CONSORTIUM FOR SMALL SCALE MODELING
COSMO

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

# Numerical experiments with a parameterization of mires in the COSMO-D2 convection permitting limited-area numerical weather prediction framework

Jürgen Helmert, Alla Yurova, Denis Blinov, Inna Rozinkina, Michael Baldauf, Ulrich Schättler, Jean-Marie Bettems, and Dmitrii Mironov

# Motivation: Summer 2018

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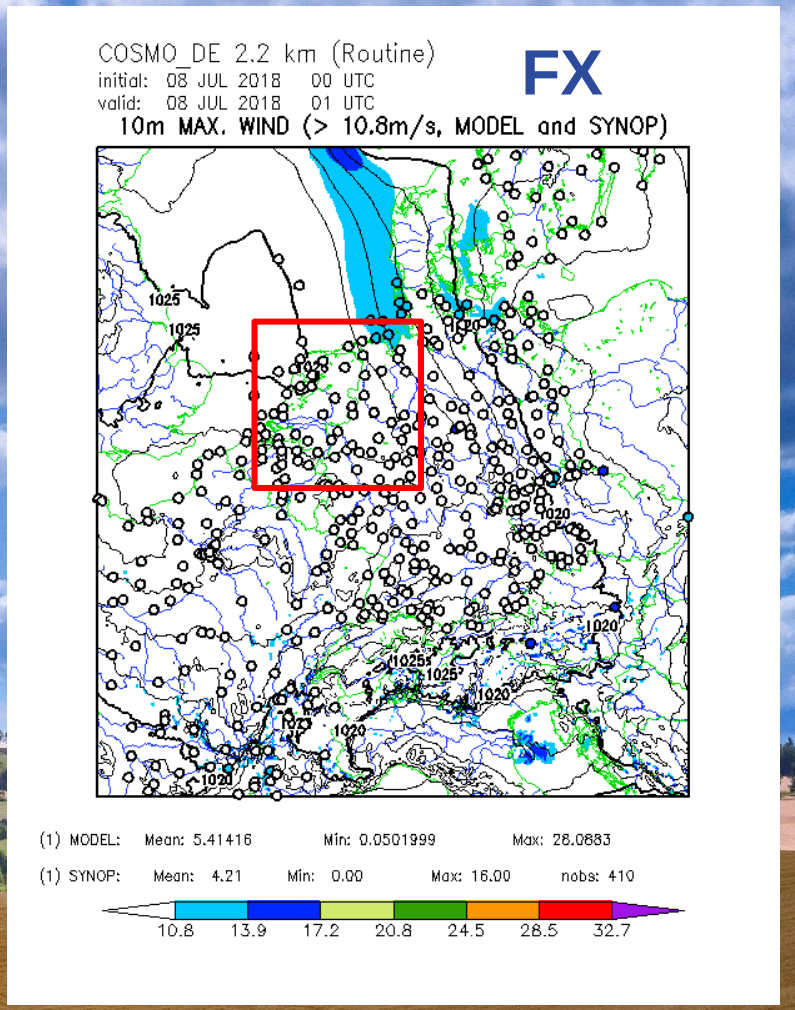
- Very warm
- Very dry
- In principle good conditions for ballon rides…

Guidance from COSMO-D2 too gusty …
Problem for ballon rides and forecasters of national service

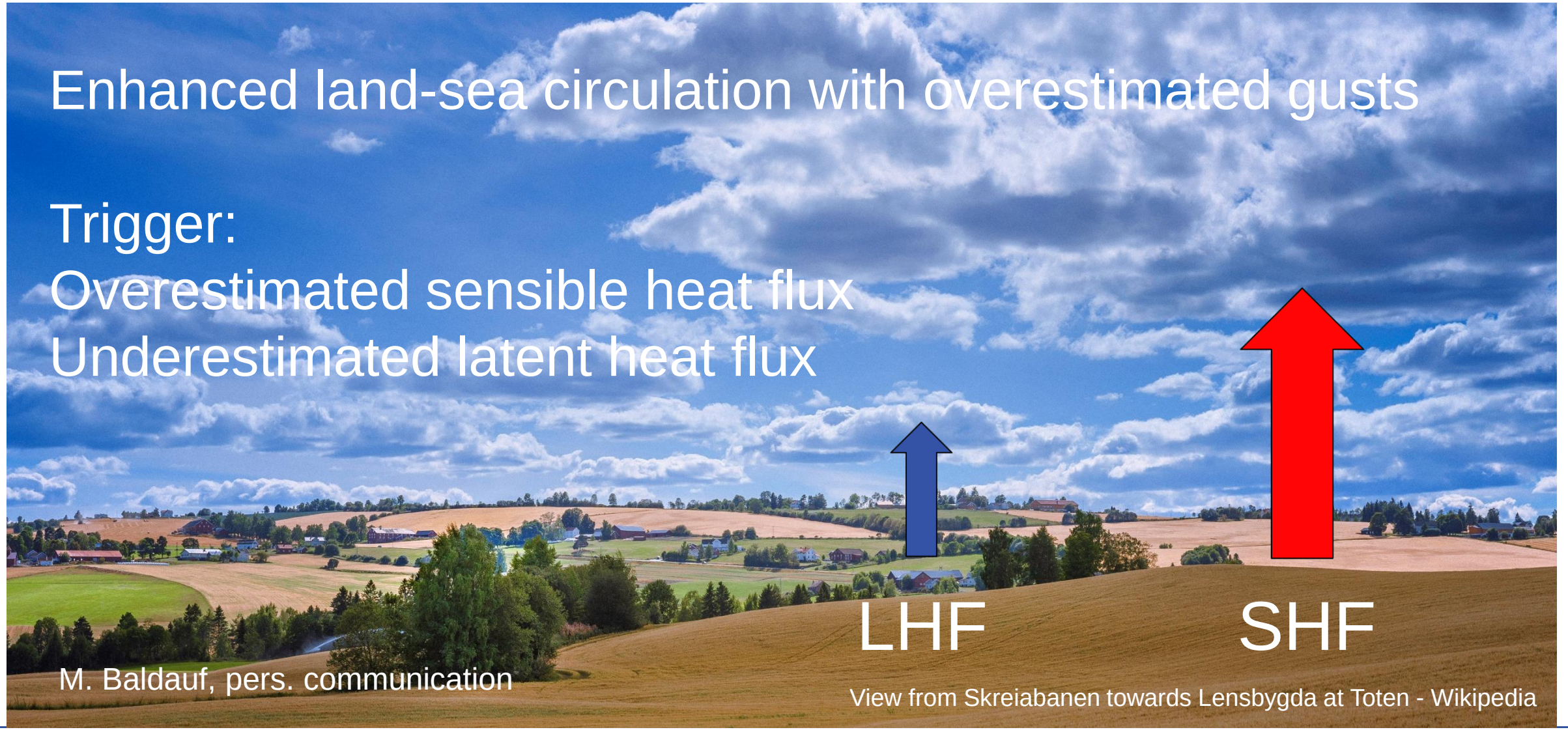



View from Skreiabanen towards Lensbygda at Toten - Wikipedia

J. Helmert et al., EGU2020

# COSMO-D2 physical processes





# Mire points in COSMO-D2 - TERRA soil model

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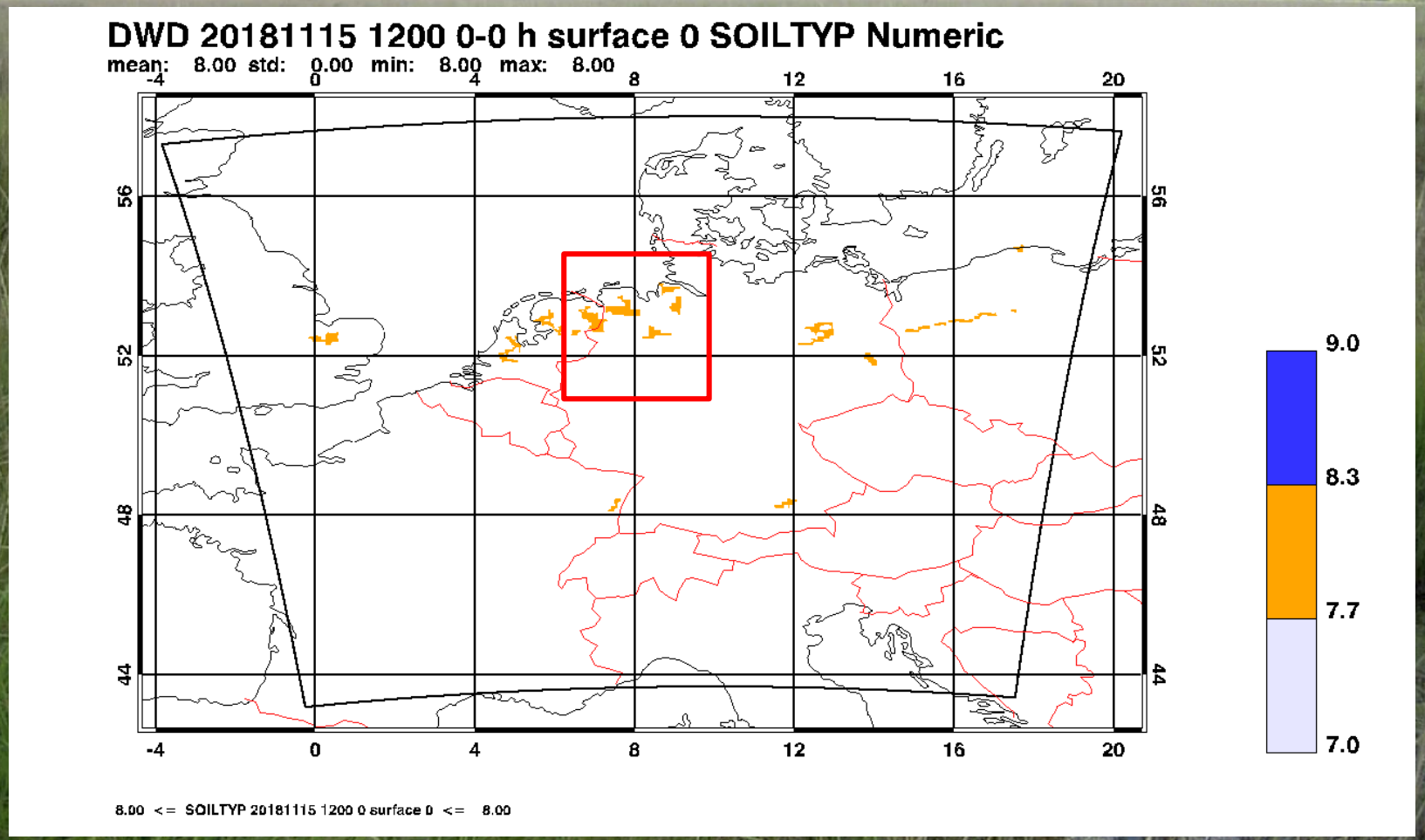
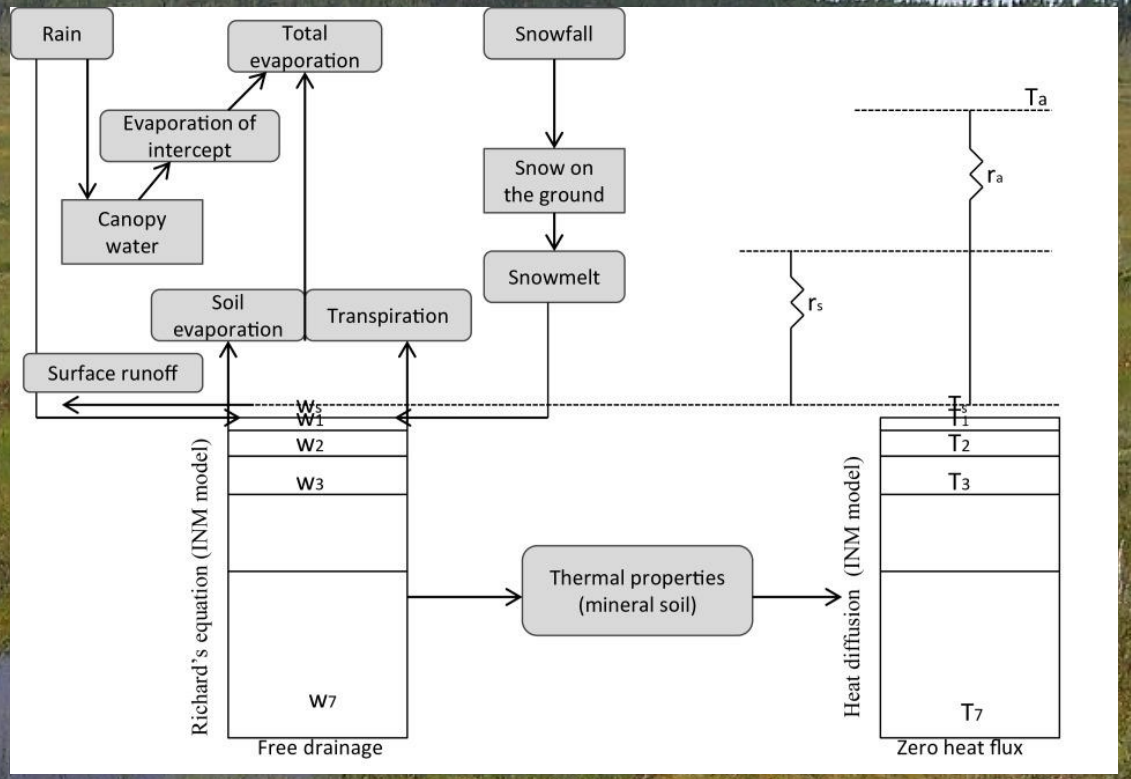



