

Implementation of a Mire parameterization in TERRA

-

Experiments with COSMO-D2

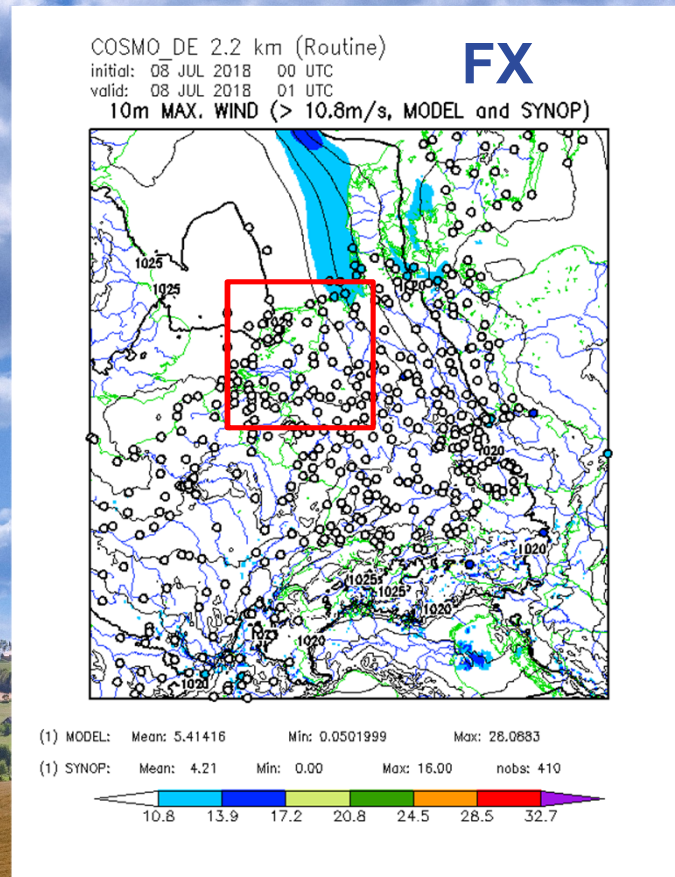
Jürgen Helmert, A. Yurova, I. Rozinkina, J.M. Bettems, M. Baldauf, K. Stephan,
U. Schättler, D. Mironov, G. Zängl



Summer 2018

- 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



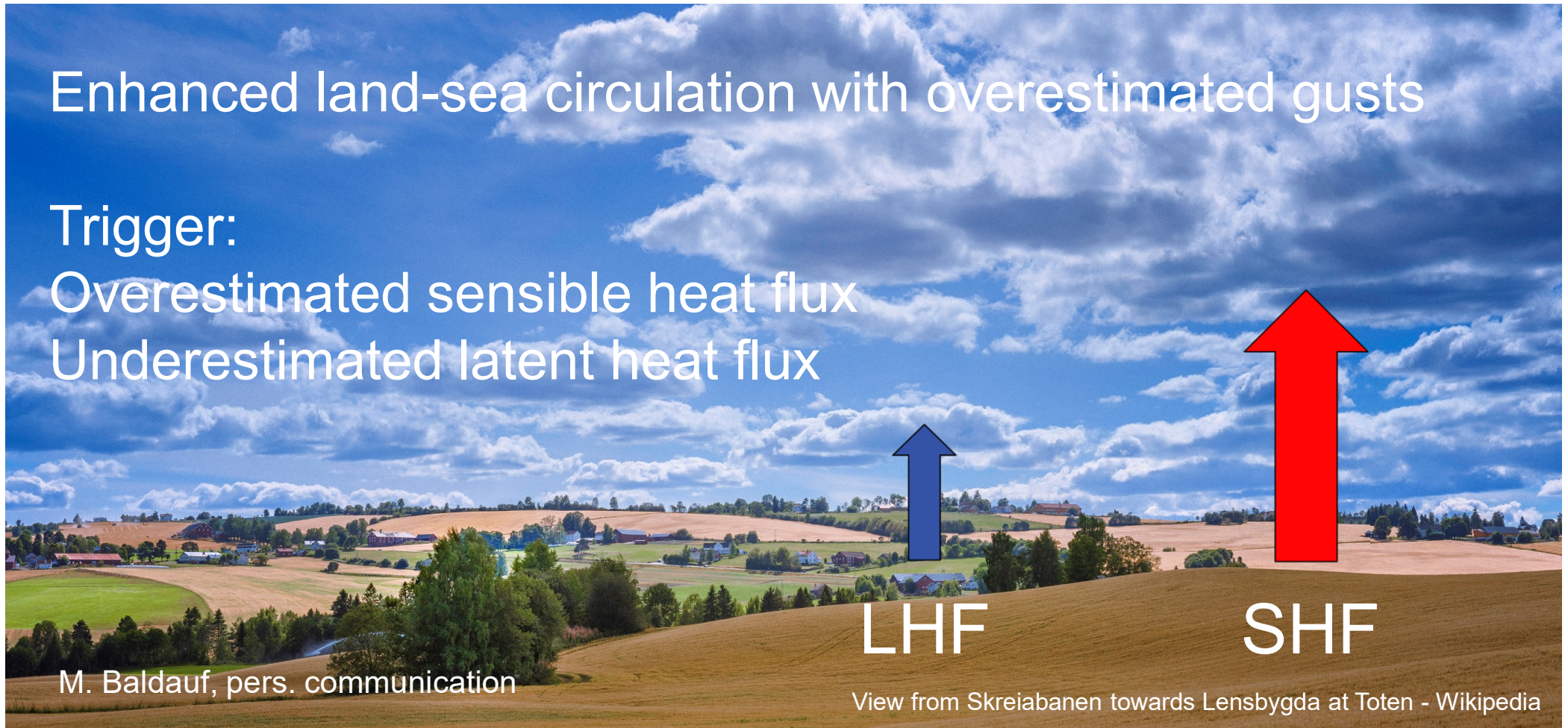
COSMO-D2 physical processes

Enhanced land-sea circulation with overestimated gusts

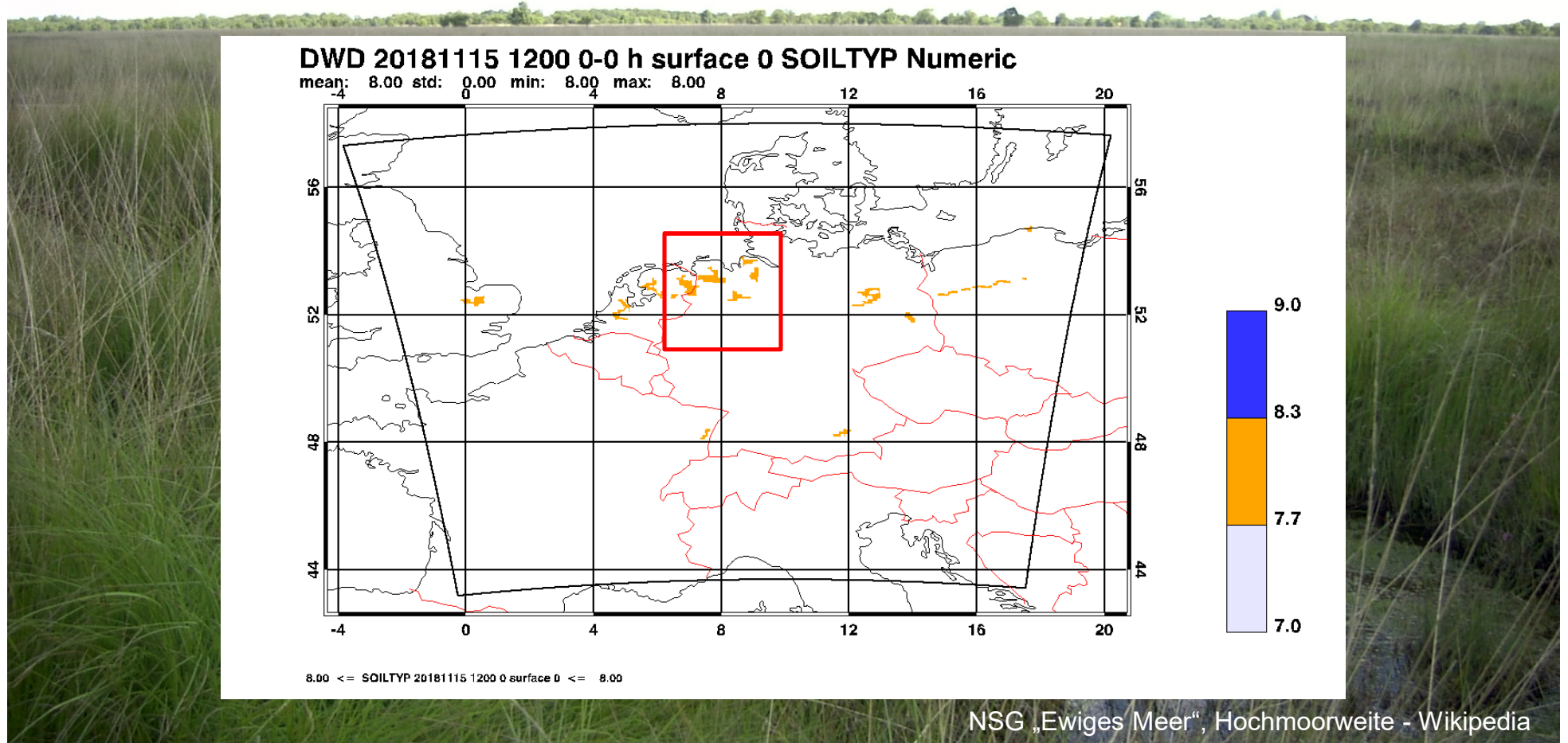
Trigger:

