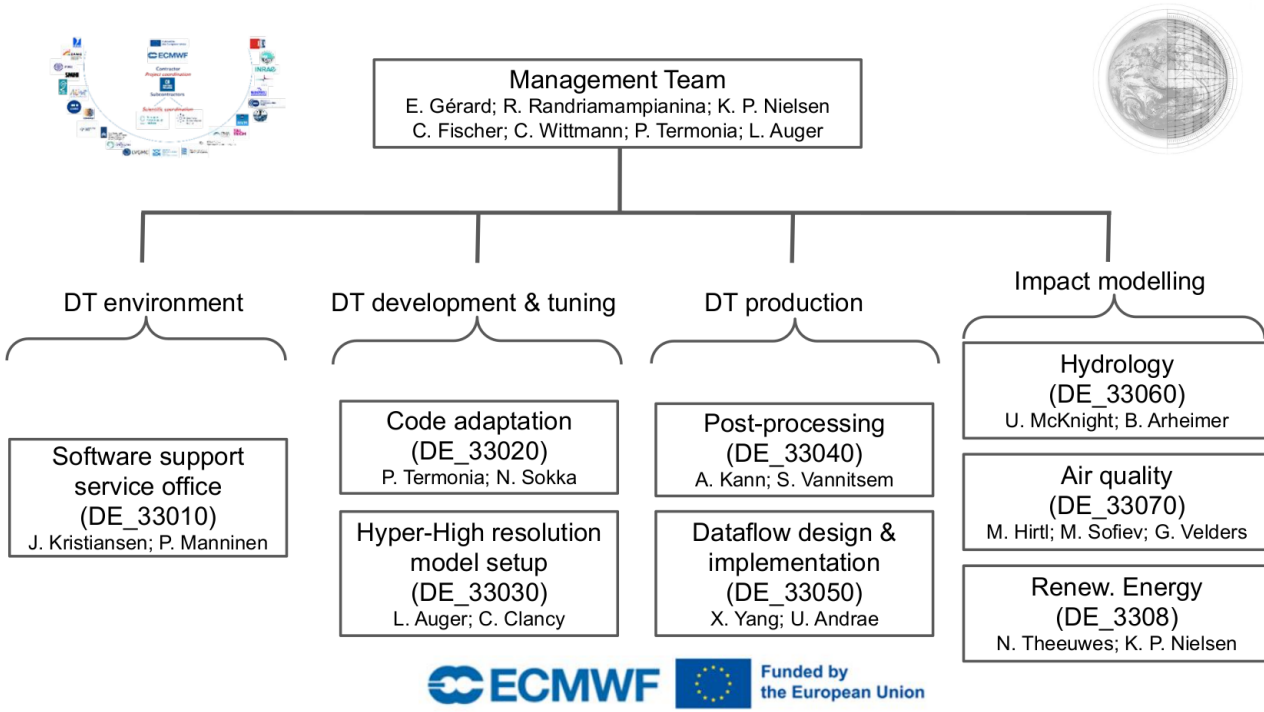
Solar power trading case - 16. marts 2023

Satellit 16. marts kl. 13.00

EC 00Z for 16. marts kl. 13.00

Germany

Destination Earth
On-Demand Ex-

Management Team
E. Gérard; R. Randriamampianina; K. P. Nielsen
C. Fischer; C. Wittmann; P. Termonia; L. Auger

DT environment

Software support
service office
(DE_33010)
J. Kristiansen; P. Manninen

DT development & tuning

Code adaptation
(DE_33020)
P. Termonia; N. Sokka

Hyper-High resolution
model setup
(DE_33030)
L. Auger; C. Clancy

DT production

Post-processing
(DE_33040)
A. Kann; S. Vannitsem

Dataflow design &
implementation
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X. Yang; U. Andrae

Impact modelling

Hydrology
(DE_33060)
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Air quality
(DE_33070)
M. Hirtl; M. Sofiev; G. Velders

Renew. Energy
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ECMWF · Funded by the European Union

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ECMWF

Funded by
the European Union

DE Digital Twins

WHAT IS A DIGITAL TWIN?

Driven by high-performance computing, advanced Earth-system simulations are fused with a continuous flow of observations to create the most accurate digital replica.

The replica includes water, energy, food and health components to link the physical with the human world.