NSG „Ewiges Meer“, Hochmoorweite - Wikipedia

J. Helmert et al., EGU2020

# Peatlands in TERRA – old approach



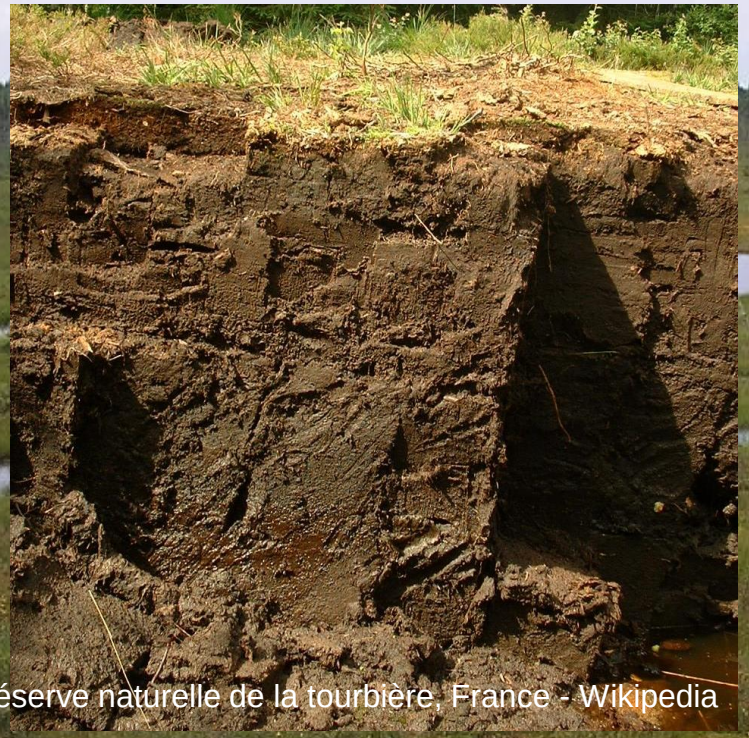



Yurova et al., 2014

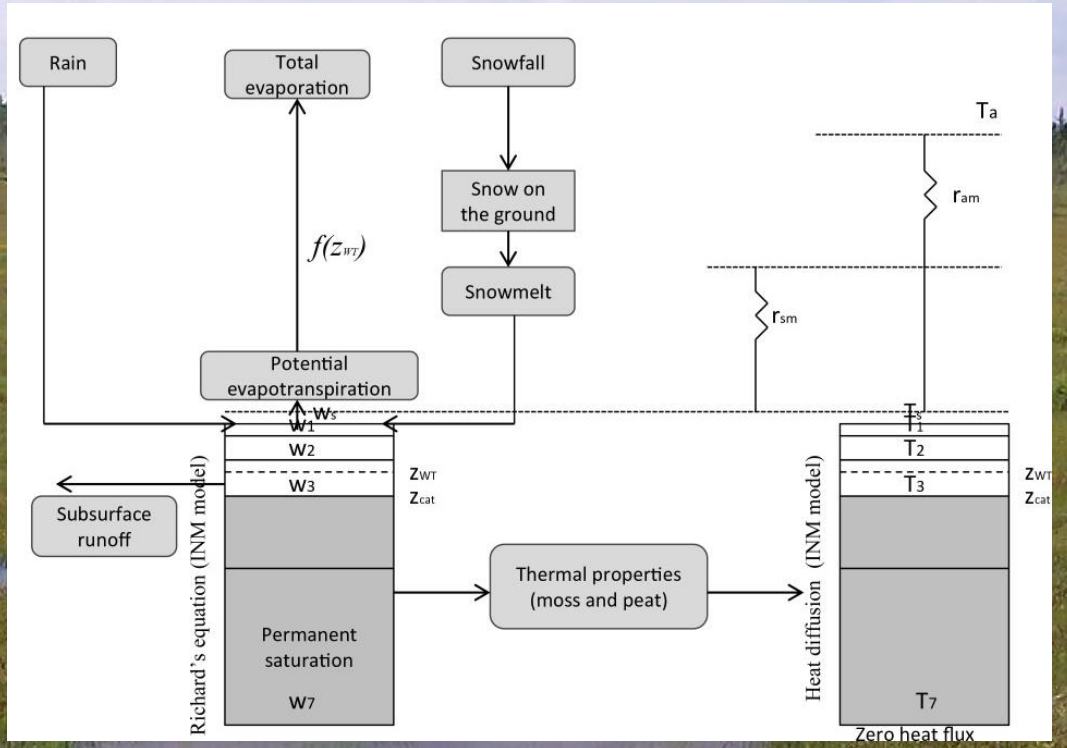
Bog - St-Daniel sector - Frontenac National Park (Québec, Canada) -Wikipedia

# Peatlands in TERRA – new mire scheme





Réserve naturelle de la tourbière, France - Wikipedia




itype_mire = 1
itype_heatcond = 3

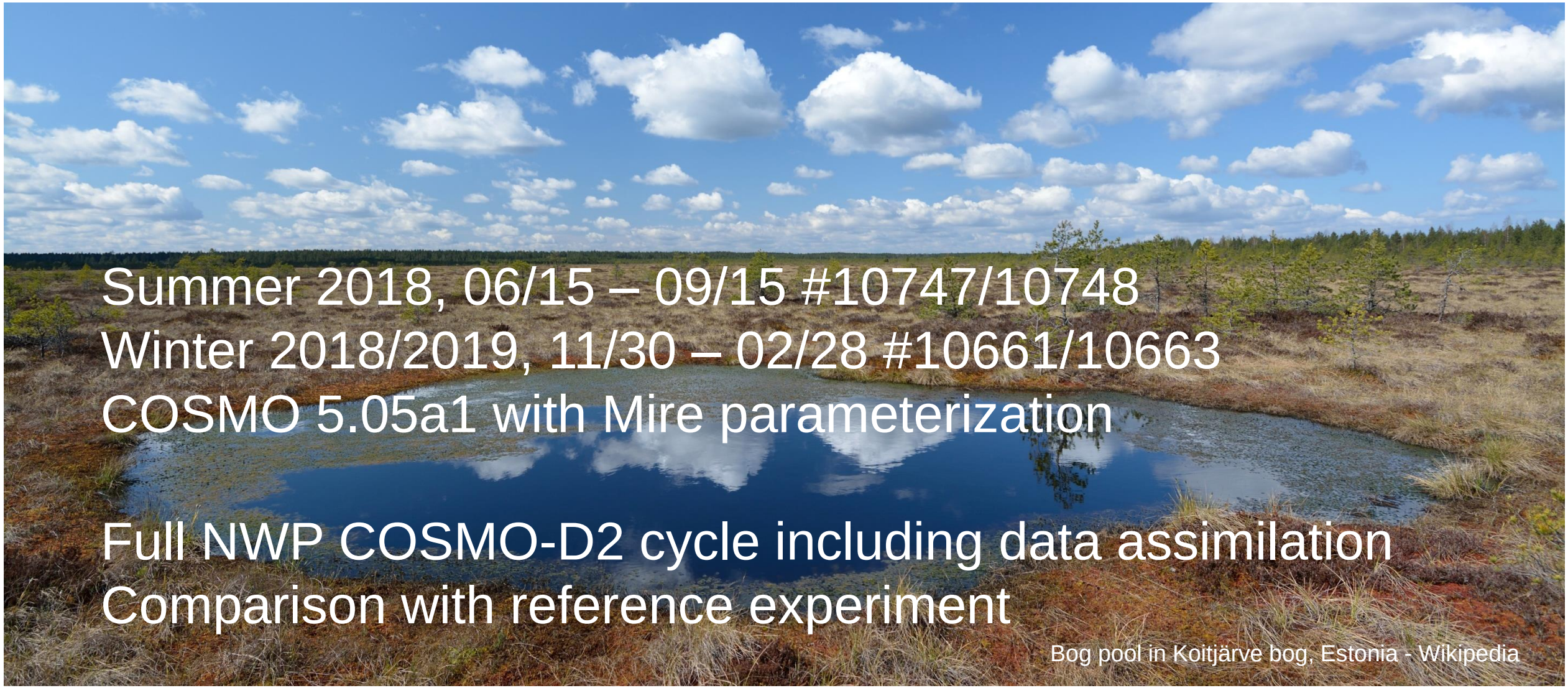
Yurova et al., 2014

- Modification in TERRA: Evaporation
  - Soil heat conductivity
  - Soil water budget

Bog - St-Daniel sector - Frontenac National Park (Québec, Canada) -Wikipedia

# Numerical experiments





Summer 2018, 06/15 – 09/15 #10747/10748
Winter 2018/2019, 11/30 – 02/28 #10661/10663
COSMO 5.05a1 with Mire parameterization

Full NWP COSMO-D2 cycle including data assimilation
Comparison with reference experiment

Bog pool in Koitjärve bog, Estonia - Wikipedia

# Results: 10 m gusts REF-EXP

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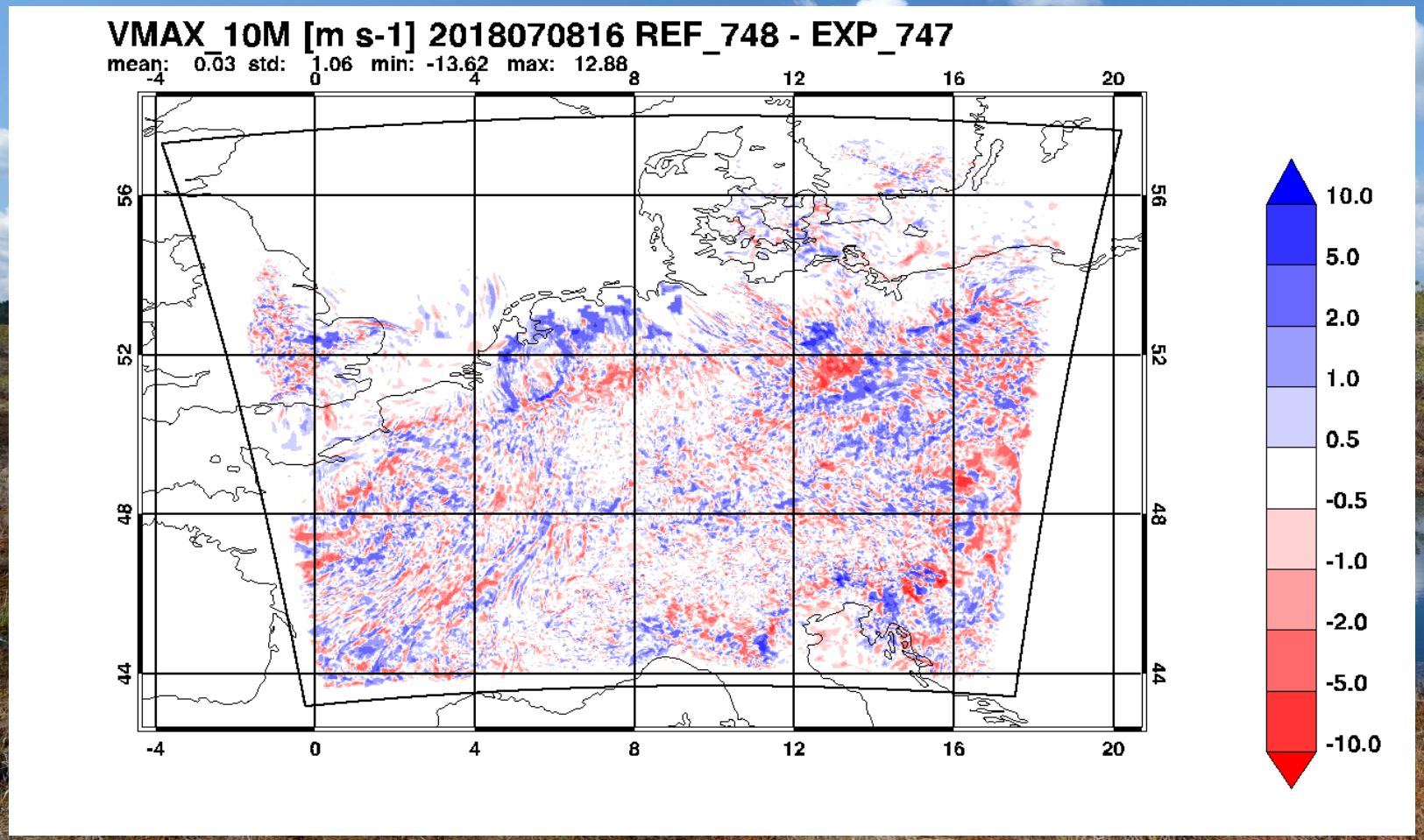