Overestimated sensible heat flux

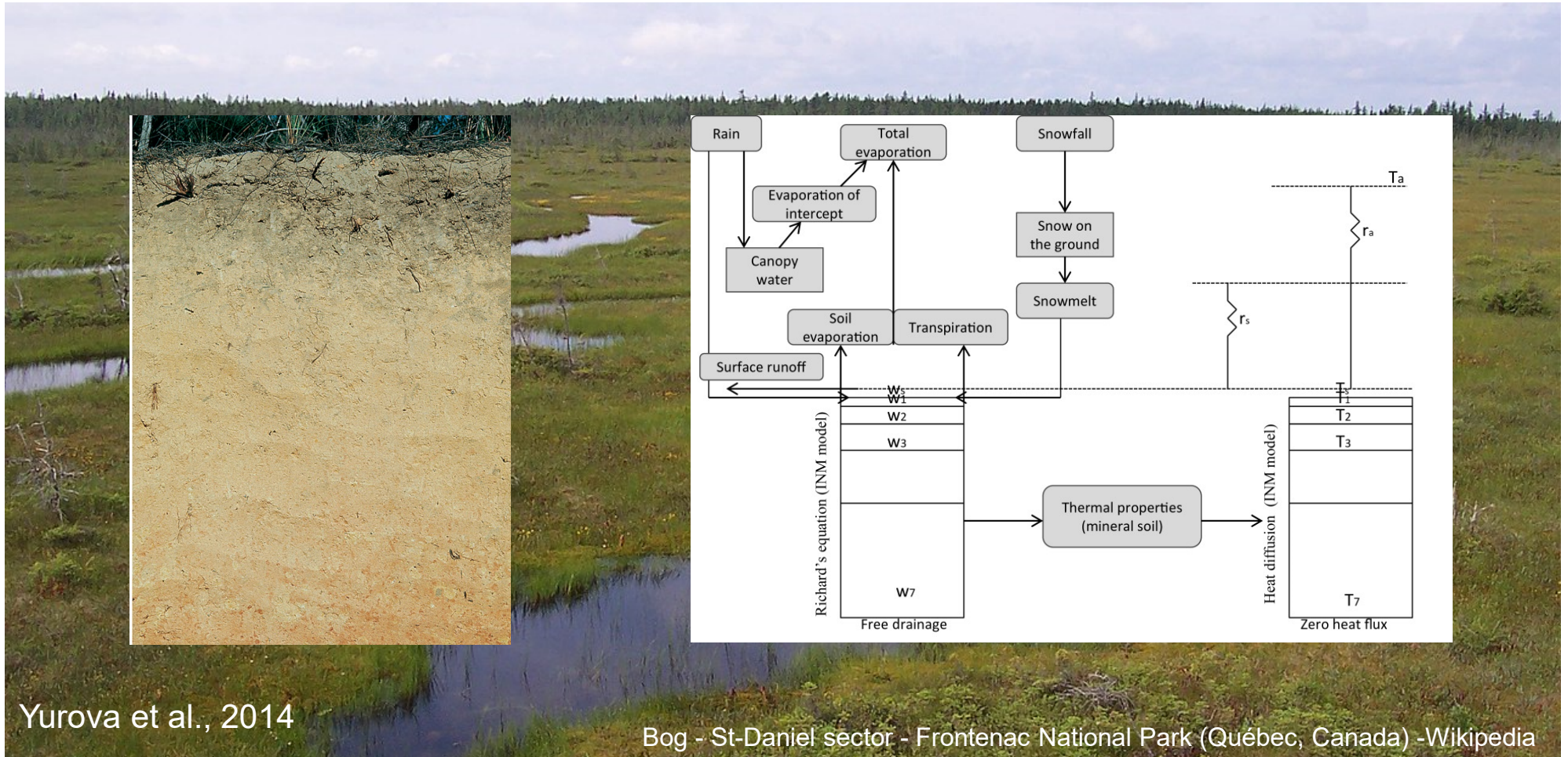
Underestimated latent heat flux



Peatlands in COSMO-D2

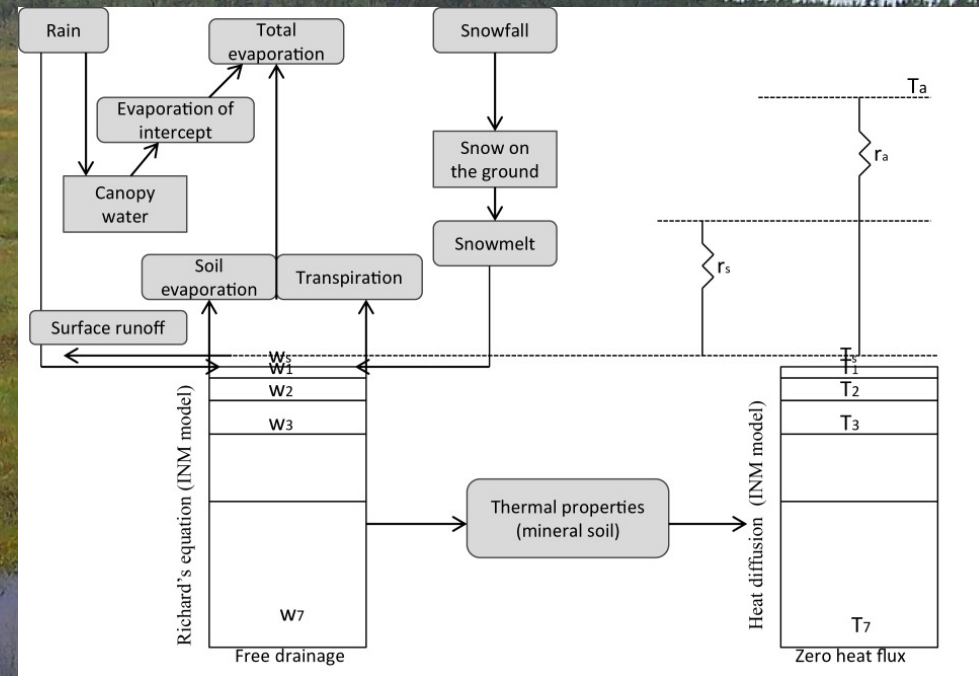


Peatlands in TERRA

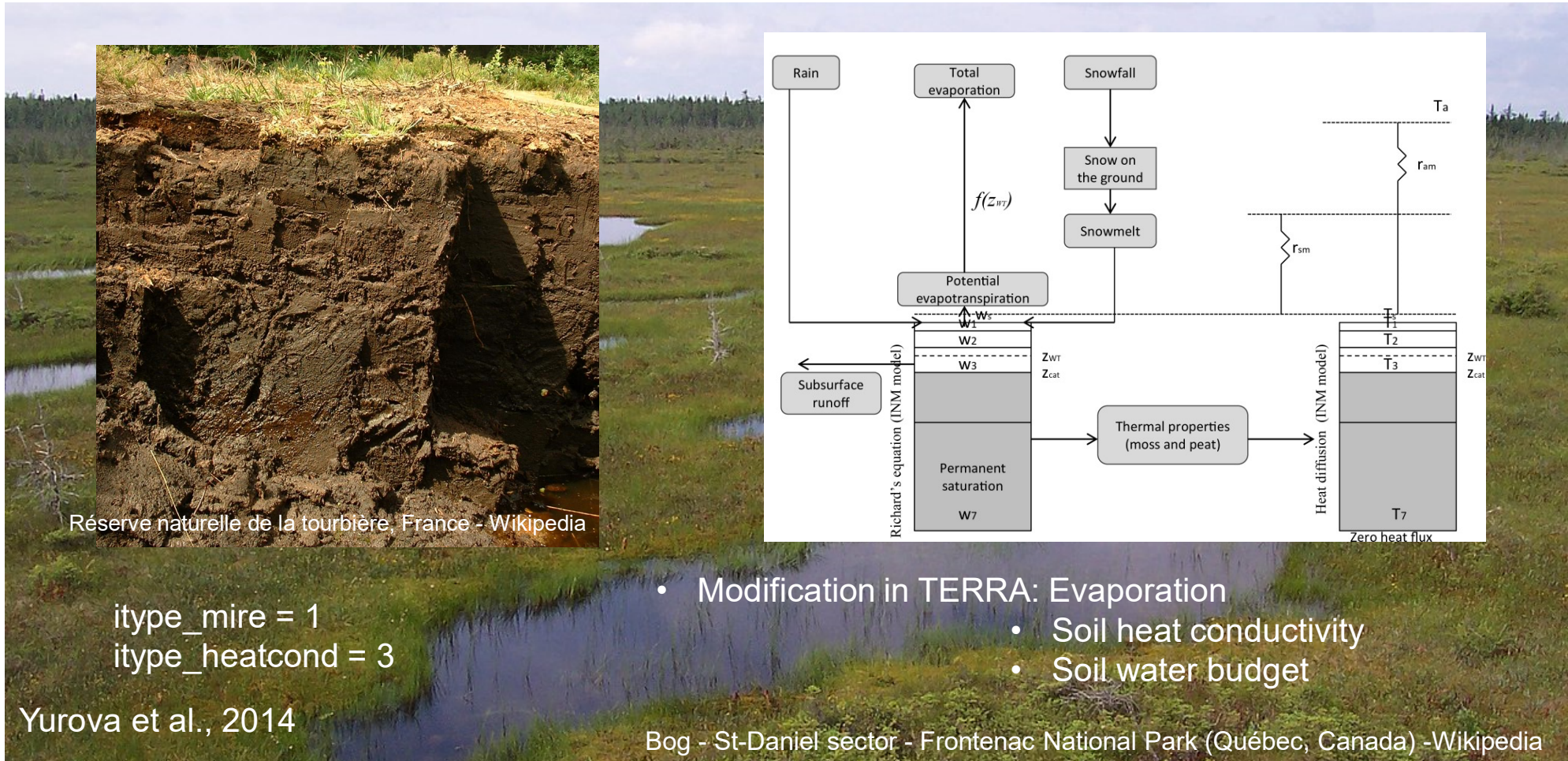


Yurova et al., 2014

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



Peatlands in TERRA



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 DA
Comparison with reference experiment

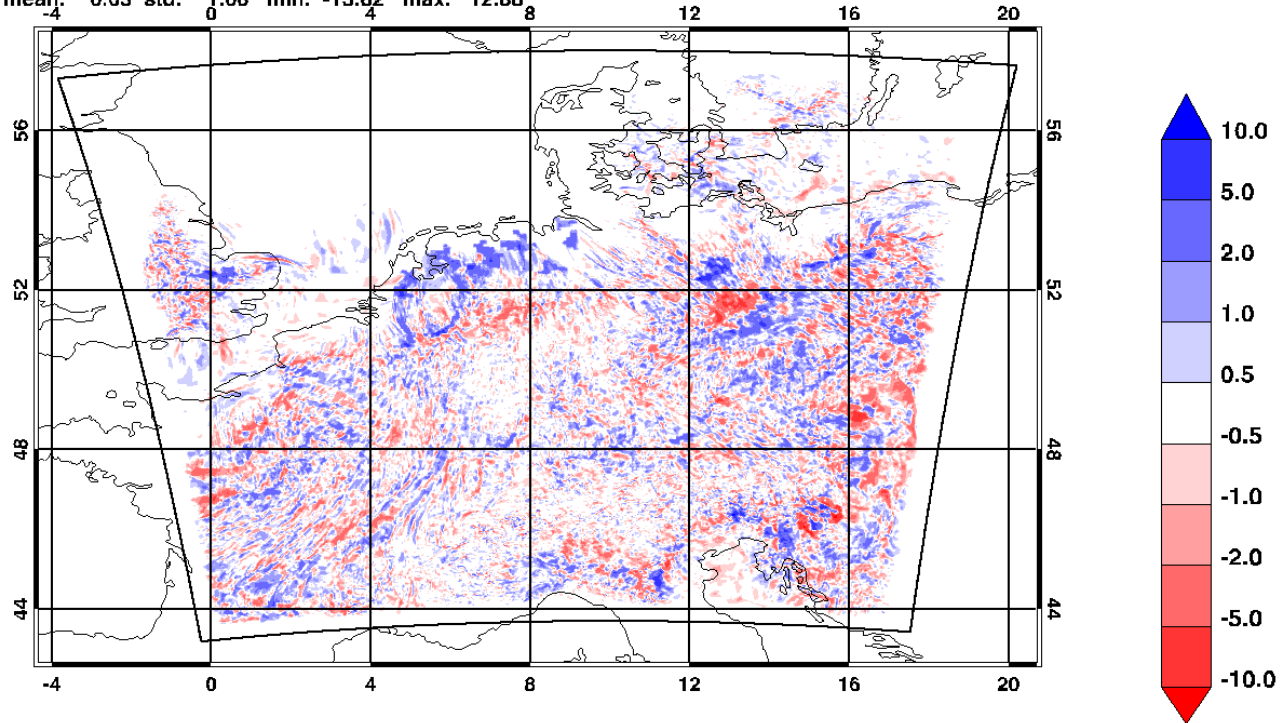
Bog pool in Koitjärve bog, Estonia - Wikipedia