This allows us to revisit the past, understand and explain change, and predict the future in support of decision making.
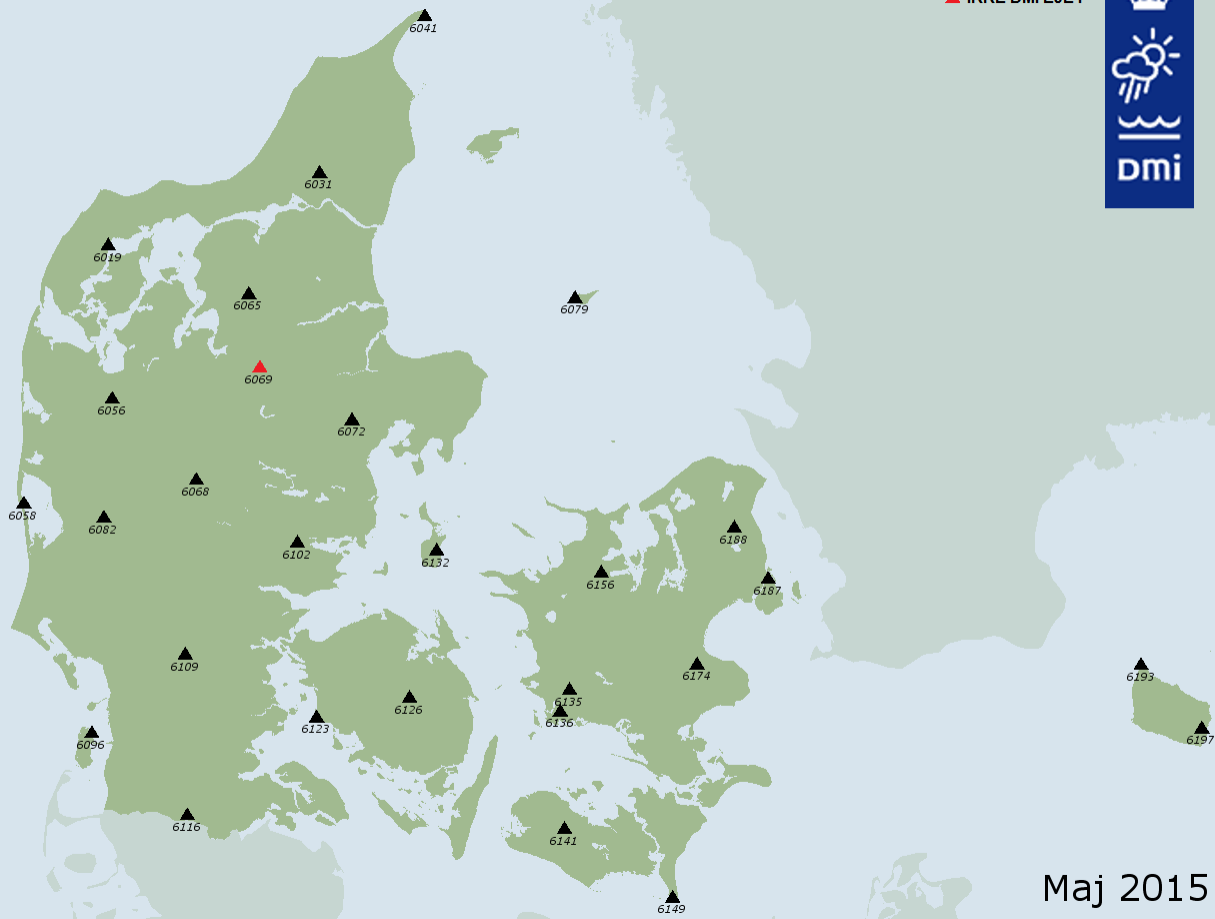
PHYSICAL WORLD
Planet Earth