with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

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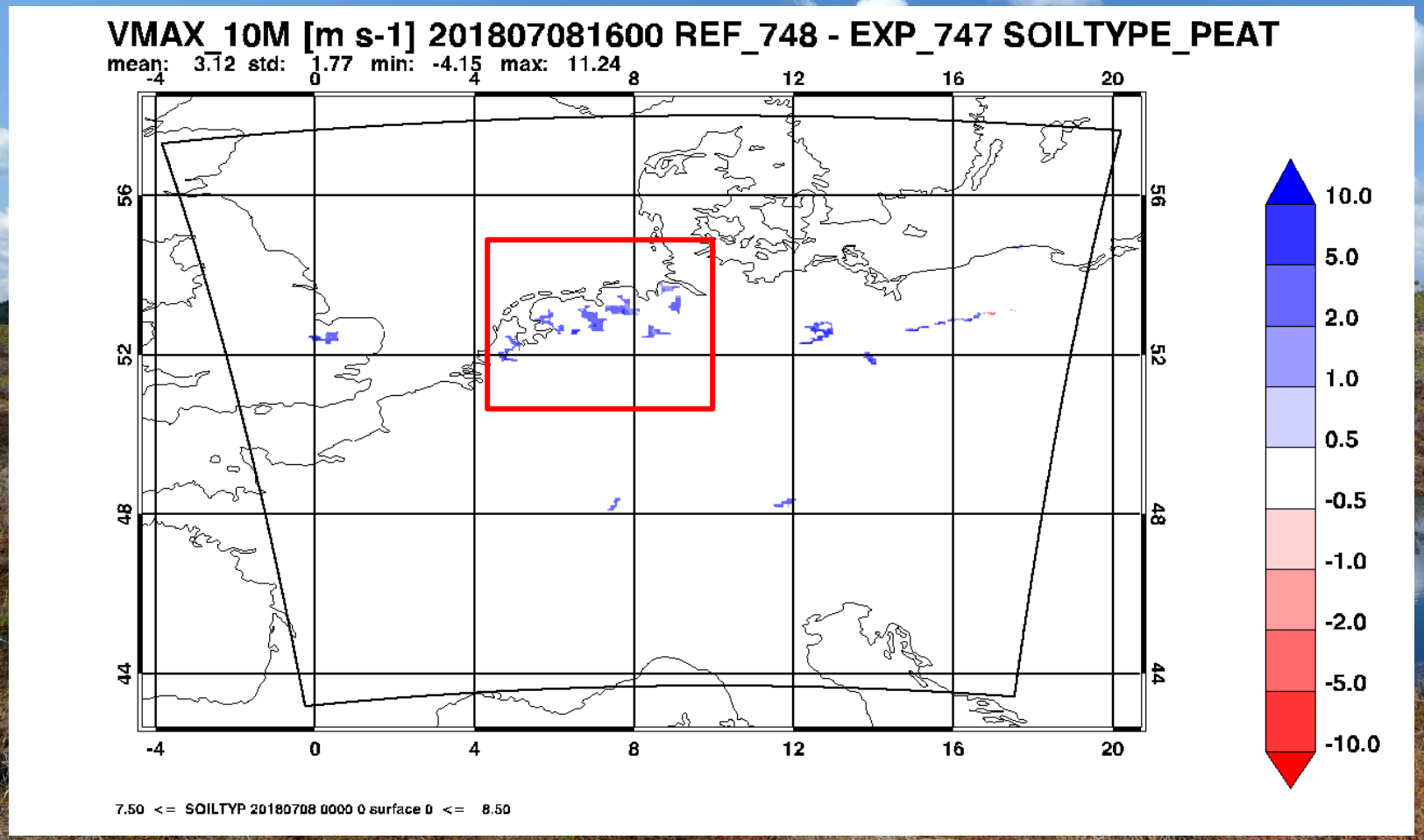


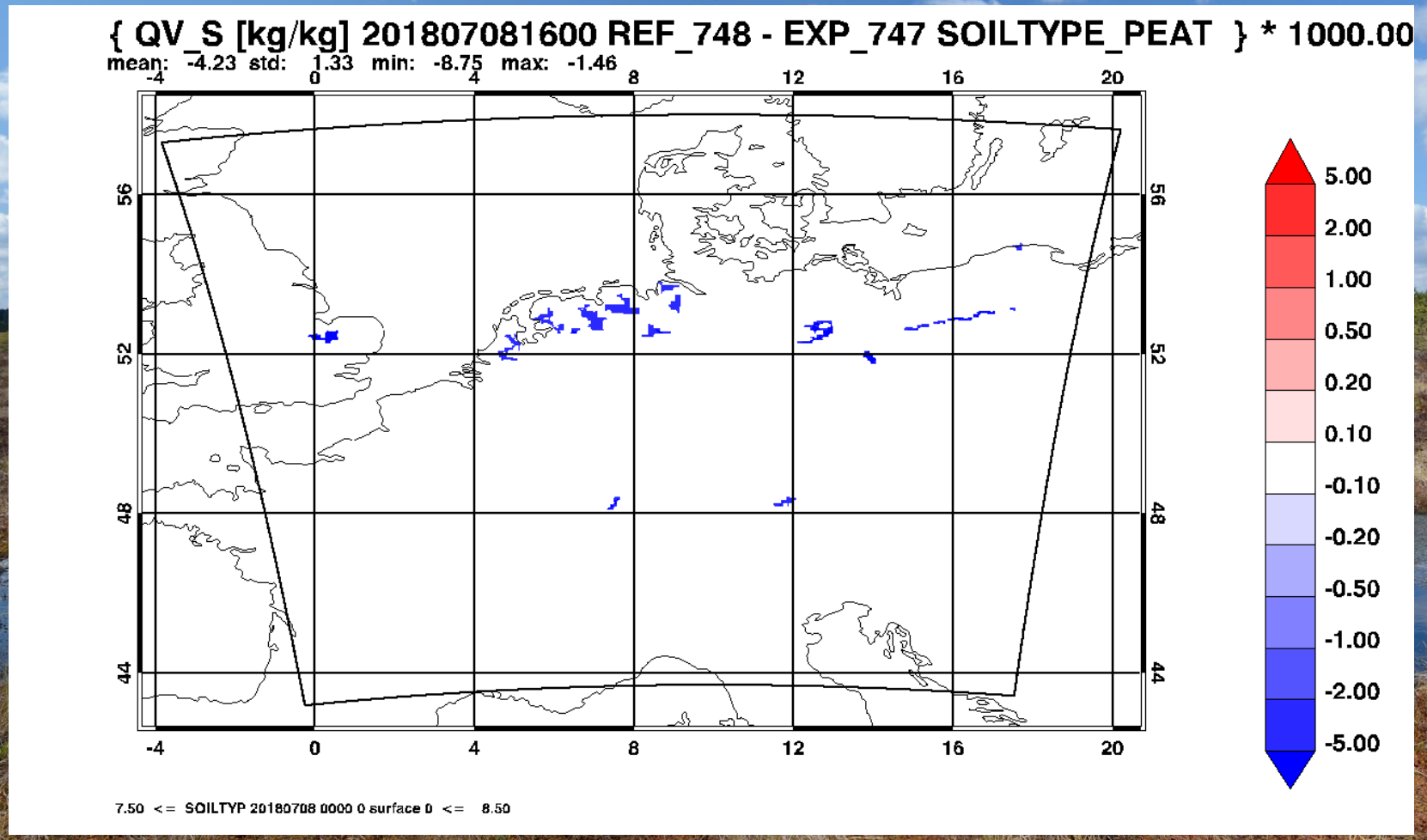

with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Results: Surface moisture REF-EXP

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



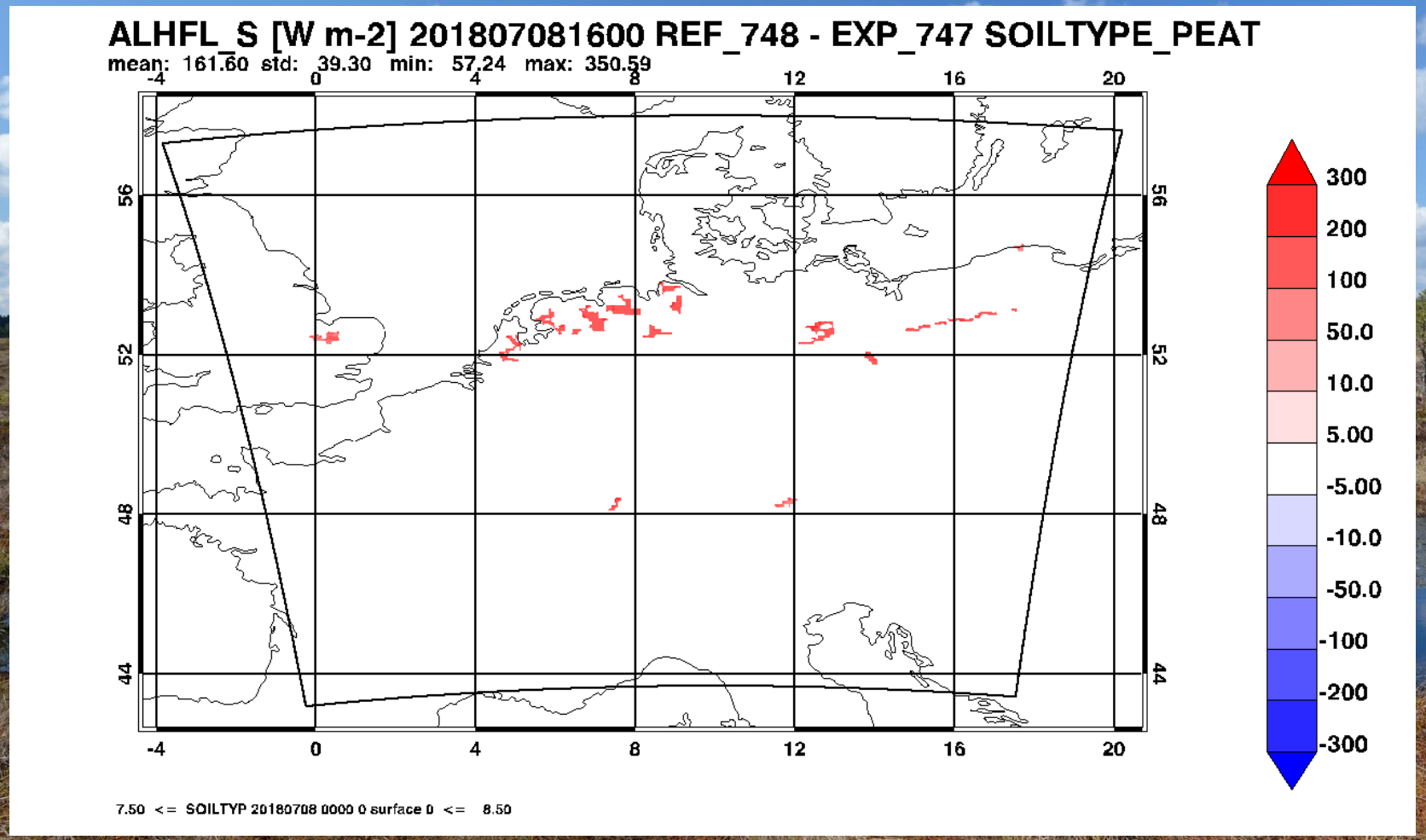

with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Results: Averaged latent heat flux REF-EXP