10 m gusts REF-EXP

VMAX_10M [m s⁻¹] 2018070816 REF_748 - EXP_747

mean: 0.03 std: 1.06 min: -13.62 max: 12.88



with Mire
scheme

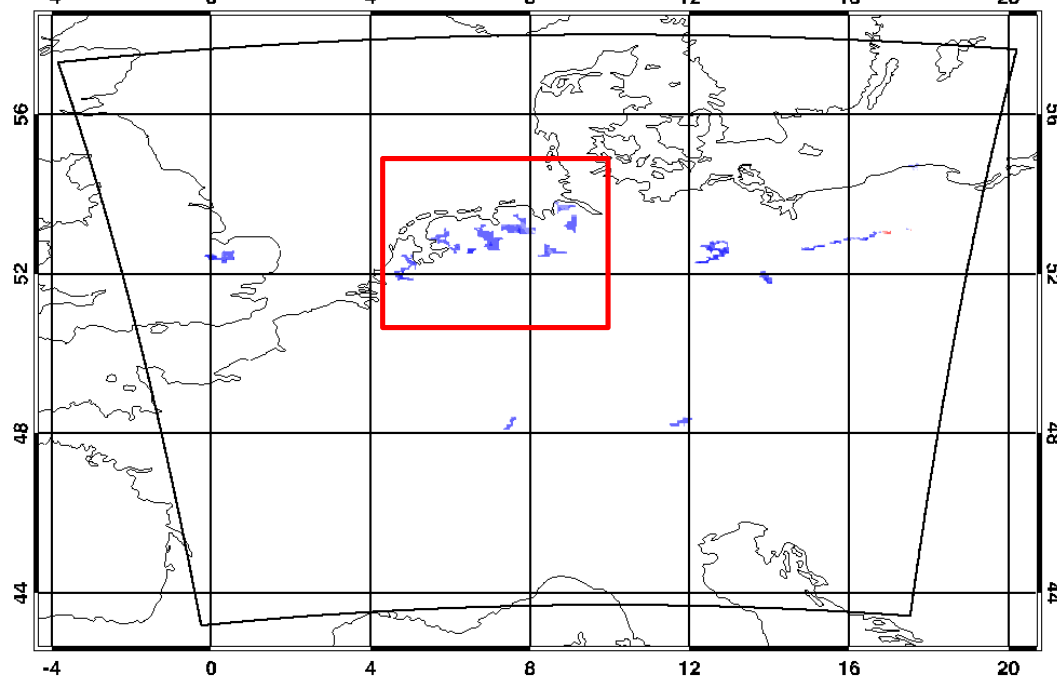
Bog pool in Koitjärve bog, Estonia - Wikipedia



10 m gusts REF-EXP

VMAX_10M [m s-1] 201807081600 REF_748 - EXP_747 SOILTYPE_PEAT

mean: 3.72 std: 1.77 min: -4.15 max: 11.24



7.50 <= SOILTYP 20180708 0000 0 surface 0 <= 8.50



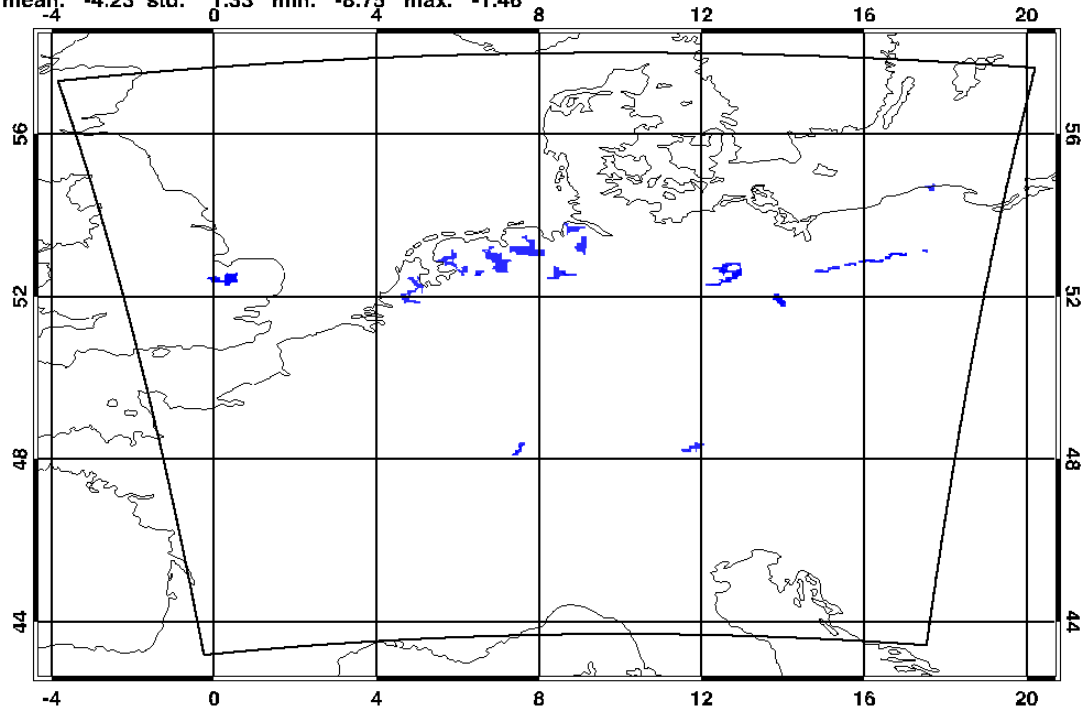
Bog pool in Koitjärve bog, Estonia - Wikipedia



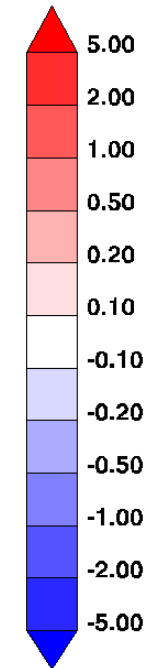
Surface moisture REF-EXP

{ QV_S [kg/kg] 201807081600 REF_748 - EXP_747 SOILTYPE_PEAT } * 1000.00

mean: -4.23 std: 1.33 min: -8.75 max: -1.46



7.50 <= SOILTYP 20180708 0000 0 surface 0 <= 8.50



with Mire
scheme

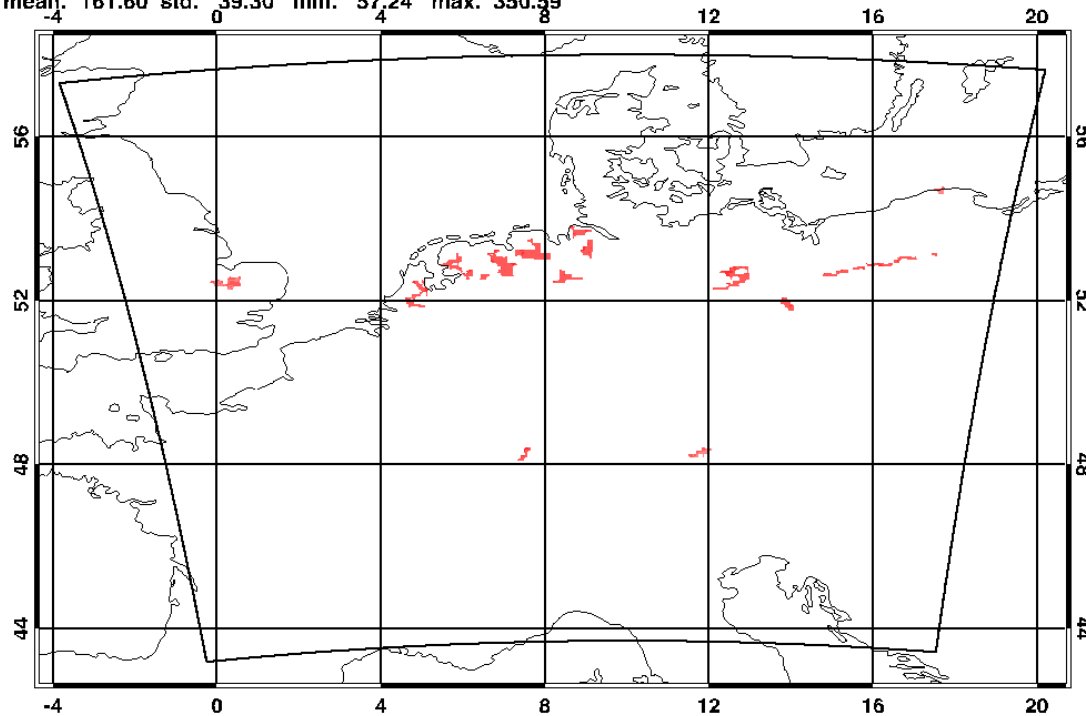
Bog pool in Koltjärve bog, Estonia - Wikipedia