DIGITAL TWIN
Computer model
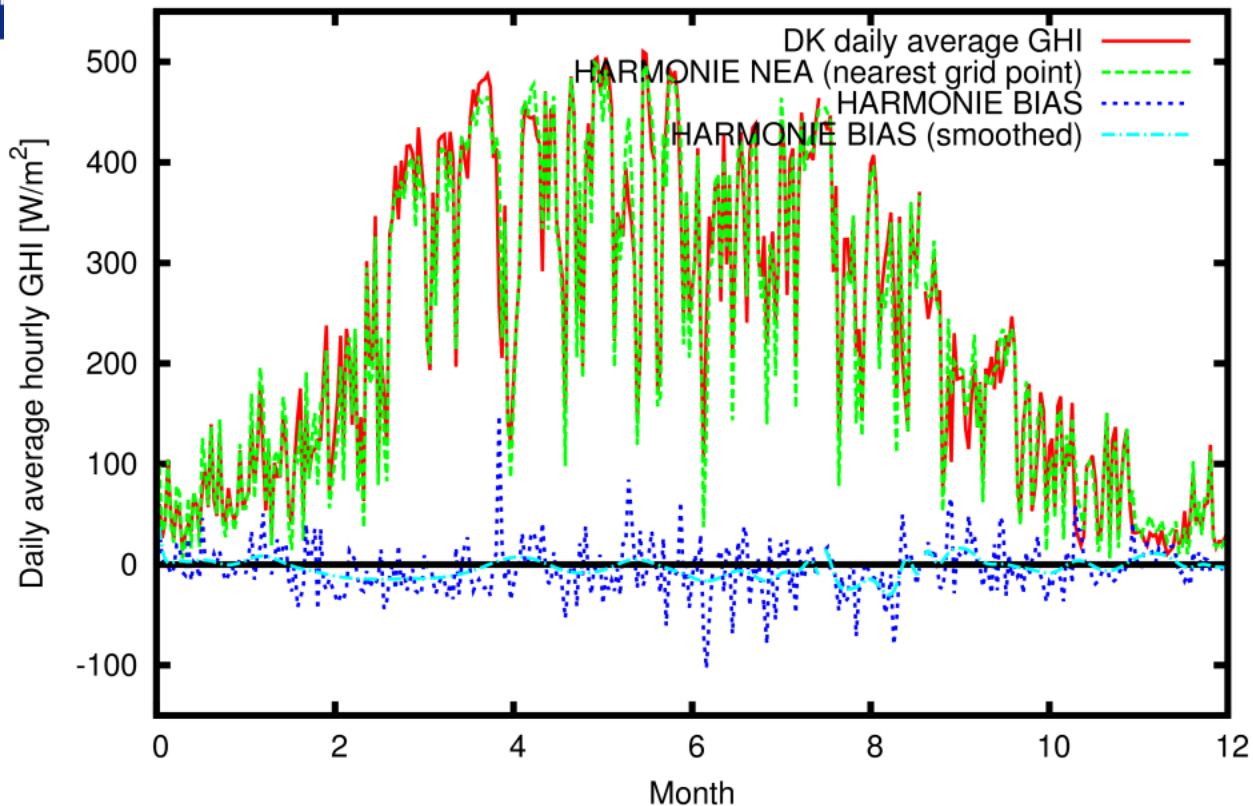
ECMWF

DK global radiation stations

STRÅLING/SOL

▲ DMI EJET
▲ IKKE DMI EJET

6041
6031
6019
6065
6069
6056
6072
6079
6068
6058
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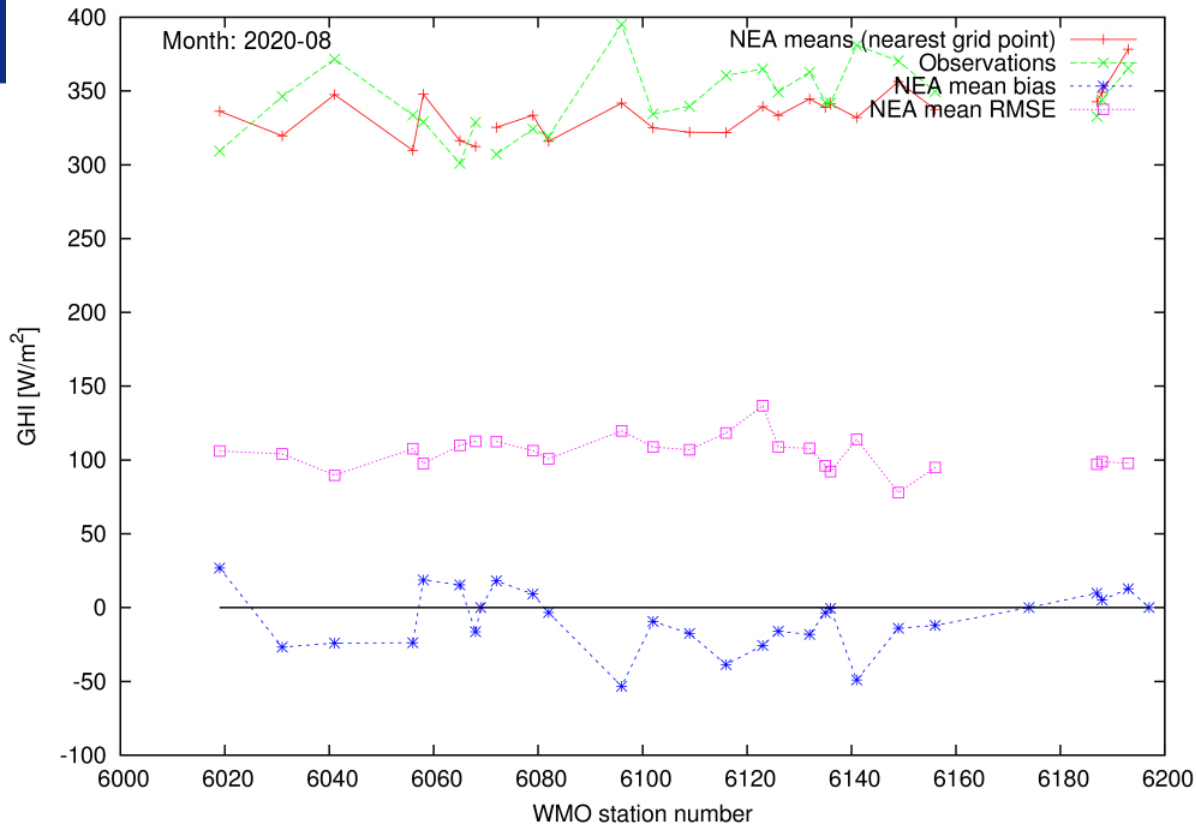6141
6116
6149