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



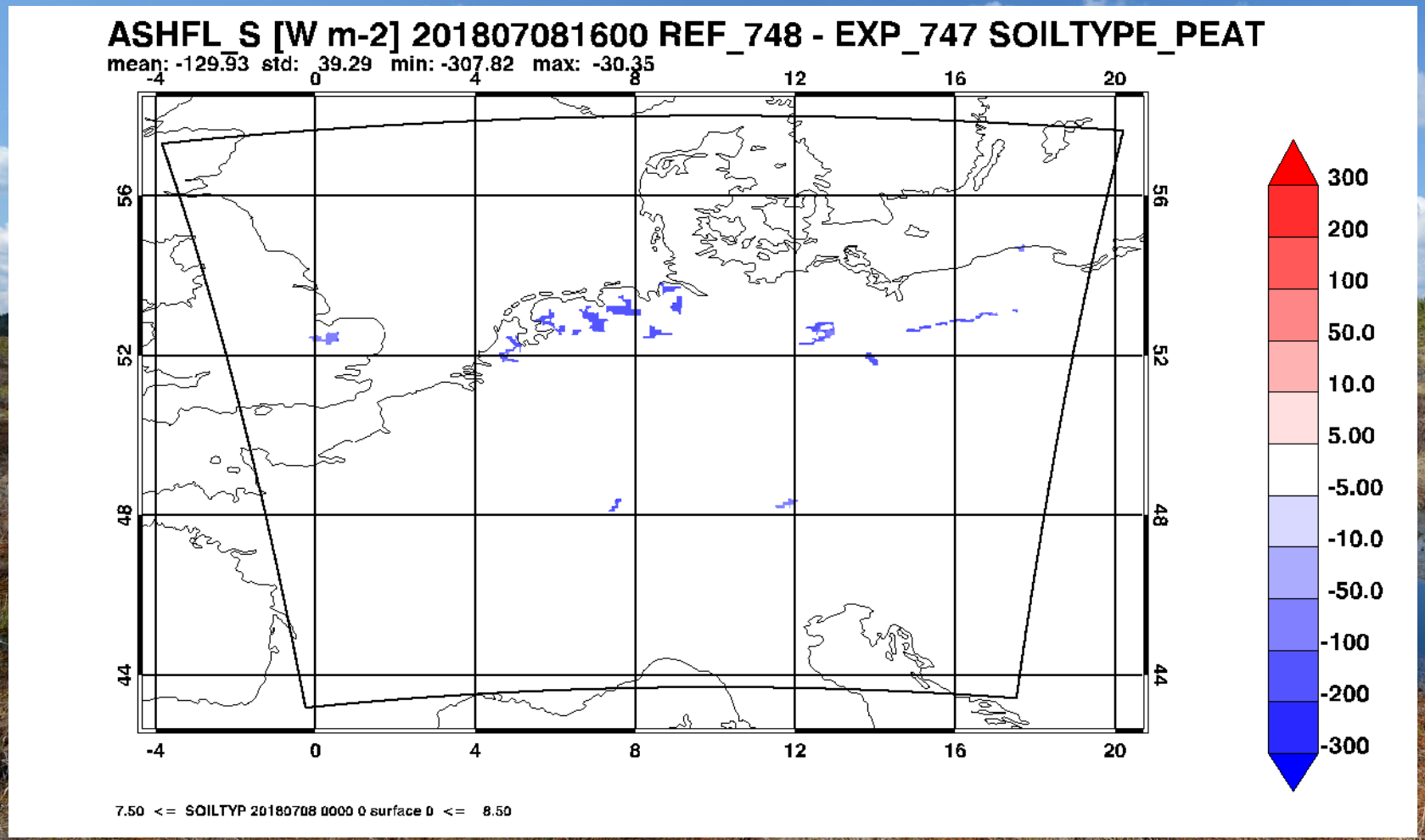

with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Results: Averaged sensible heat flux REF-EXP

Deutscher Wetterdienst
Wetter und Klima aus einer Hand







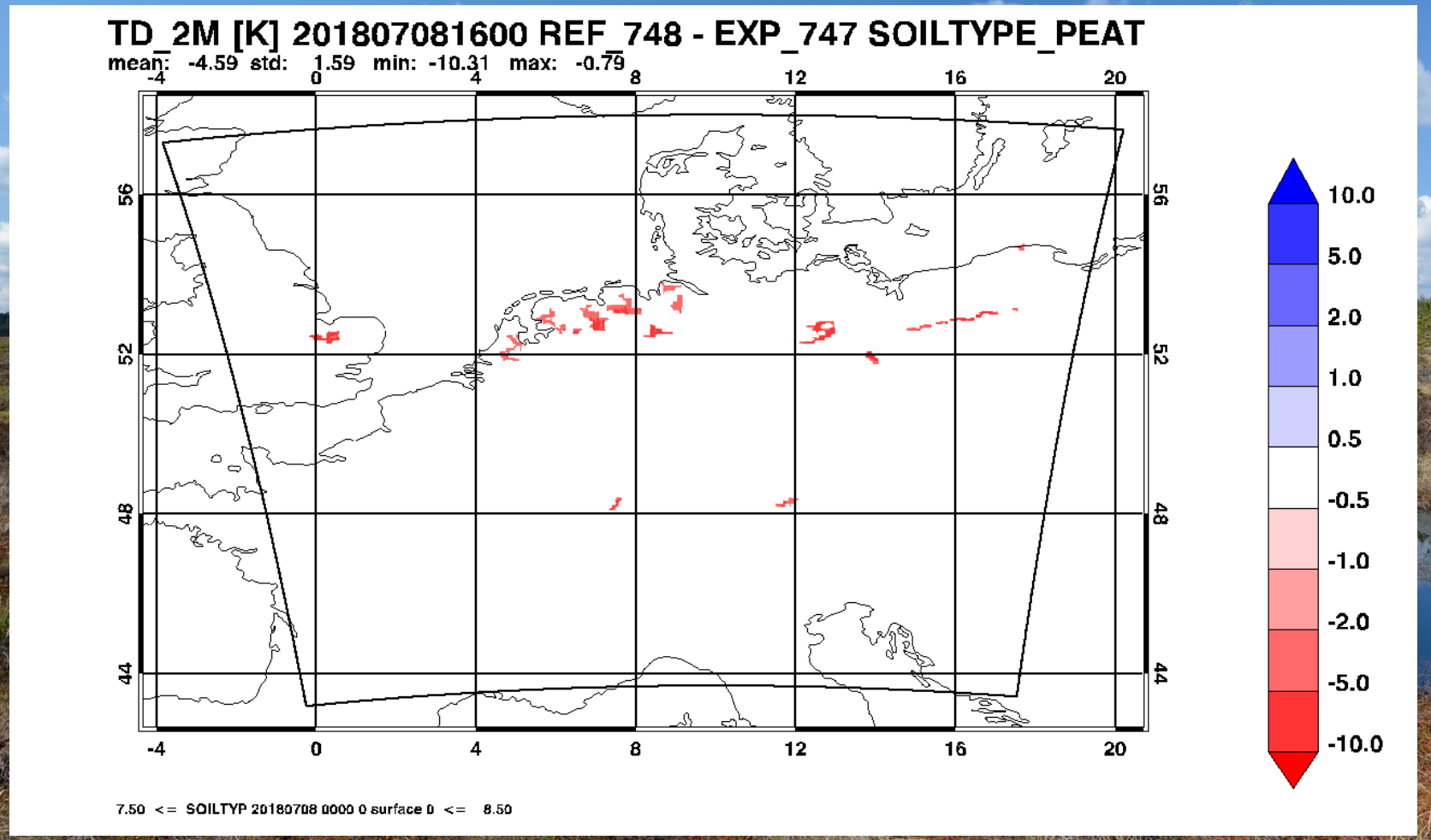
with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Results: 2m dew point temperature REF-EXP

Deutscher Wetterdienst
Wetter und Klima aus einer Hand




with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Results: 2m temperature REF-EXP

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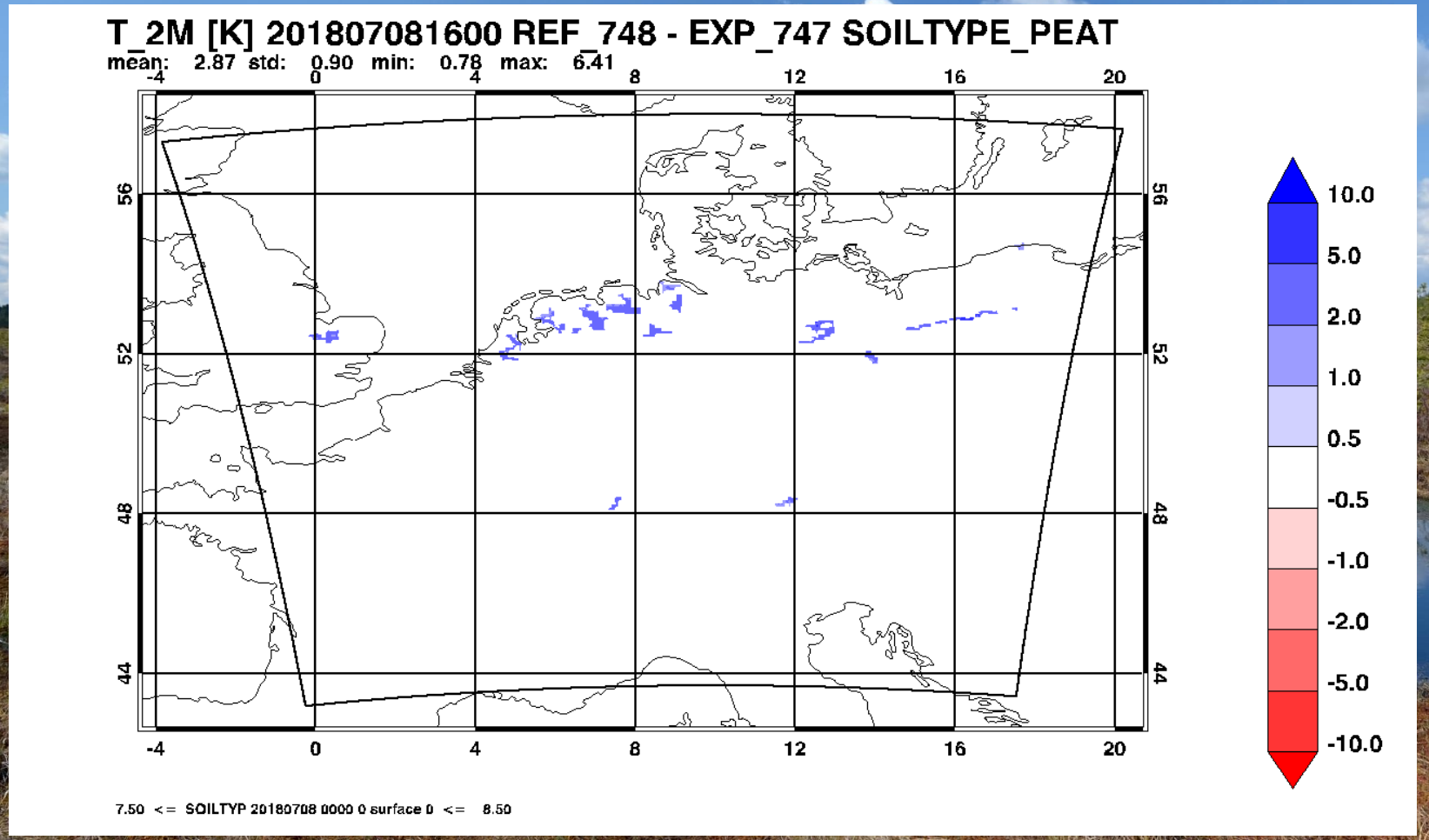
Wetter und Klima aus einer Hand