Averaged latent heat flux REF-EXP

ALHFL_S [W m⁻²] 201807081600 REF_748 - EXP_747 SOILTYPE_PEAT

mean: 161.60 std: 39.30 min: 57.24 max: 350.59



7.50 <= SOILTYP 20180708 0000 0 surface 0 <= 8.50



with Mire
scheme

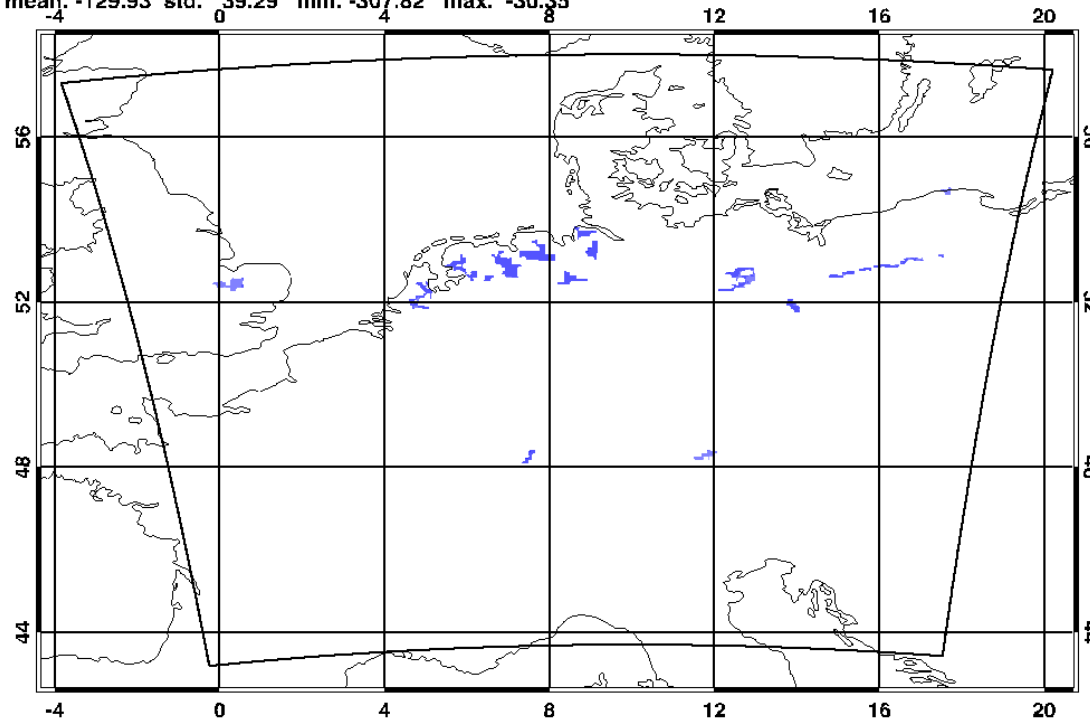
Bog pool in Koitjärve bog, Estonia - Wikipedia



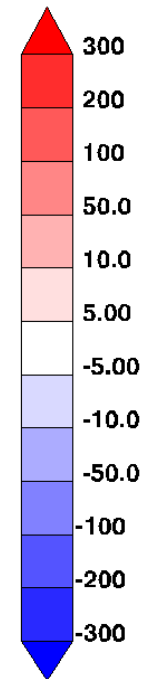
Averaged sensible heat flux REF-EXP

ASHFL_S [W m⁻²] 201807081600 REF_748 - EXP_747 SOILTYPE_PEAT

mean: -129.93 std: 39.29 min: -307.82 max: -30.35



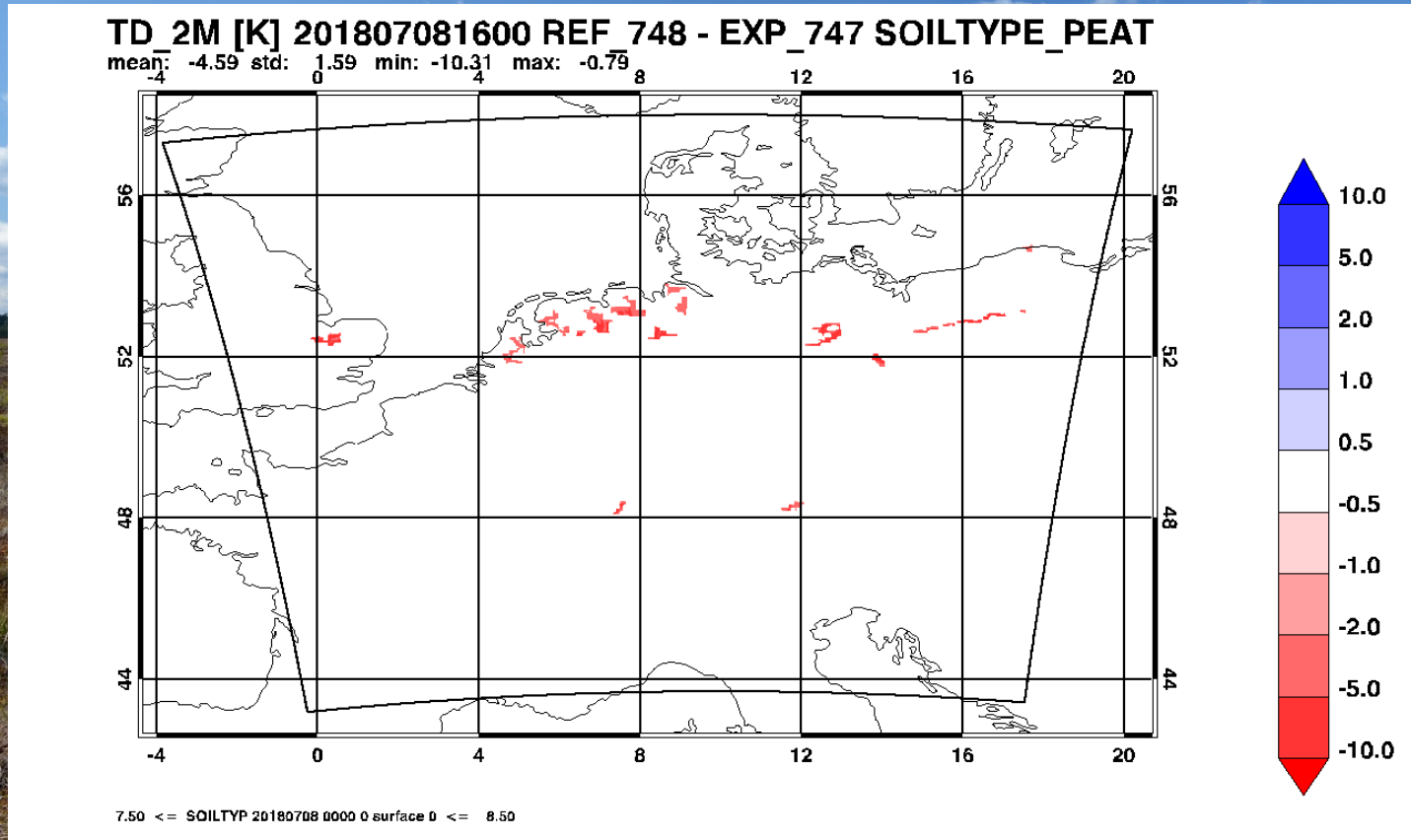
7.50 <= SOILTYP 20180708 0000 0 surface 0 <= 8.50



Bog pool in Koitjärve bog, Estonia - Wikipedia



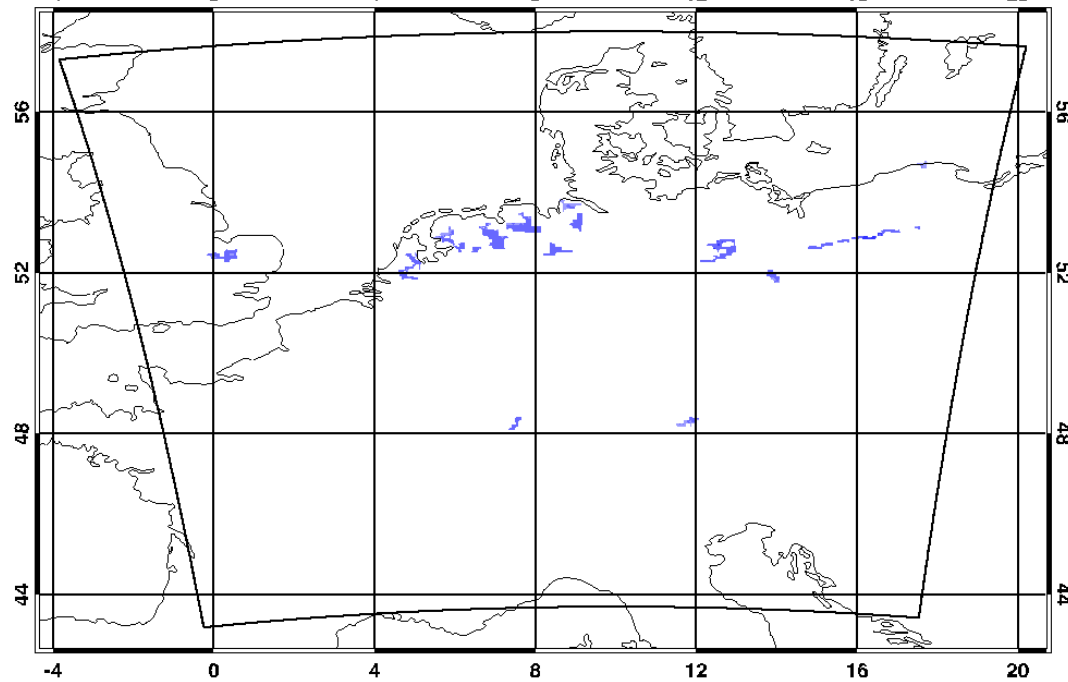
2m dew point temperature REF-EXP



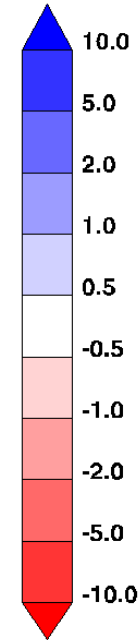
2m temperature REF-EXP

T_2M [K] 201807081600 REF_748 - EXP_747 SOILTYPE_PEAT

mean: 2.87 std: 0.90 min: 0.78 max: 6.41



7.50 <= SOILTYP 20180708 0000 0 surface 0 <= 8.50



with Mire
scheme

Bog pool in Koitjärve bog, Estonia - Wikipedia



Verification – COSMO-D2

| SURFACE VERIFICATION | | | | |
|----------------------|-------------|---------------------------------|-----------------------------|-------------------------|
| DETERMINISTIC | CONTINUOUS | lead-time | time-series | station |
| | CATEGORICAL | lead-time | time-series | station |
| EPS | ENS & PROB | lead-time (old) | | |

| UPPER AIR VERIFICATION | | | | |
|------------------------|------------|---------------------------|-----------------------------|-------------------------|
| DETERMINISTIC | CONTINUOUS | lead-time | time-series | station |
| EPS | ENSEMBLE | lead-time | time-series | station |

| ROUTINE VERIFICATION | | | |
|----------------------|-------|-----------------------------|--------------------------|
| ICON P1 | SYNOP | categorical | |
| | | hit rates | |
| | | continuous | |
| ICON PA | SYNOP | categorical | |
| | | hit rates | |
| | | continuous | |
| ICON-EPS P1 | SYNOP | ensemble | |
| | TEMP | ensemble | |
| ICON vs IFS | SYNOP | categorical | |
| | | hit rates | |
| | | continuous | |
| ICON-EPS vs IFS-EPS | SYNOP | ensemble | |
| | | TEMP | ensemble |
| | | categorical | |

| MONTHLY SERIES | |
|----------------|--|
| WMO-CBS | Temp Synop Ana |
| WMO-EPS | Ana |
| WGNE | 24h precip |
| Spatial | 1h precip (user:ffundel) "new" |
| Score Card | Link "beta" |

| SPECIAL VERIFICATION | |
|-------------------------|----------------------|
| Catchments precip. | Link |
| Verification since 1968 | Link |

| UTILITIES | |
|---|--------------------------------|
| Fdbk File Table | Fdbk File Plot |
| Do-It-Yourself Verification | |
| Documentation Rfdbk | |
| Documentation FFV | |

| MONITORING | |
|--------------------------------------|--|
| Shiny-server | Feedback files PBS jobs VeriJobs |
| Wind profiler | |
| AIREP | |
| Klimadaten (SASSCAL) | |