Maj 2015

DK daily global irradiation

DK daily global irradiation — 2020
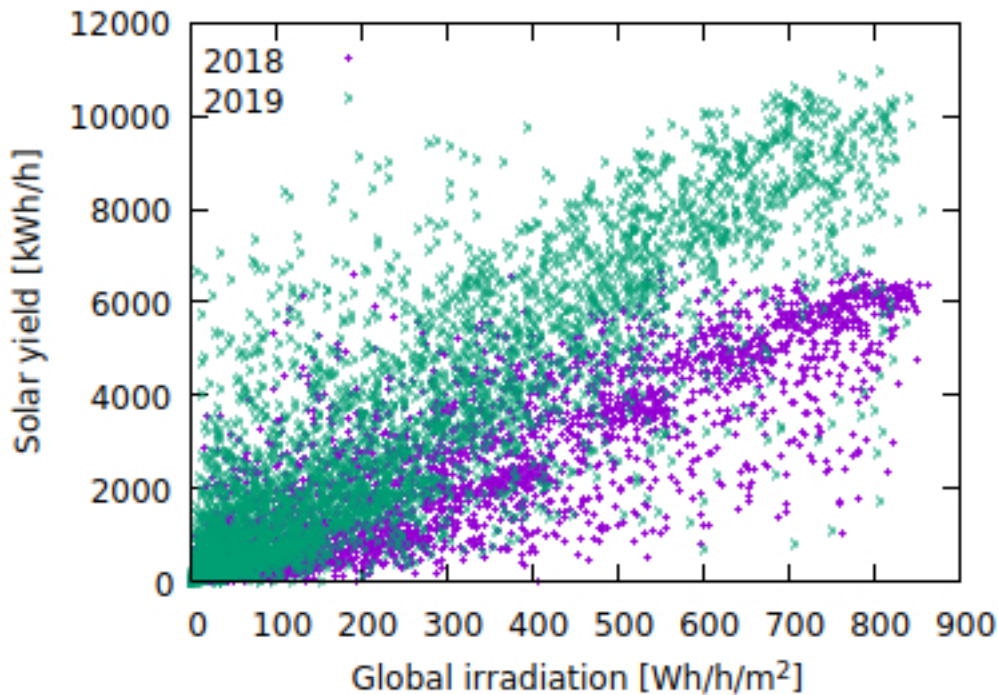
August 2020 statistics per station

Solar PV yield data

- Data from EnerginetDK – the Danish Transmission System Operator (TSO)

- . . . from 2017 onwards

- 15 minute resolution

- . . . for 98 DK municipalities (GDPR)

Solar PV yields and NEA forecasting, Vejen

Key concept: irradiance components

- Global radiation / "Global Horizontal Irradiance (GHI)"

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- Direct Horizontal Irradiance (DrHI)
- Direct Normal Irradiance (DNI)

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  – Should be calculated/output base on individual timesteps!

- Diffuse irradiance (DIF)

- GHI = DrHI + DIF

Key concept: Clear sky index

- Normalized Global radiation
- CSI = GHI / GHI$_{\text{clearsky}}$
- Can and should be output from our models

DMI

ACC RD
A Consortium for COnvection-scale modelling Research and Development

Conclusions

- **Renewable is an important field of meteorology today**

- Day-ahead forecasts are of great value

- **Renewable energy production data from TSOs could also help our models**

DMI

ACC☰RD