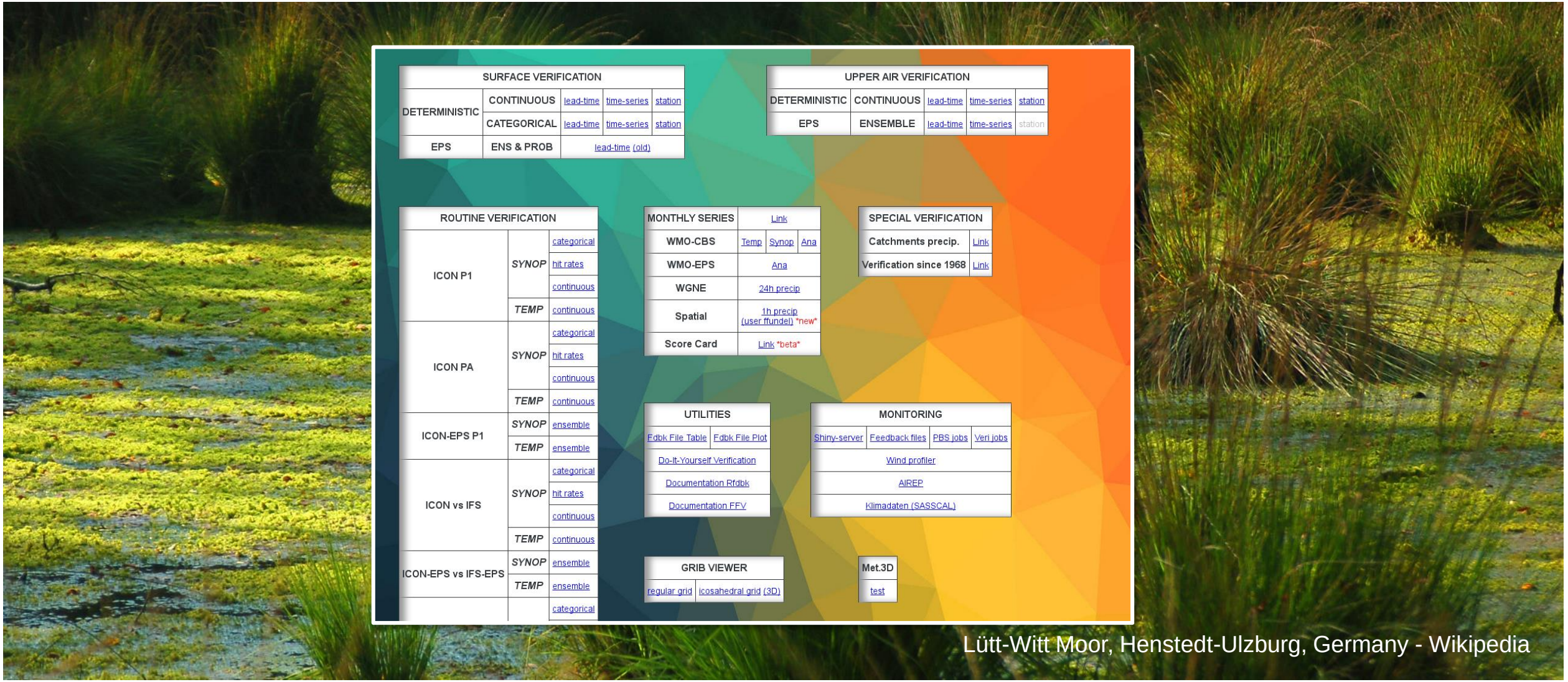

with Mire scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia

J. Helmert et al., EGU2020

# Verification – COSMO-D2

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

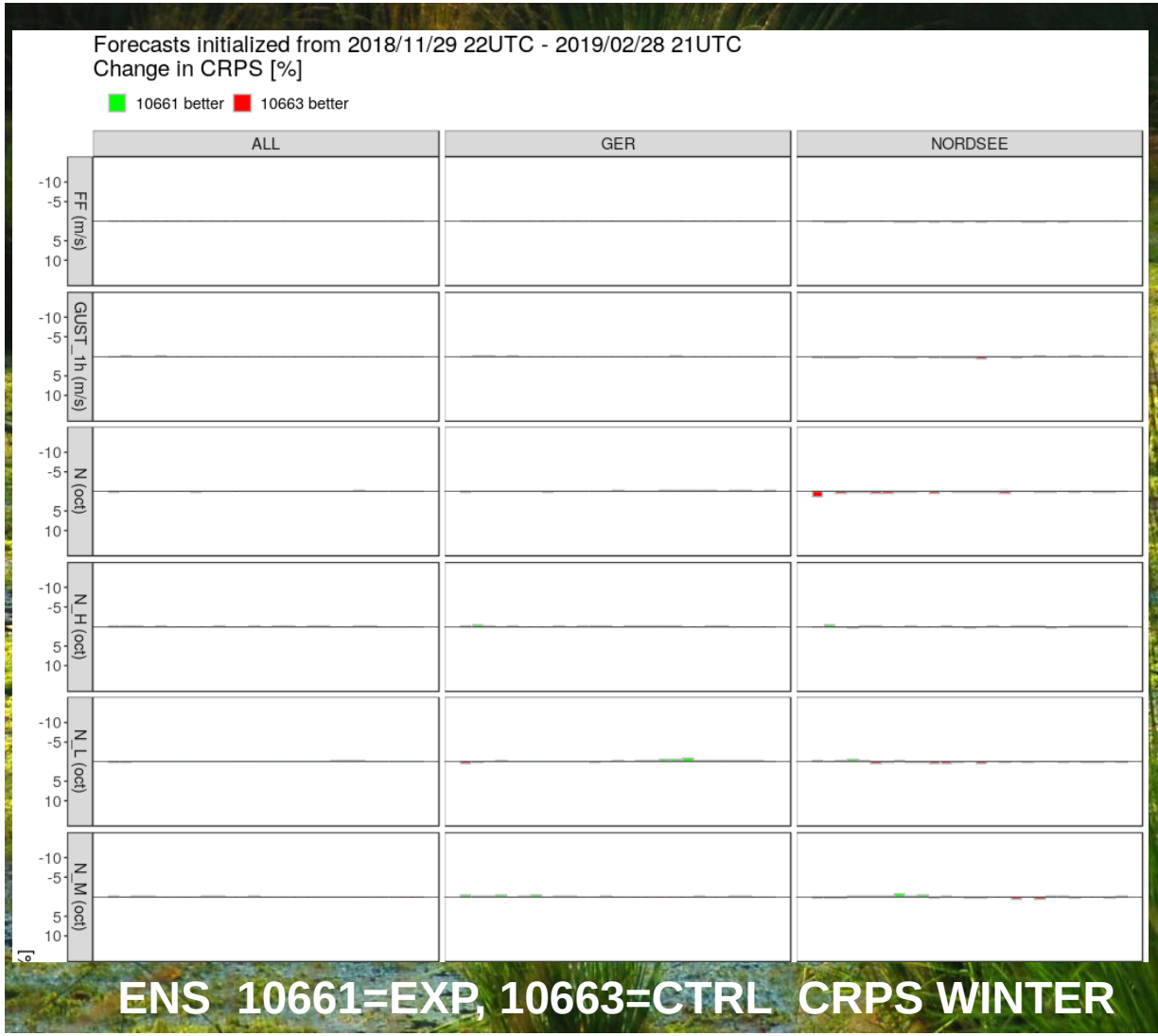



Lütt-Witt Moor, Henstedt-Ulzburg, Germany - Wikipedia

J. Helmert et al., EGU2020

# Verification – COSMO-D2 Winter

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



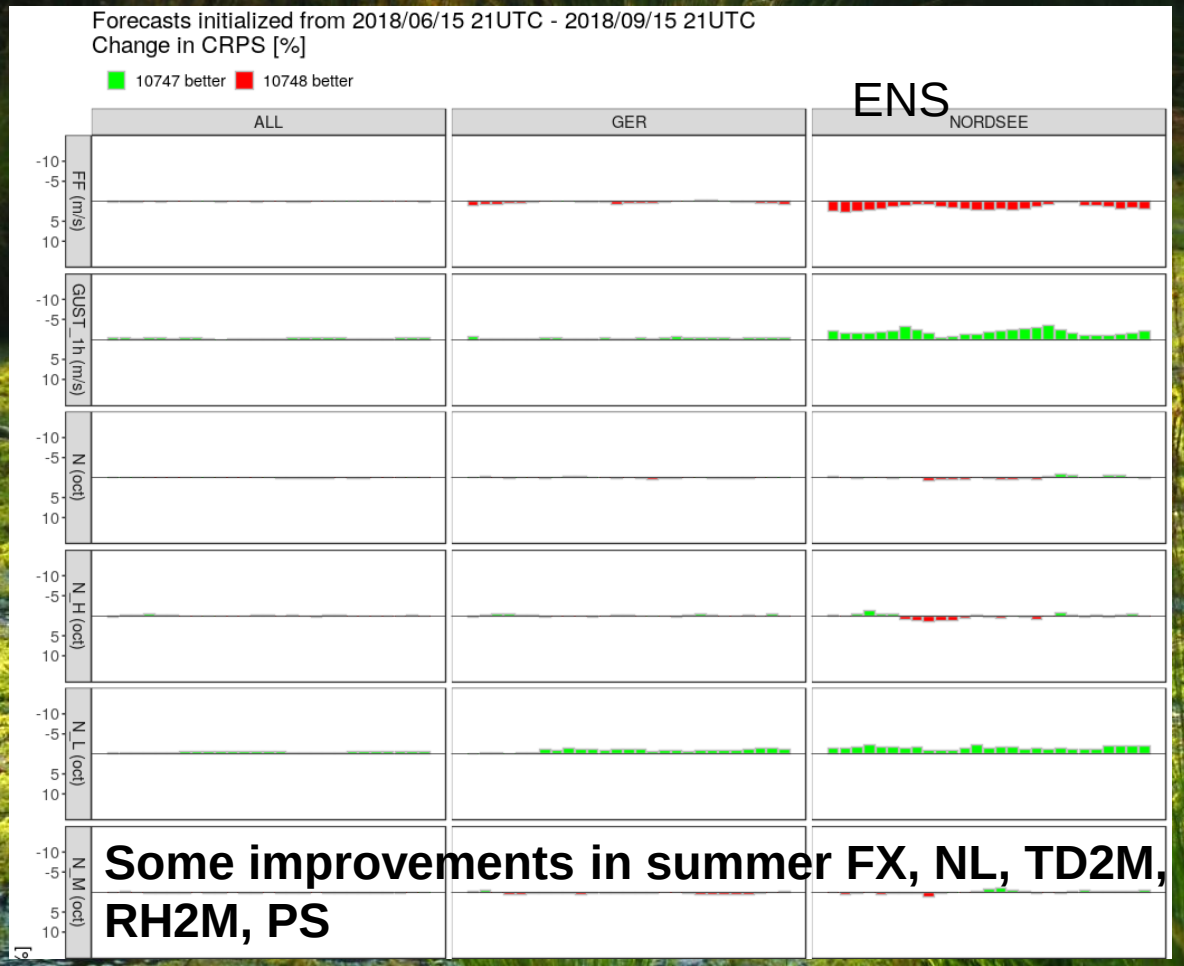

ENS 10661=EXP, 10663=CTRL CRPS WINTER

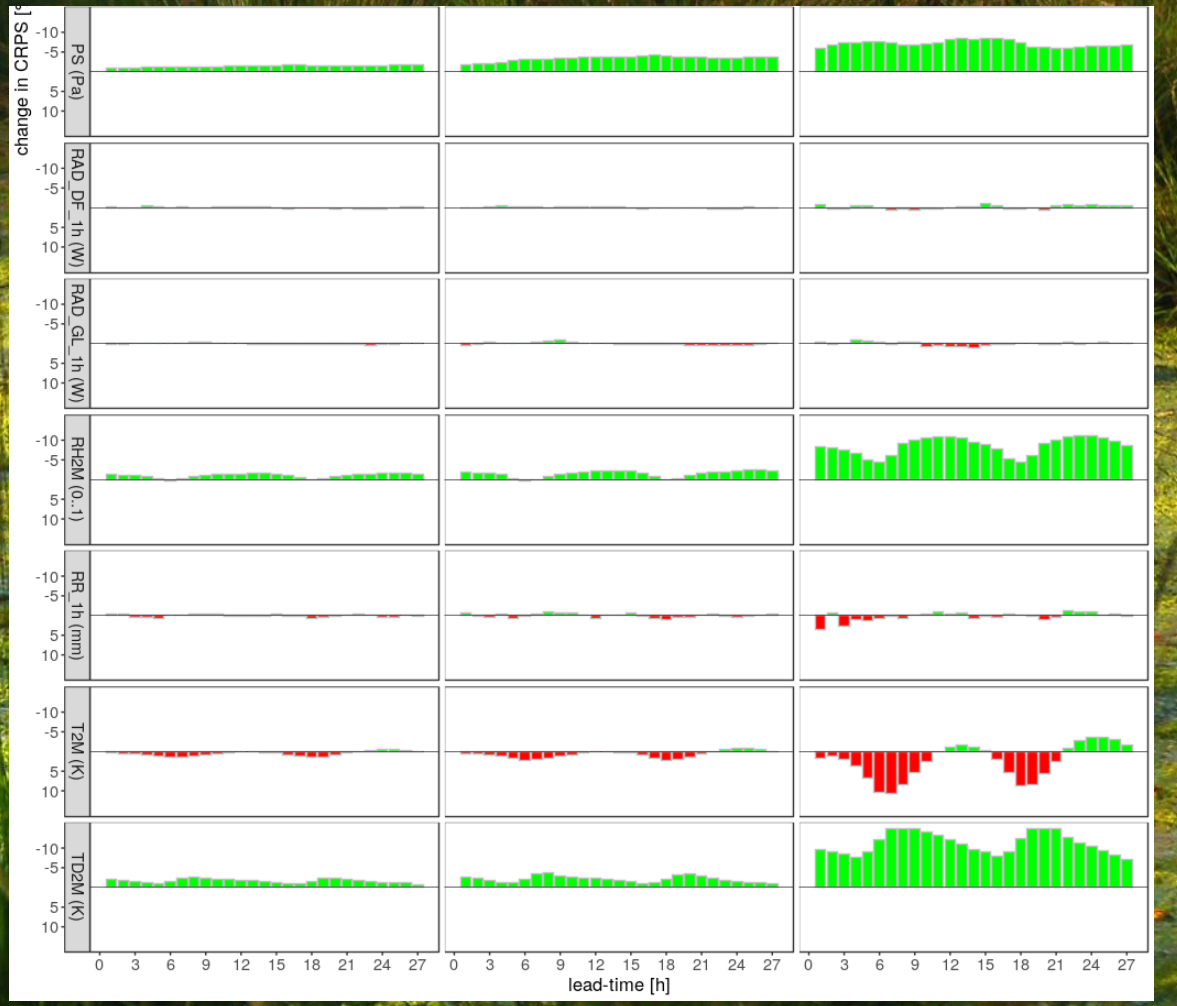

**Impact of the mire scheme in winter rather small**

J. Helmert et al., EGU2020

# Verification – COSMO-D2 Summer

Deutscher Wetterdienst
Wetter und Klima aus einer Hand




ENS 10747=EXP, 10748=CTRL CRPS SOMMER

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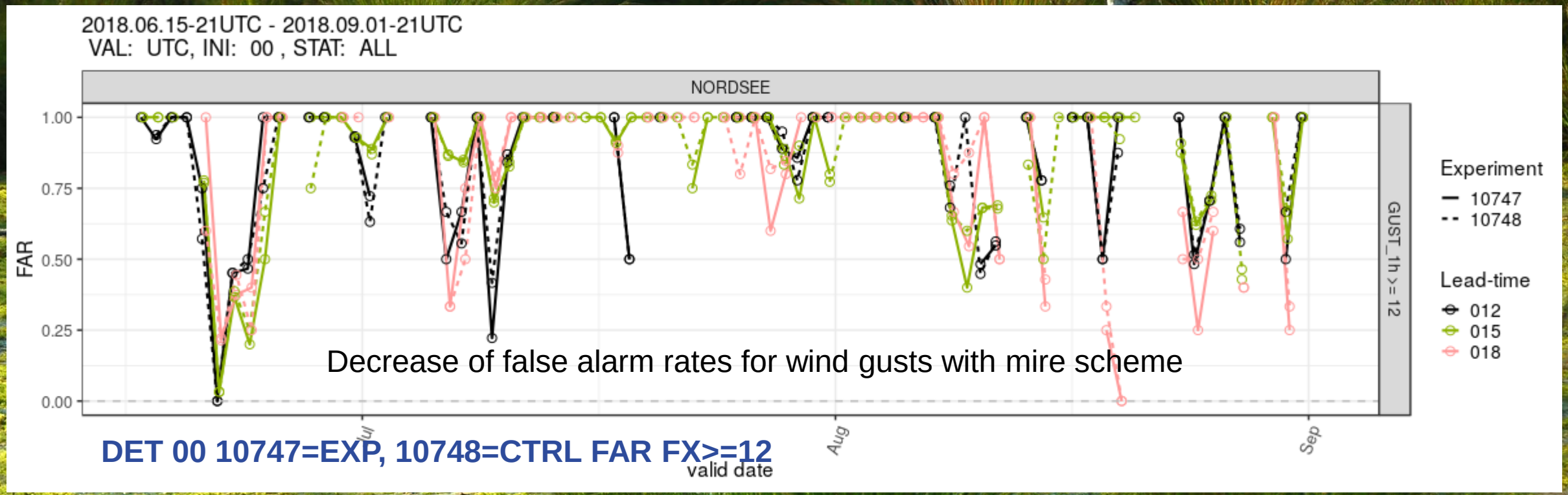
# Verification – COSMO-D2

Deutscher Wetterdienst
Wetter und Klima aus einer Hand




Lütt-Witt Moor, Henstedt-Ulzburg, Germany - Wikipedia