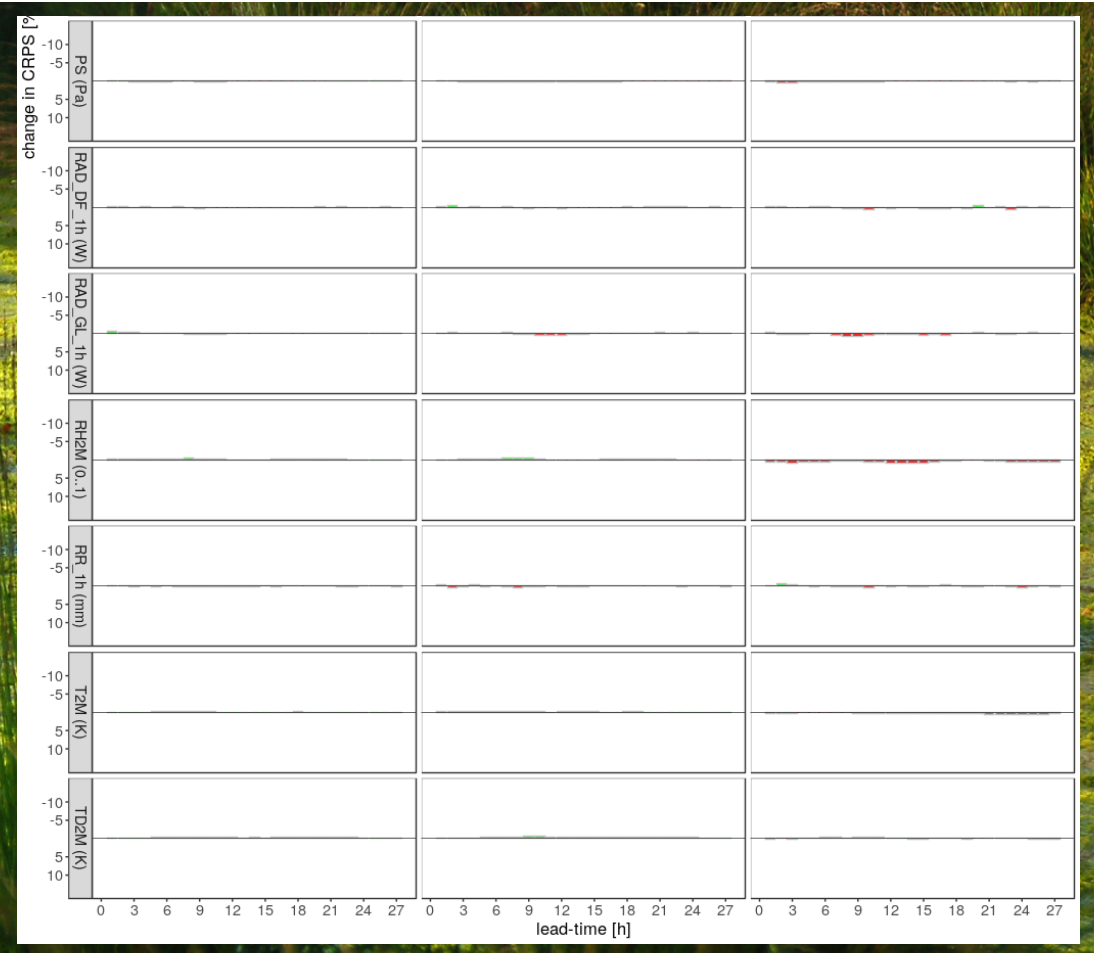
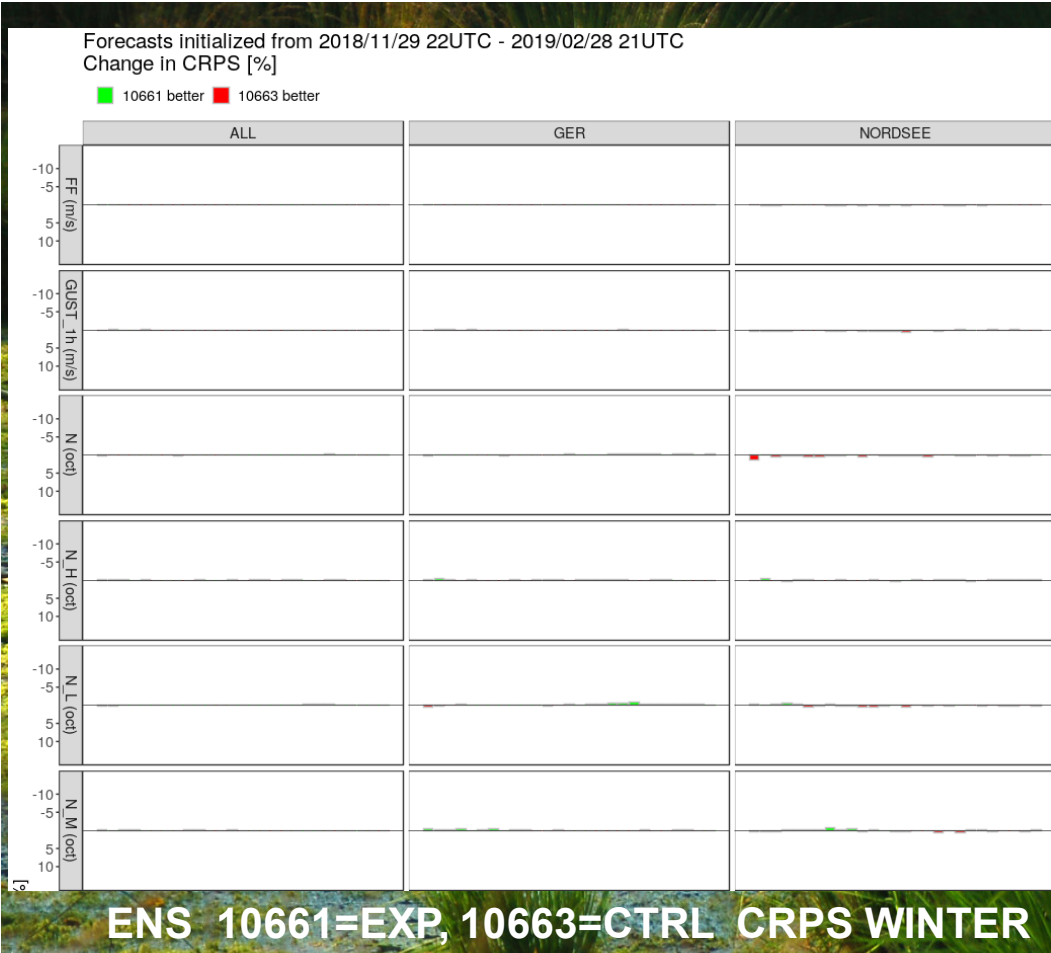
| GRIB VIEWER | |
|------------------------------|---------------------------------------|
| regular grid | icosahedral grid (3D) |

| Met.3D | |
|----------------------|--|
| test | |

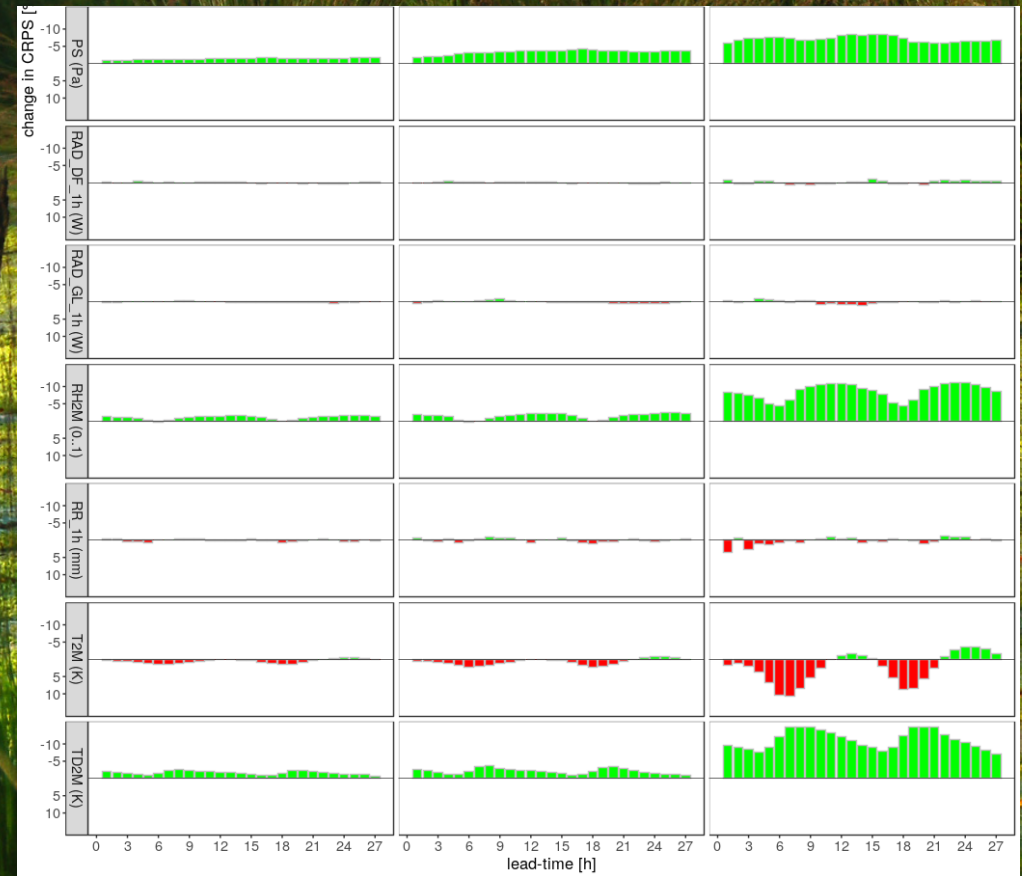
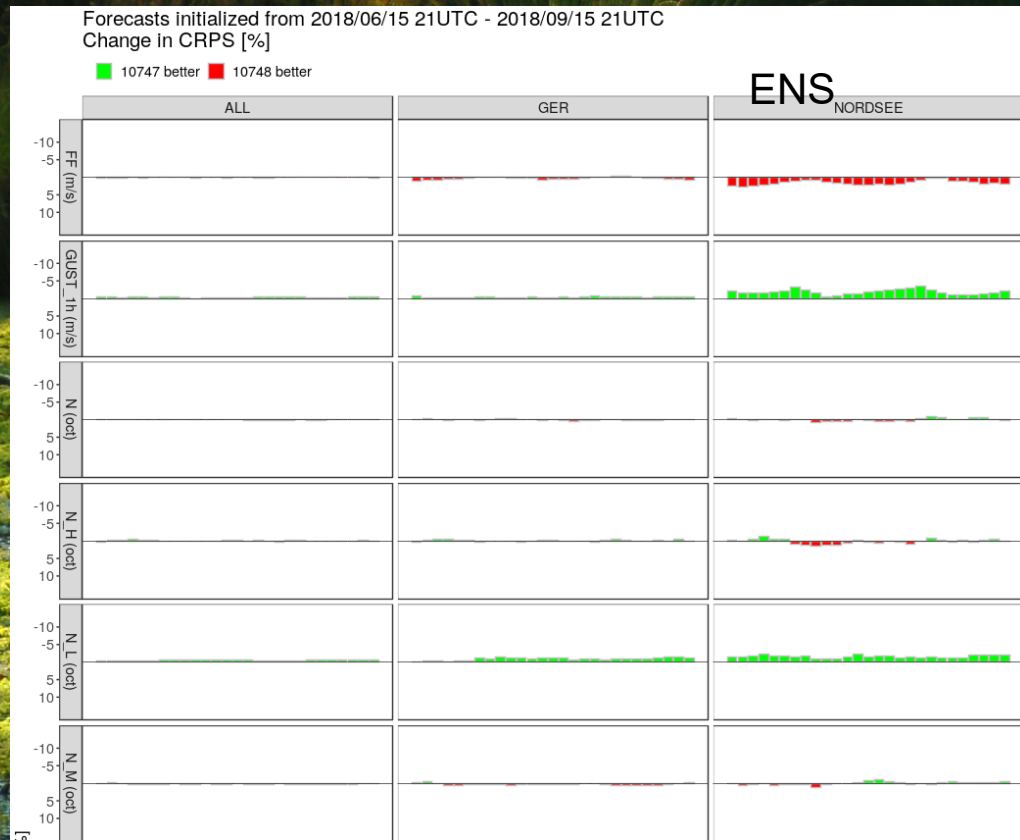
Lütt-Witt Moor, Henstedt-Ulzburg, Germany - Wikipedia



Verification – COSMO-D2



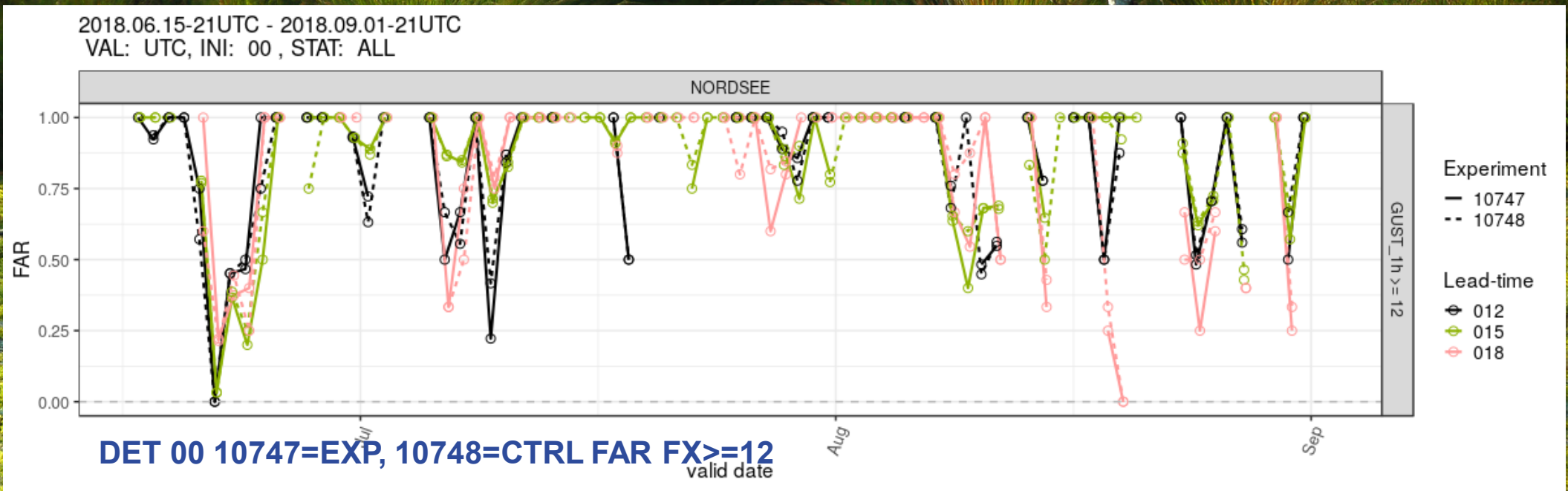
Verification – COSMO-D2



ENS 10747=EXP, 10748=CTRL CRPS SOMMER



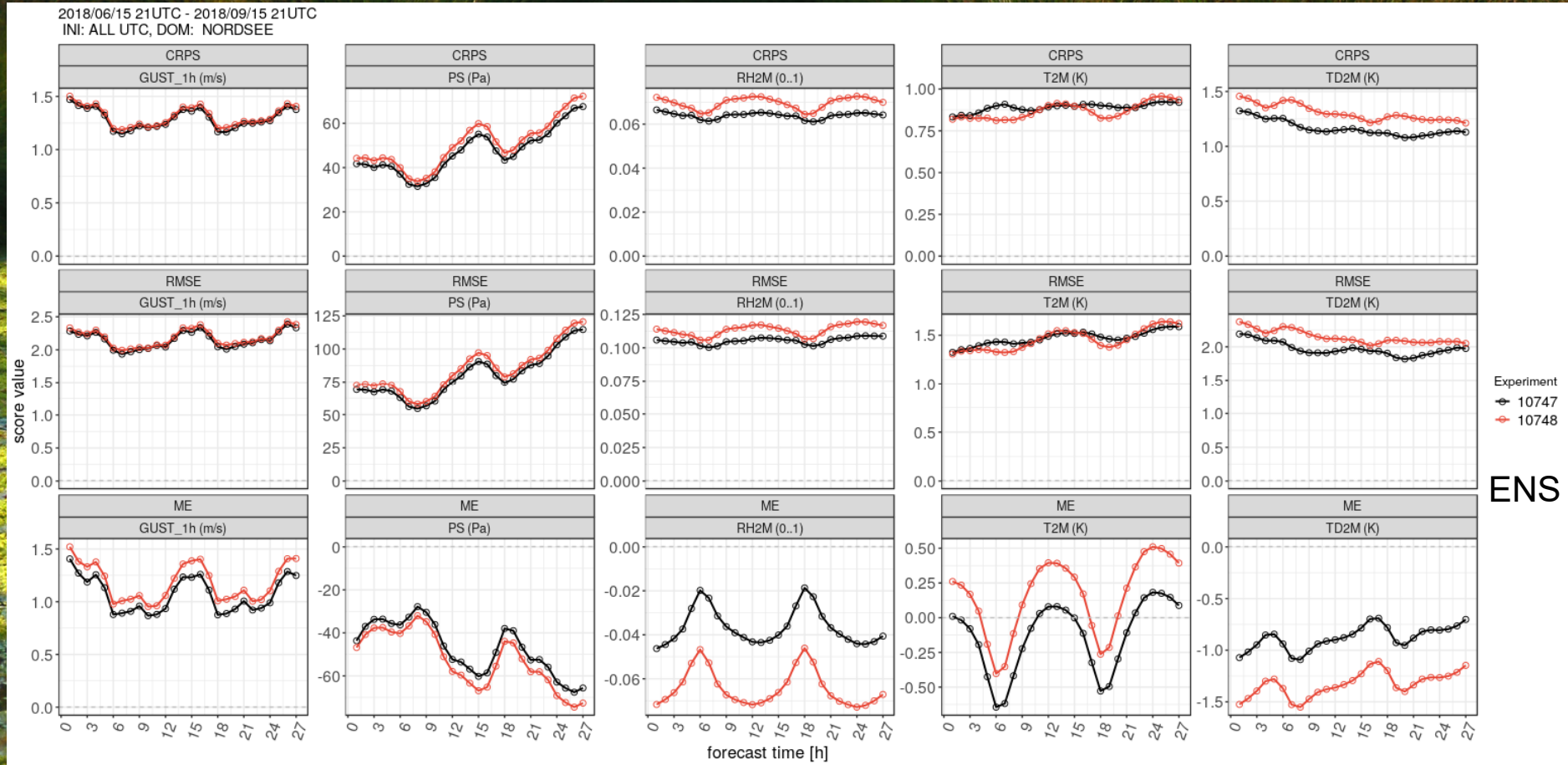
Verification – COSMO-D2



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



Verification – COSMO-D2



Proposal



- 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 are actually 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) with adapted geospatial data