J. Helmert et al., EGU2020

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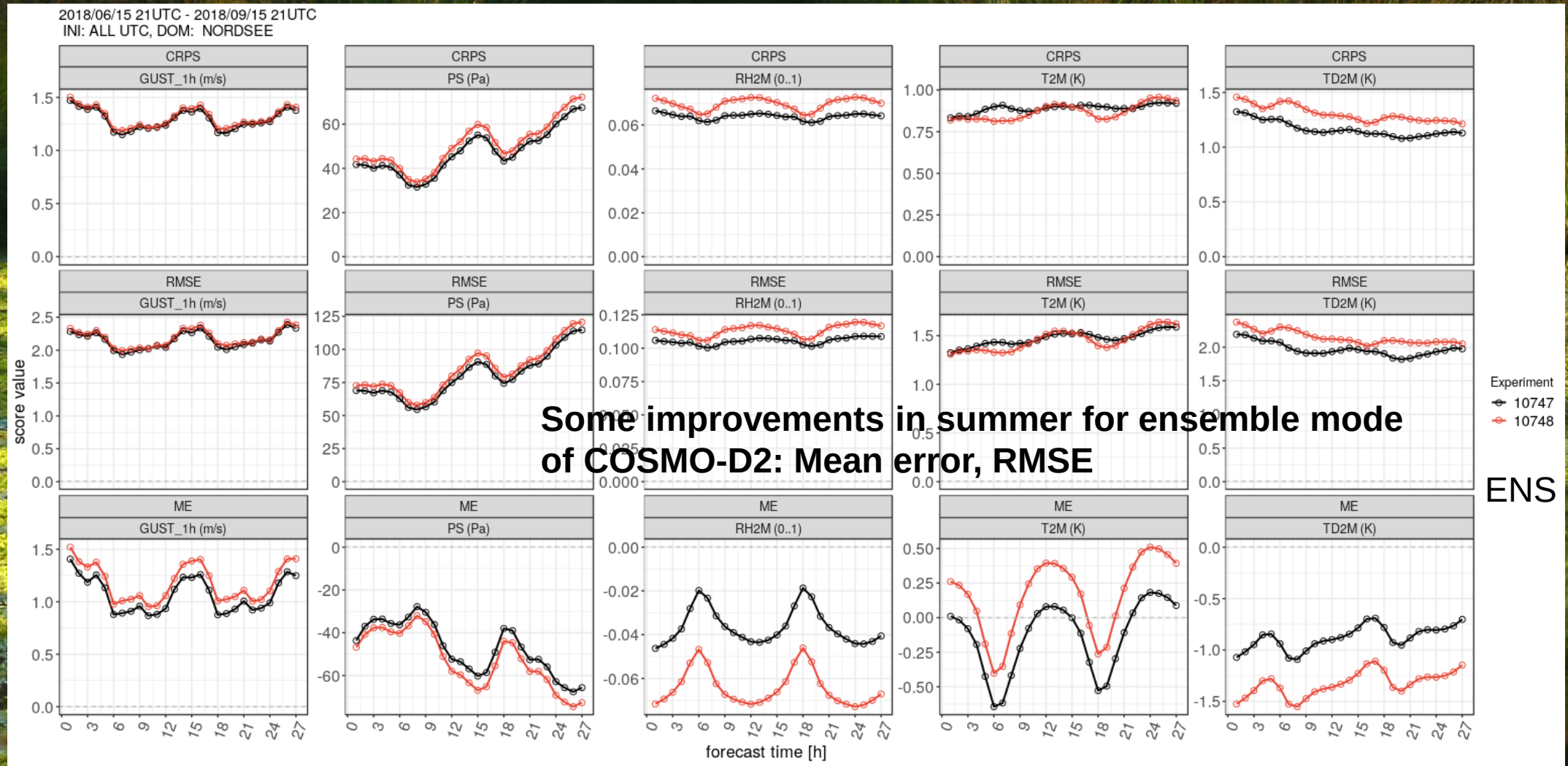



**Some improvements in summer for ensemble mode of COSMO-D2: Mean error, RMSE**

ENS

J. Helmert et al., EGU2020

# Summary



- Mire parameterization developed in COSMO framework
- Contribution by Hydrometeorological Centre of Russia
- With version 5.06 COSMO now first op. NWP system considering peatlands in a special scheme
- Current limitations: fast but simple scheme: evapotranspiration, fixed water table, dry bogs not captured
- However, experiment verification showed some positive impact from Mire parameterization in COSMO-D2
- Further tests in COSMO partner domains are ongoing (RHM)
- Will be further tested in ICON-(LAM)

# Outlook

Formerly peat bog,recultivated as a wetland near Sitniki, Russia - Wikipedia

# Peatlands - Map



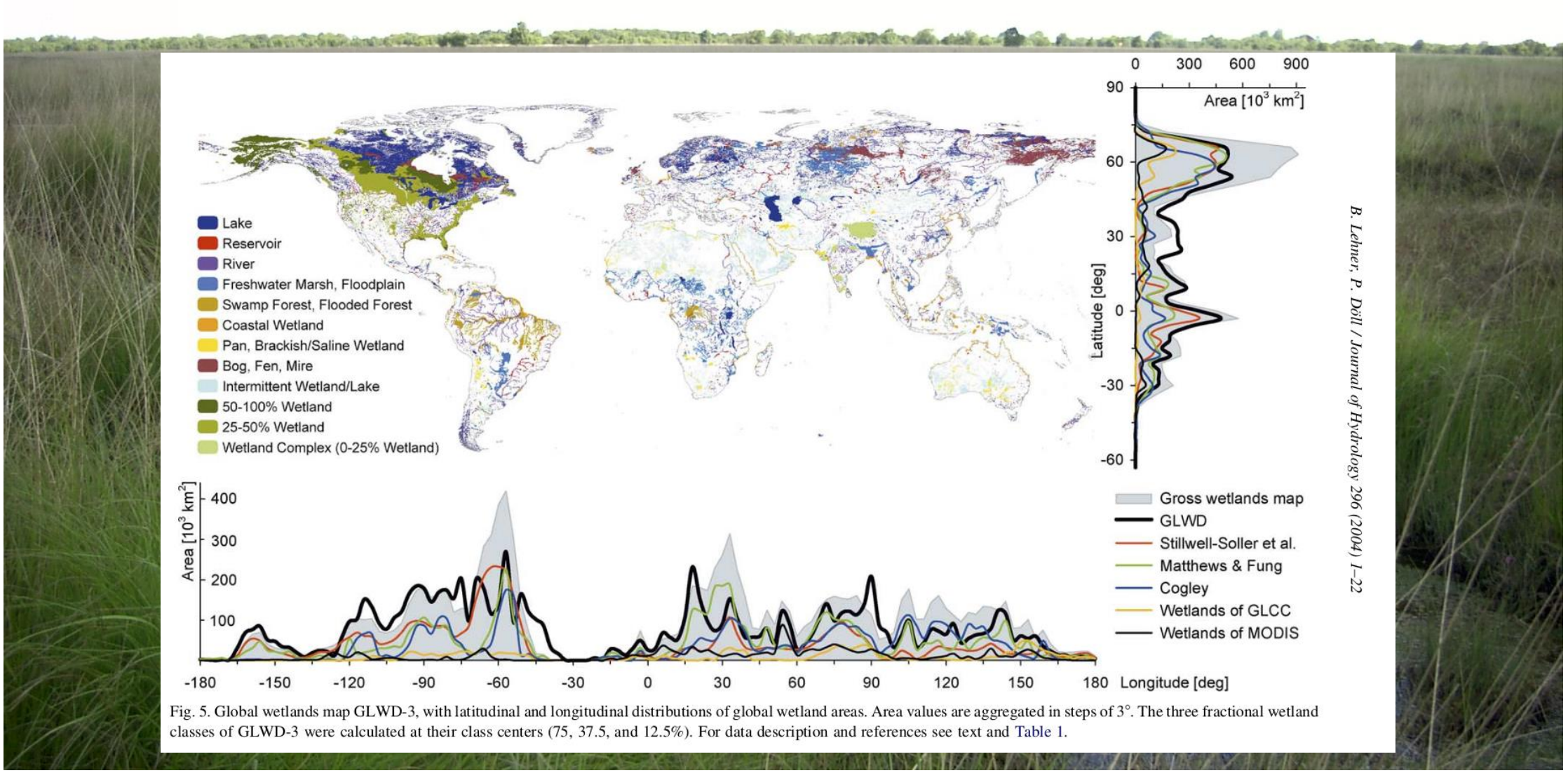
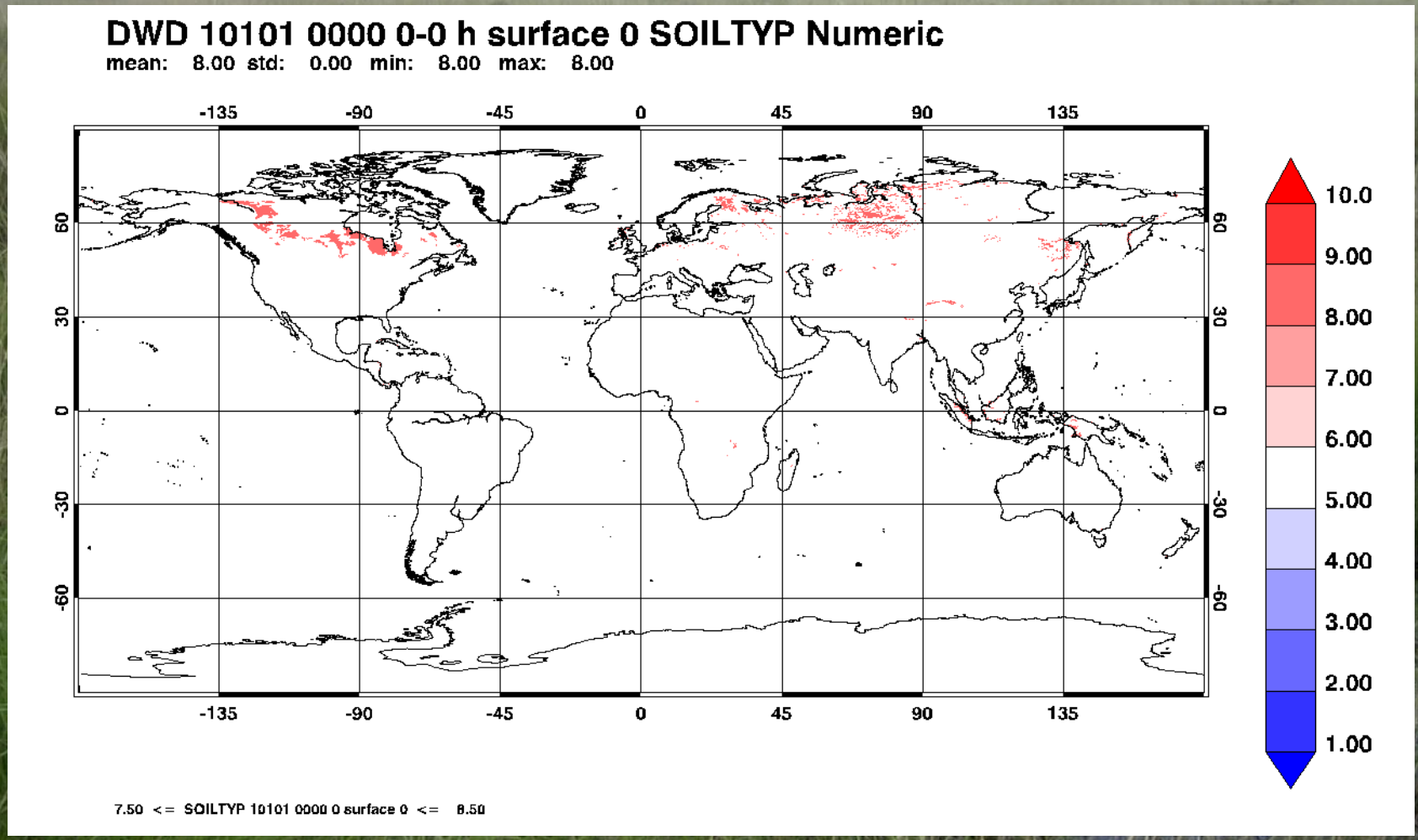