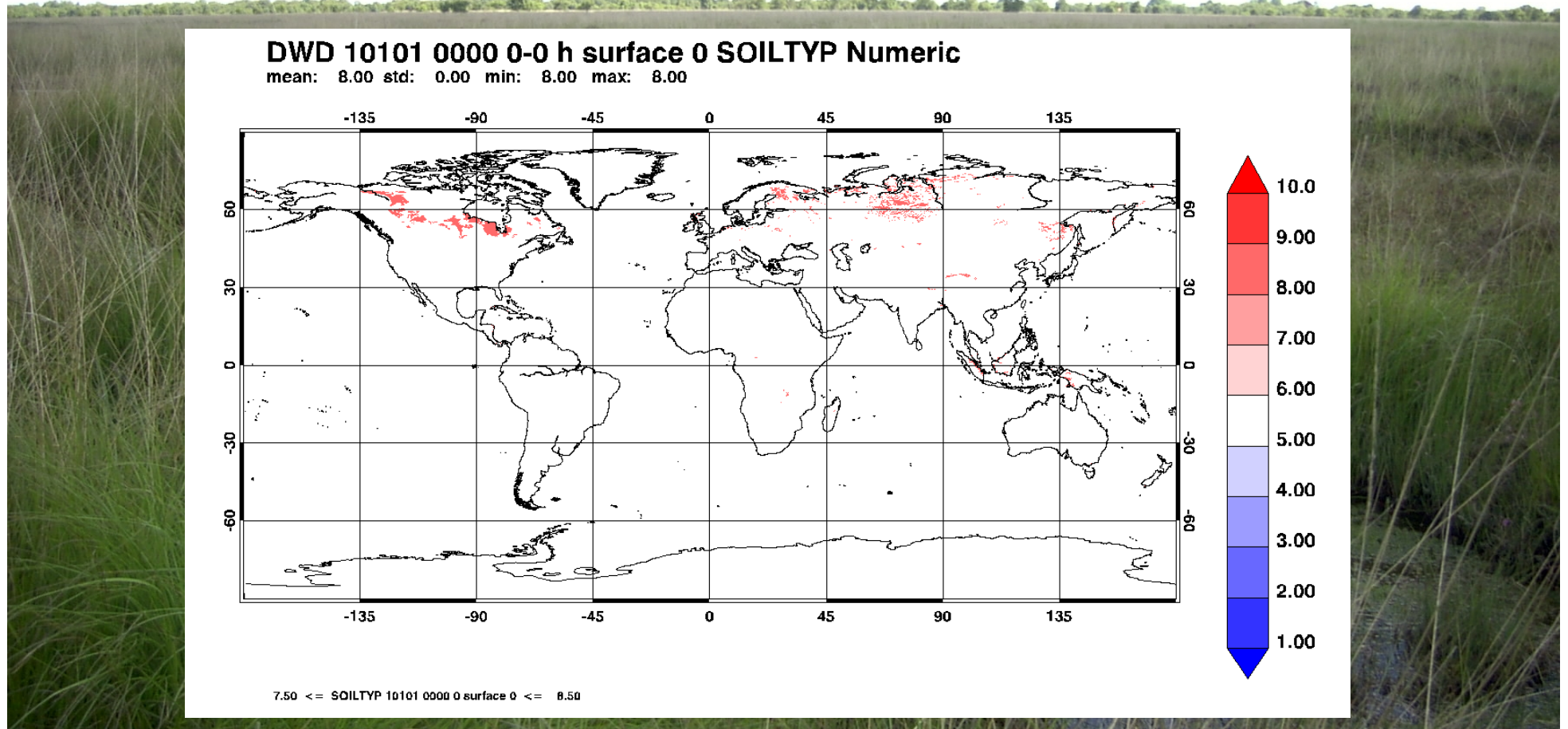


Outlook

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



Peatlands – ICON R03B07



Peatlands - Map

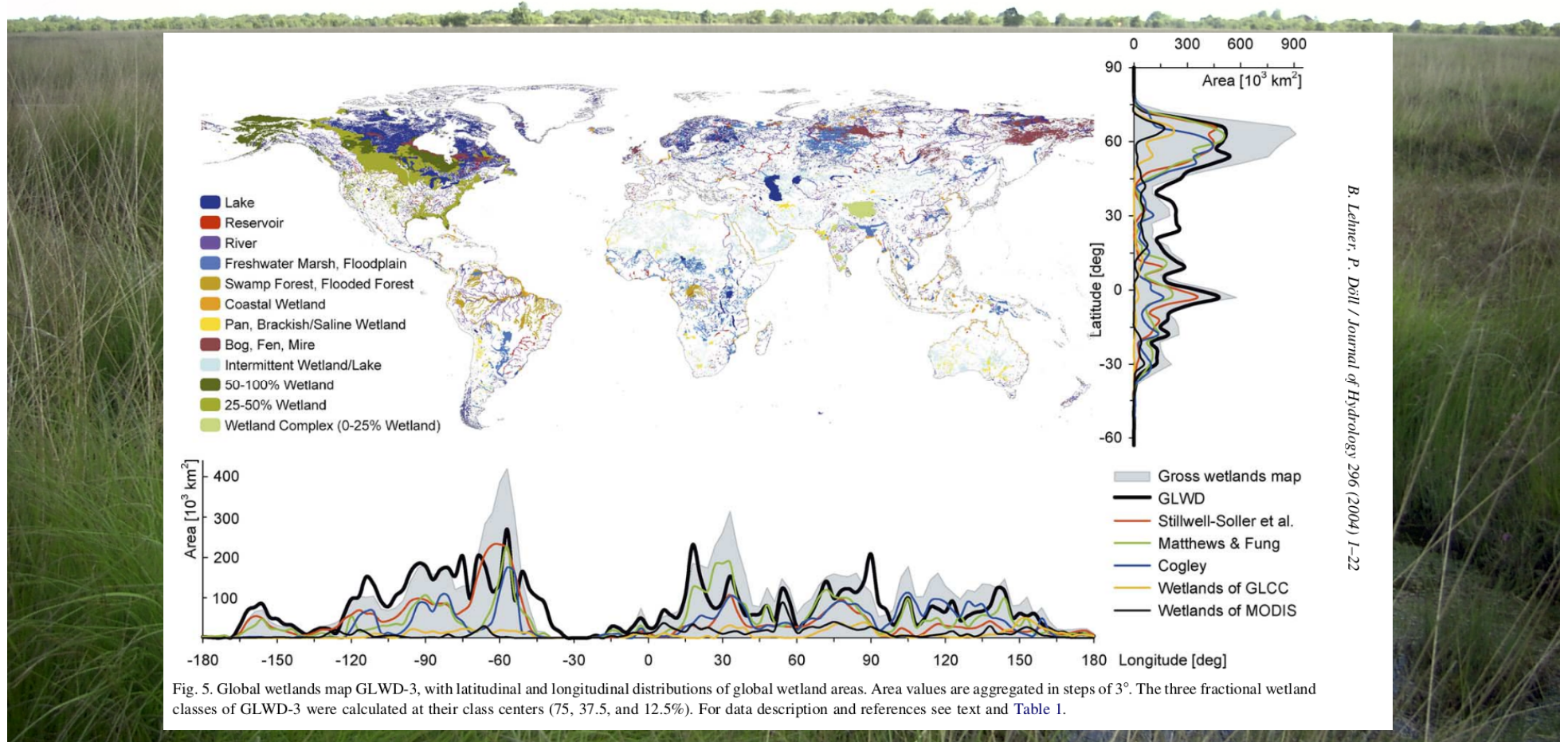
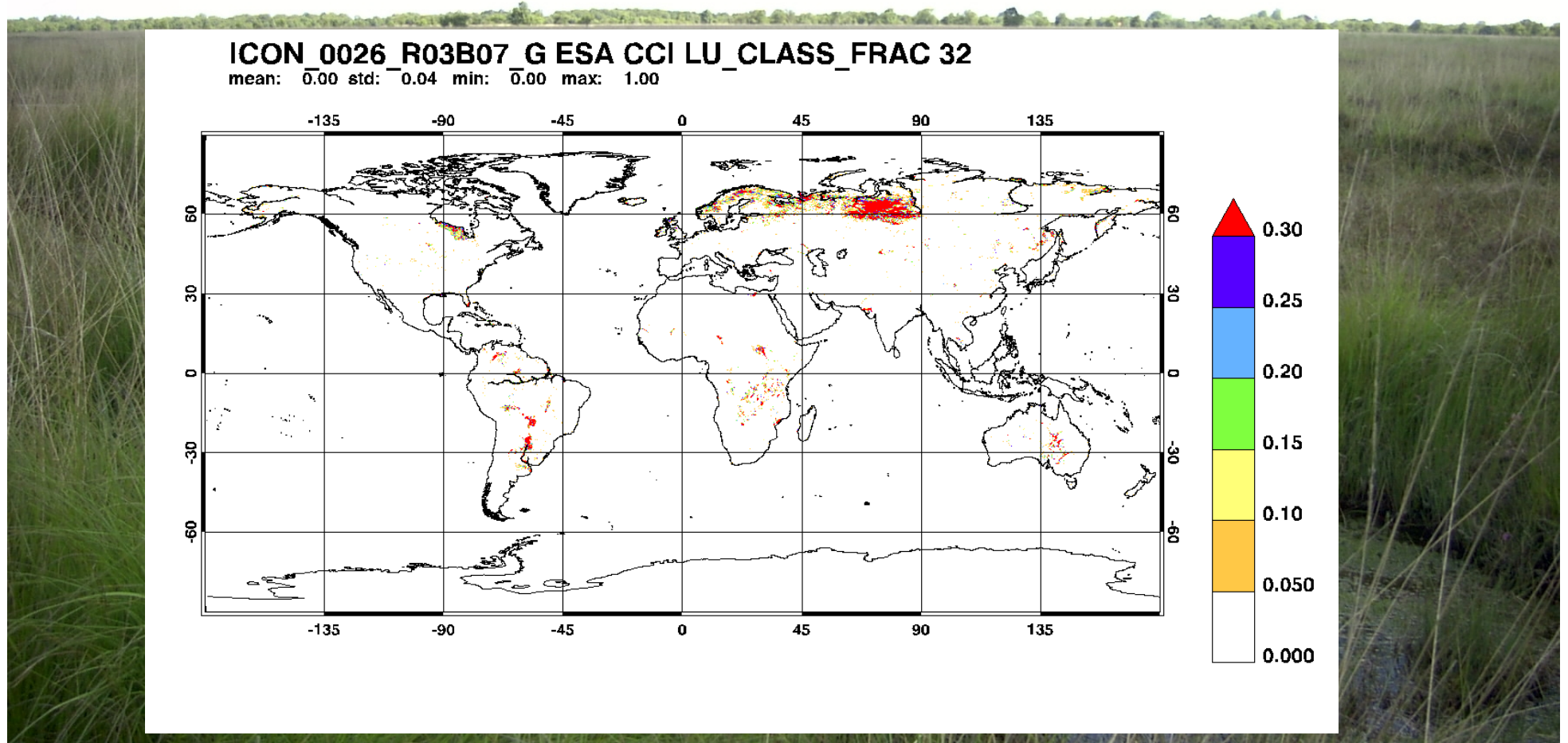