Fig. 5. Global wetlands map GLWD-3, with latitudinal and longitudinal distributions of global wetland areas. Area values are aggregated in steps of 3°. The three fractional wetland classes of GLWD-3 were calculated at their class centers (75, 37.5, and 12.5%). For data description and references see text and Table 1.

# Peatlands – ICON R03B07 old FAO data

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

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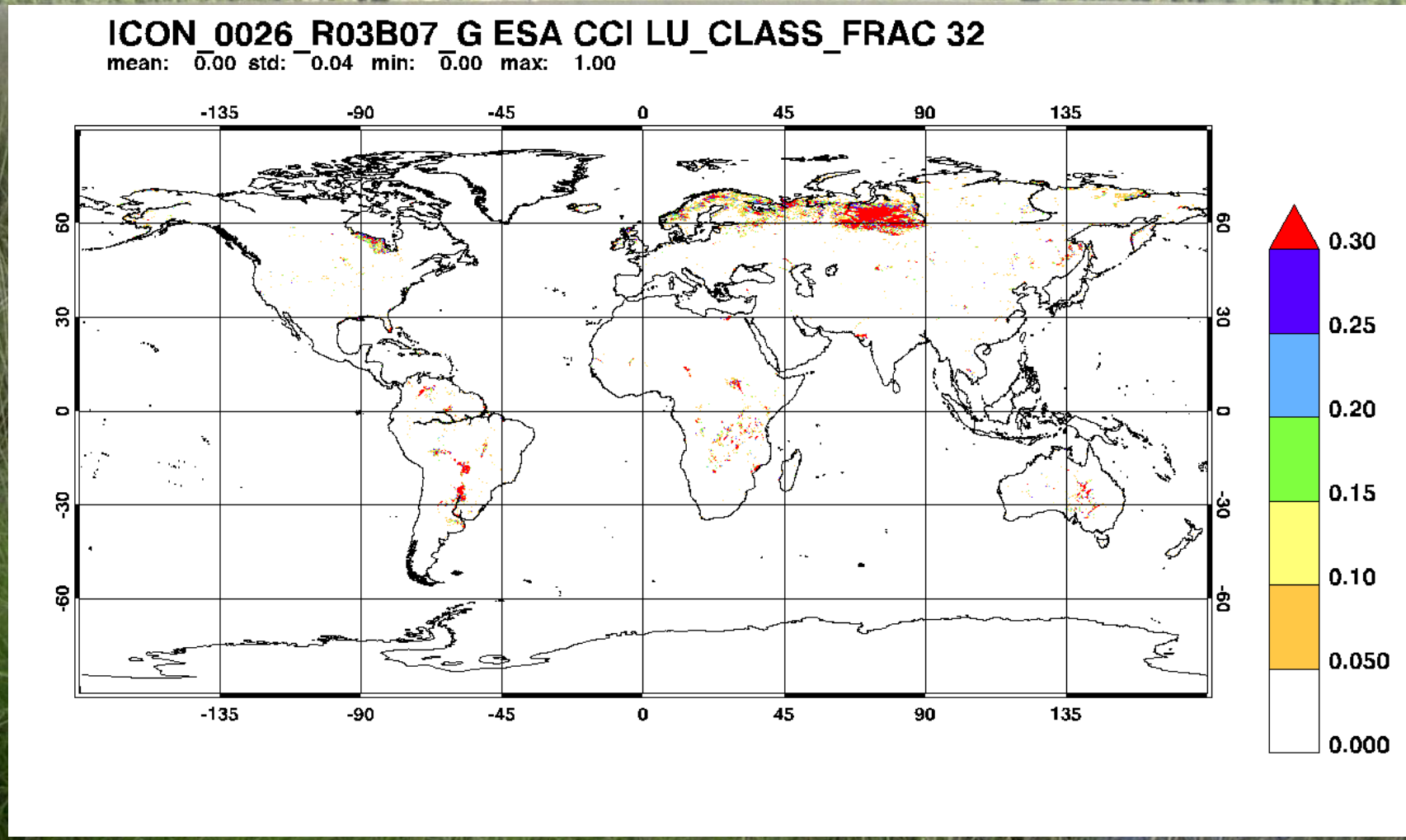
# Peatlands – ICON R03B07 (ESA CCI)

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

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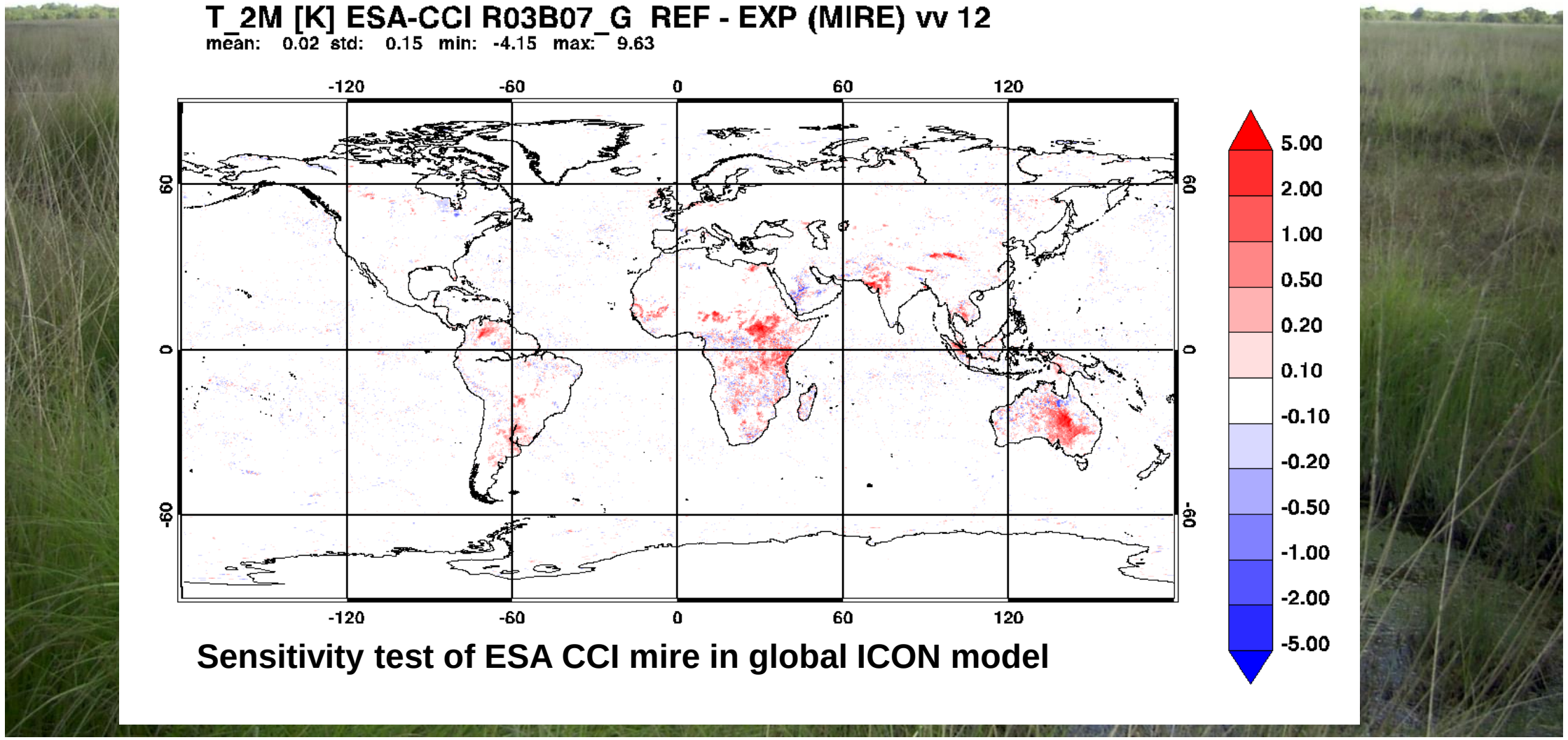
# Peatlands – ICON R03B07

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

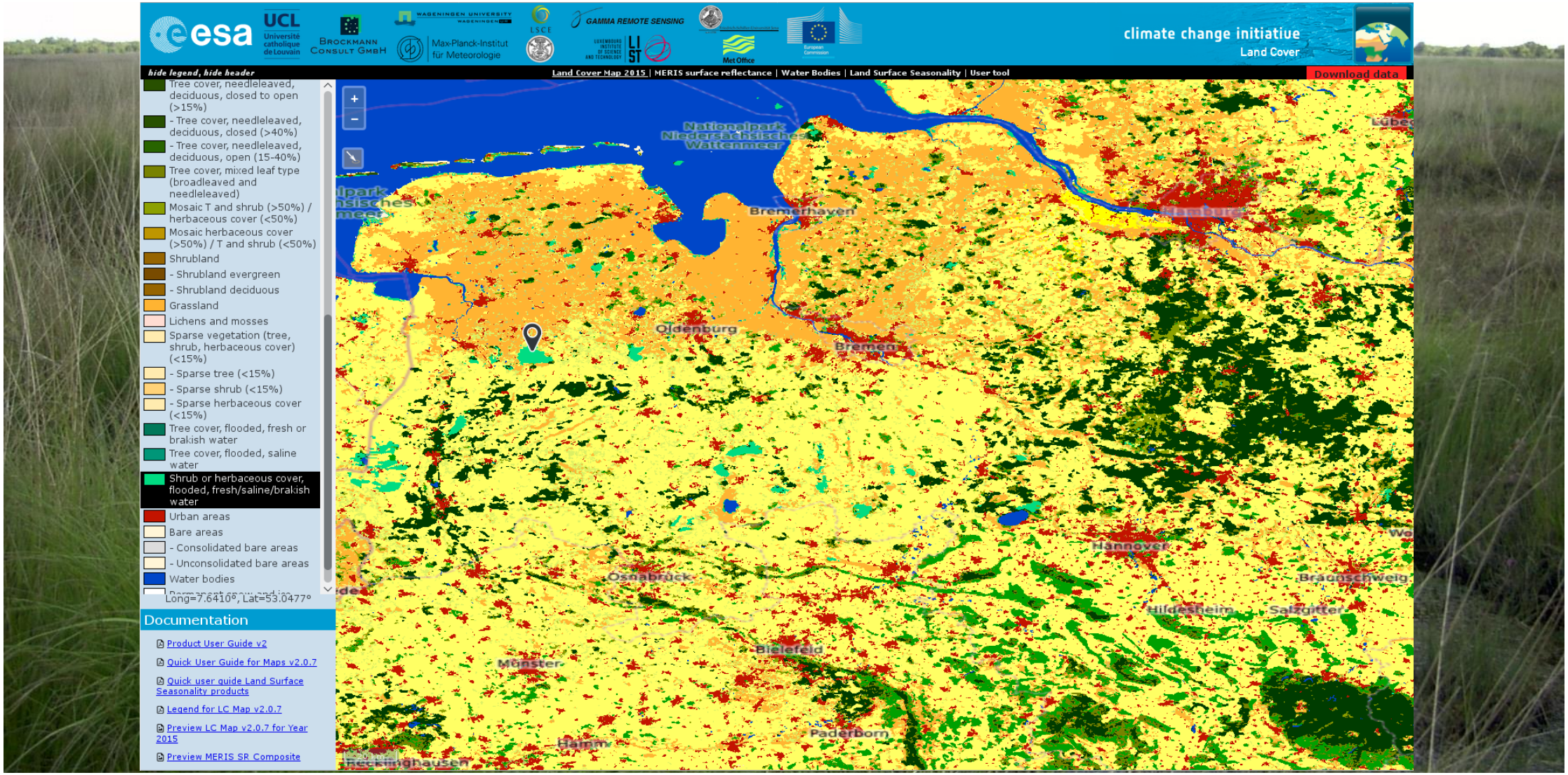



**Sensitivity test of ESA CCI mire in global ICON model**

J. Helmert et al., EGU2020

# External parameter for peatlands



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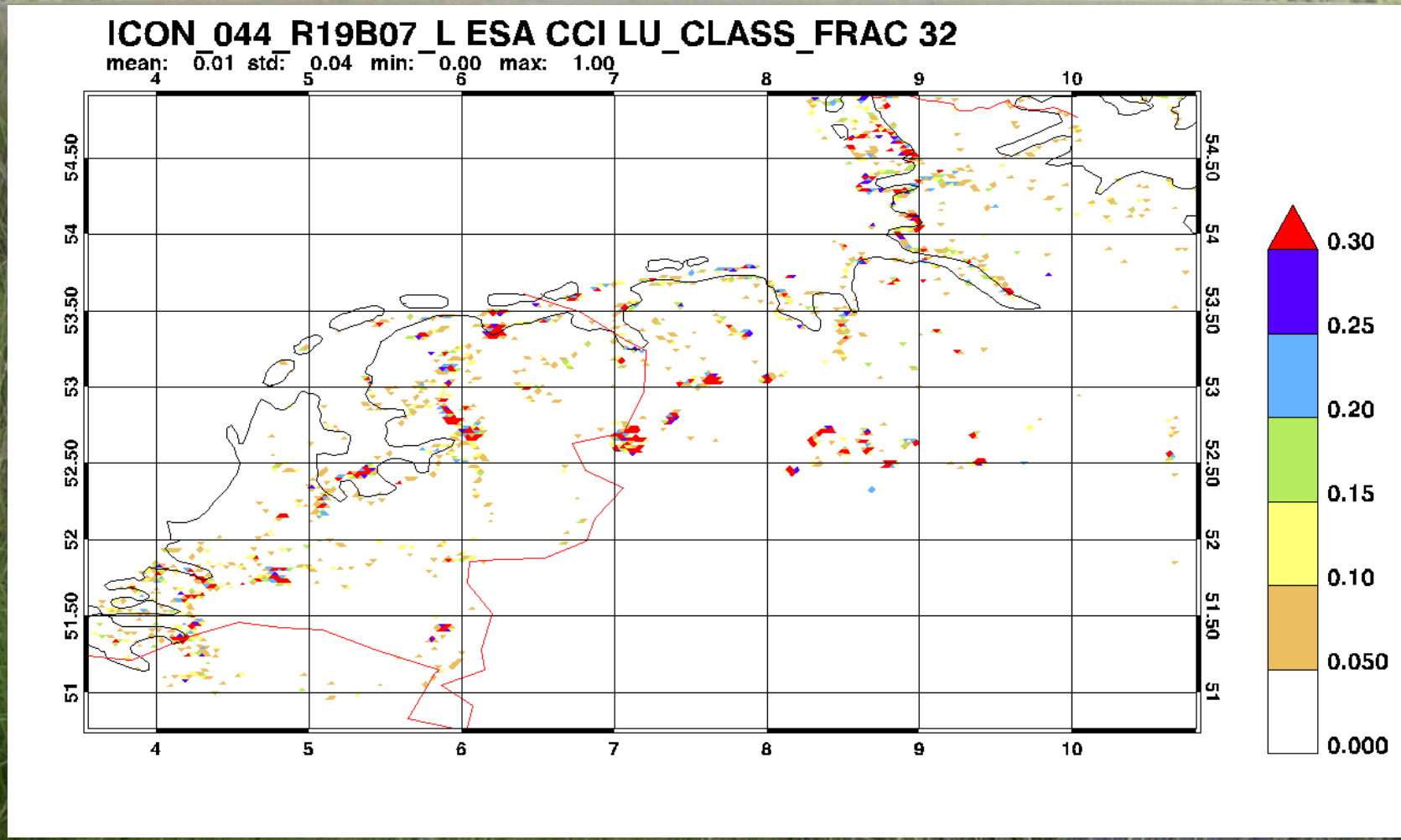
# Peatlands – ICON R19B07 ESA CCI

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

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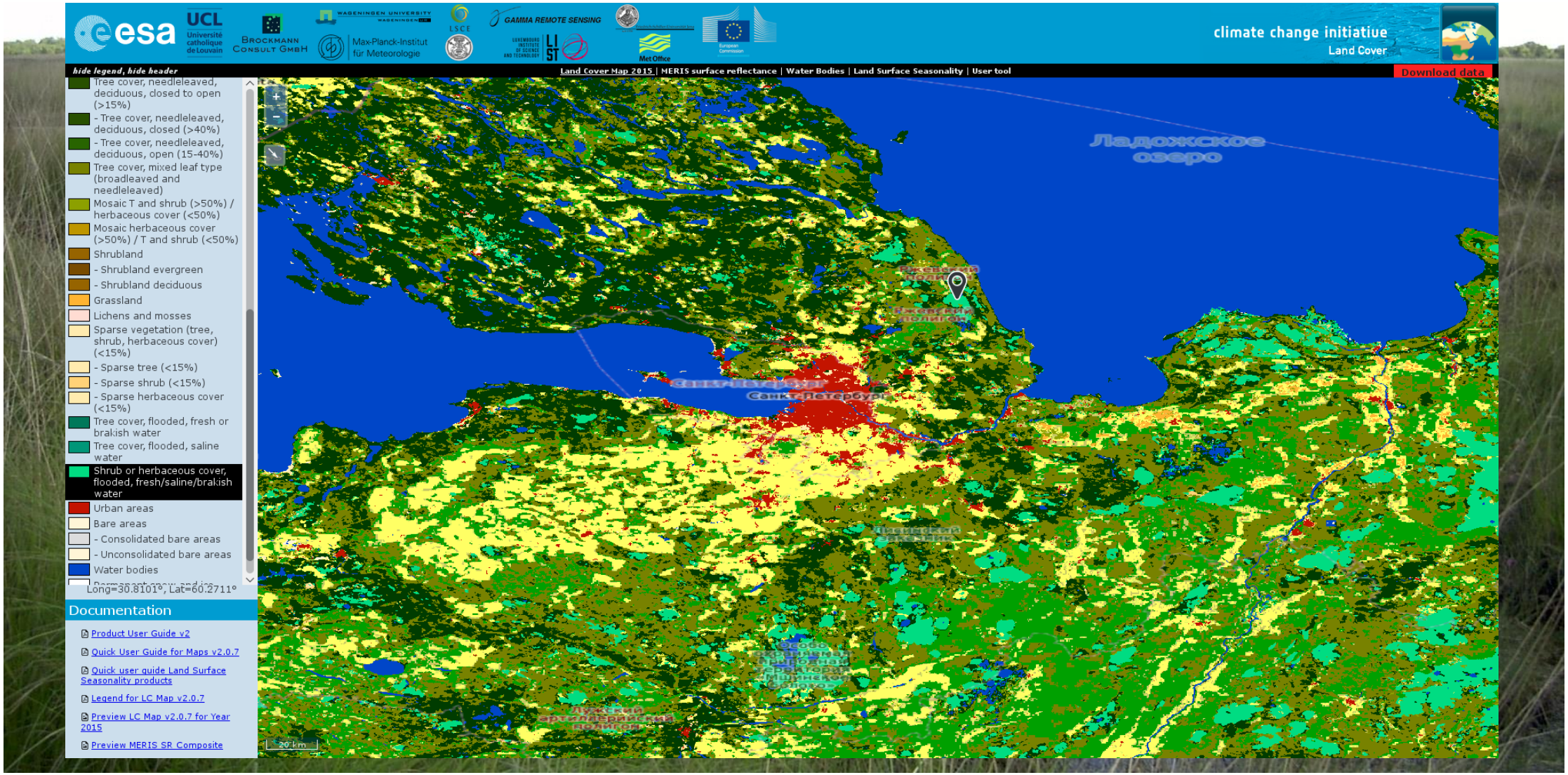
# External parameter for peatlands



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# Peatlands – ICON R03B07

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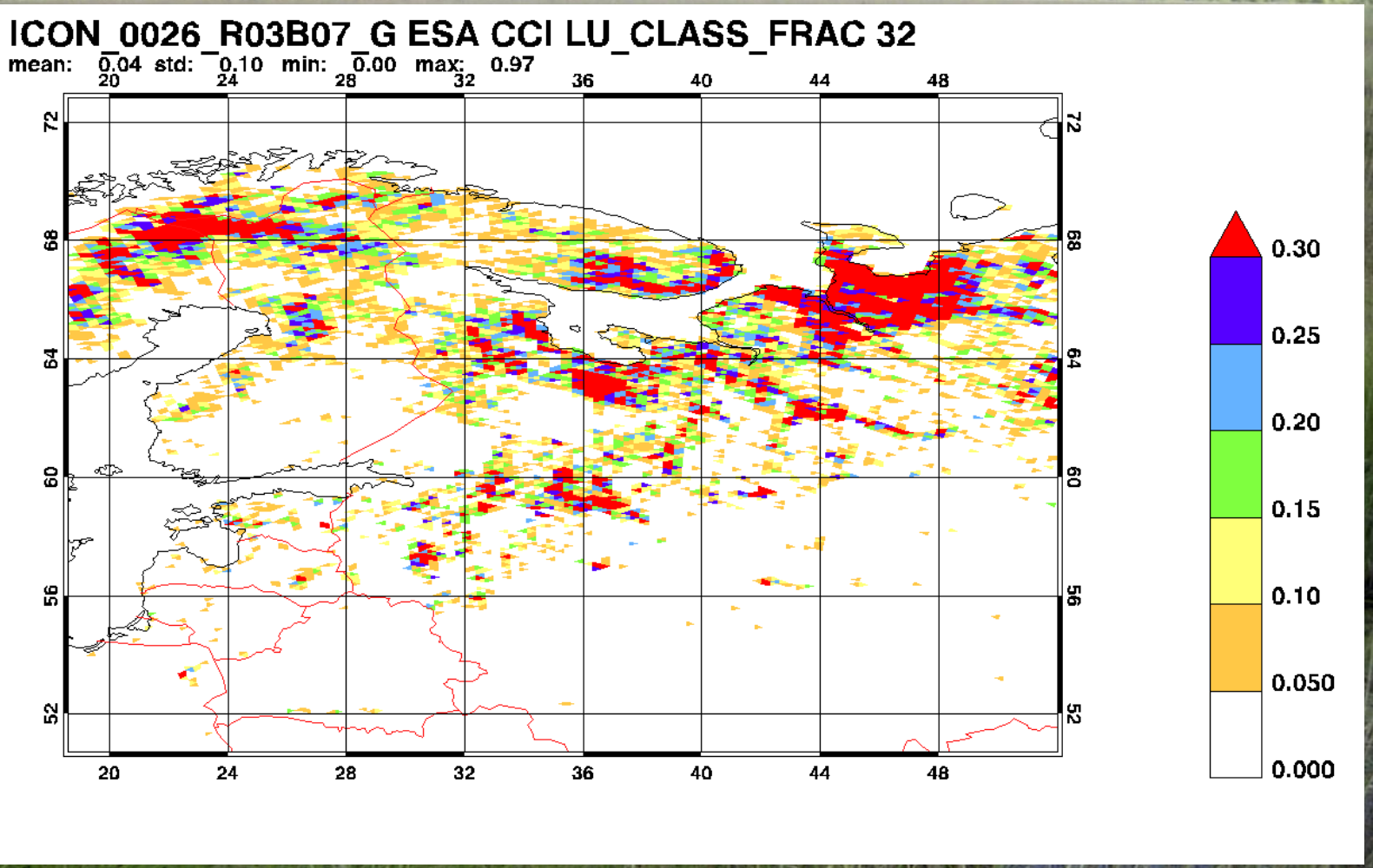


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