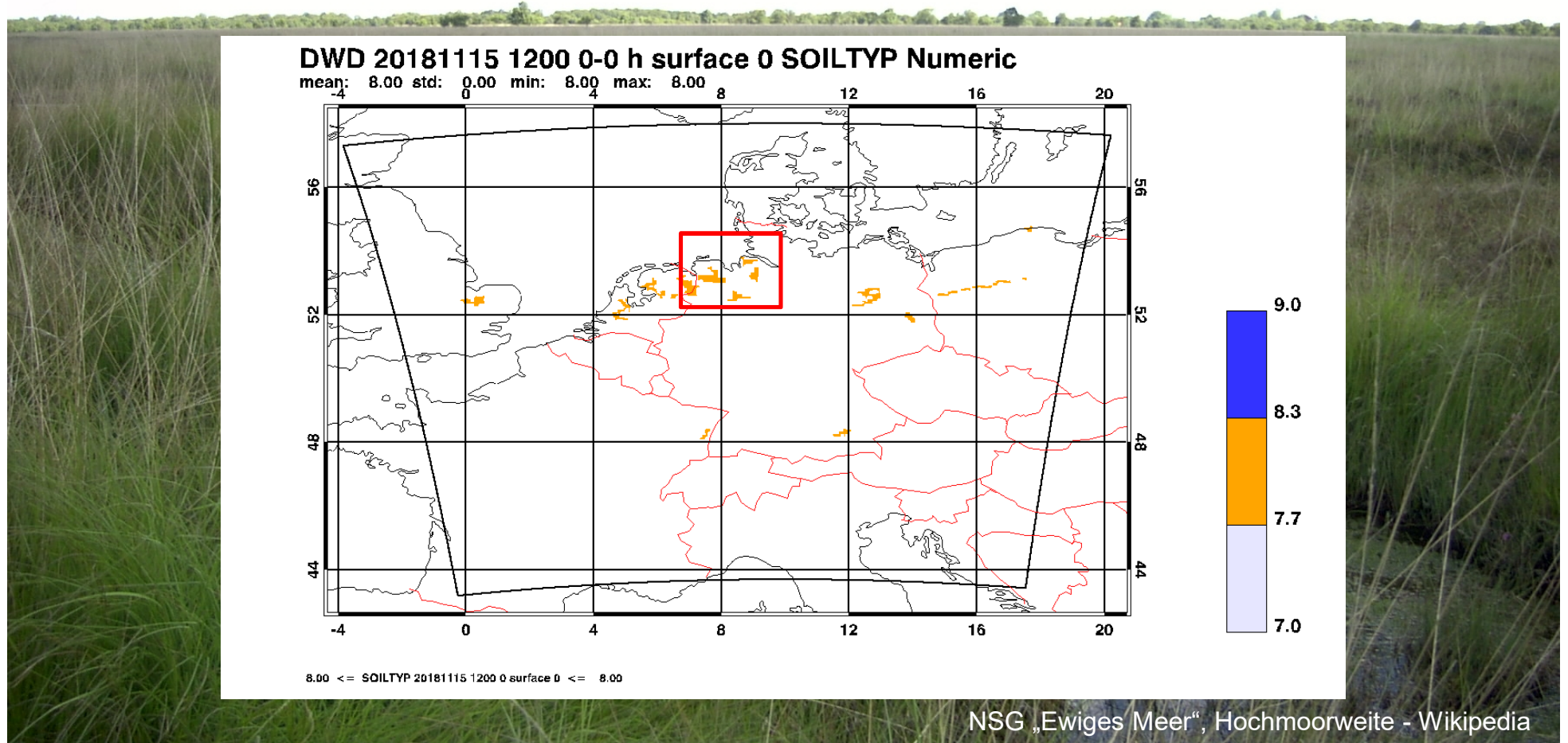
Fig. 5. Global wetlands map GLWD-3, with latitudinal and longitudinal distributions of global wetland areas. Area values are aggregated in steps of 3°. The three fractional wetland classes of GLWD-3 were calculated at their class centers (75, 37.5, and 12.5%). For data description and references see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



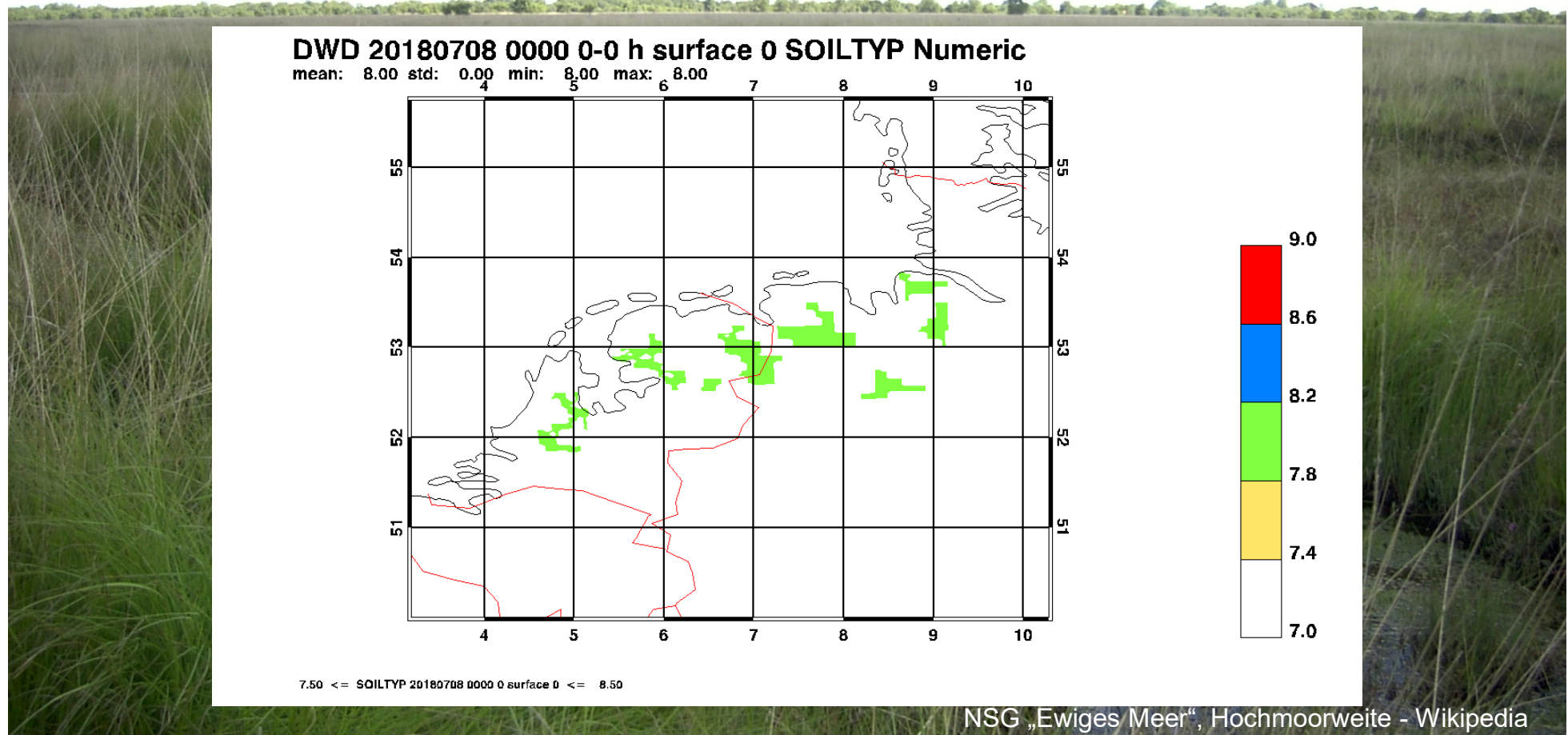
Peatlands – ICON R19B07



Peatlands in COSMO-D2



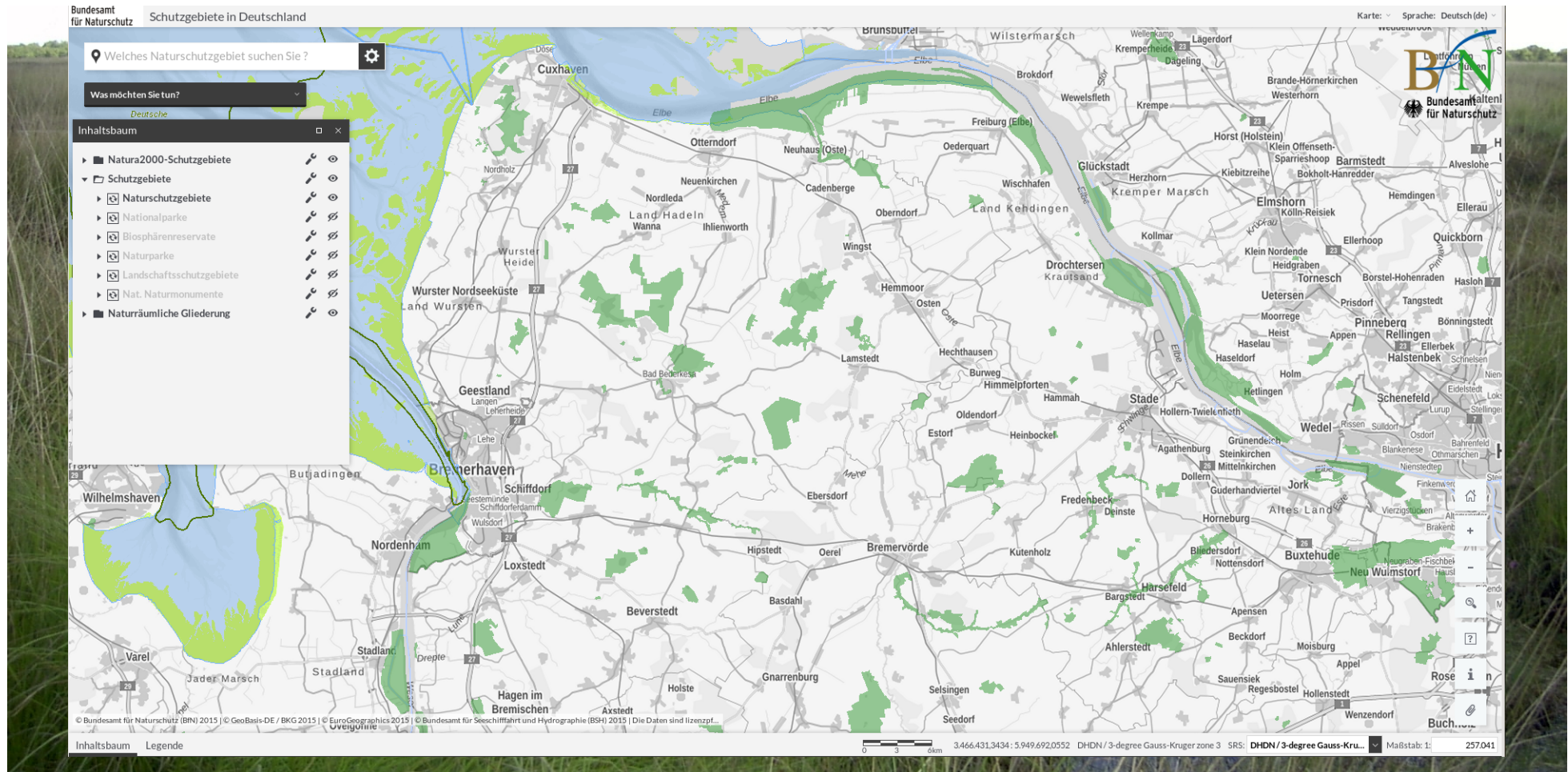
Peatlands in COSMO-D2



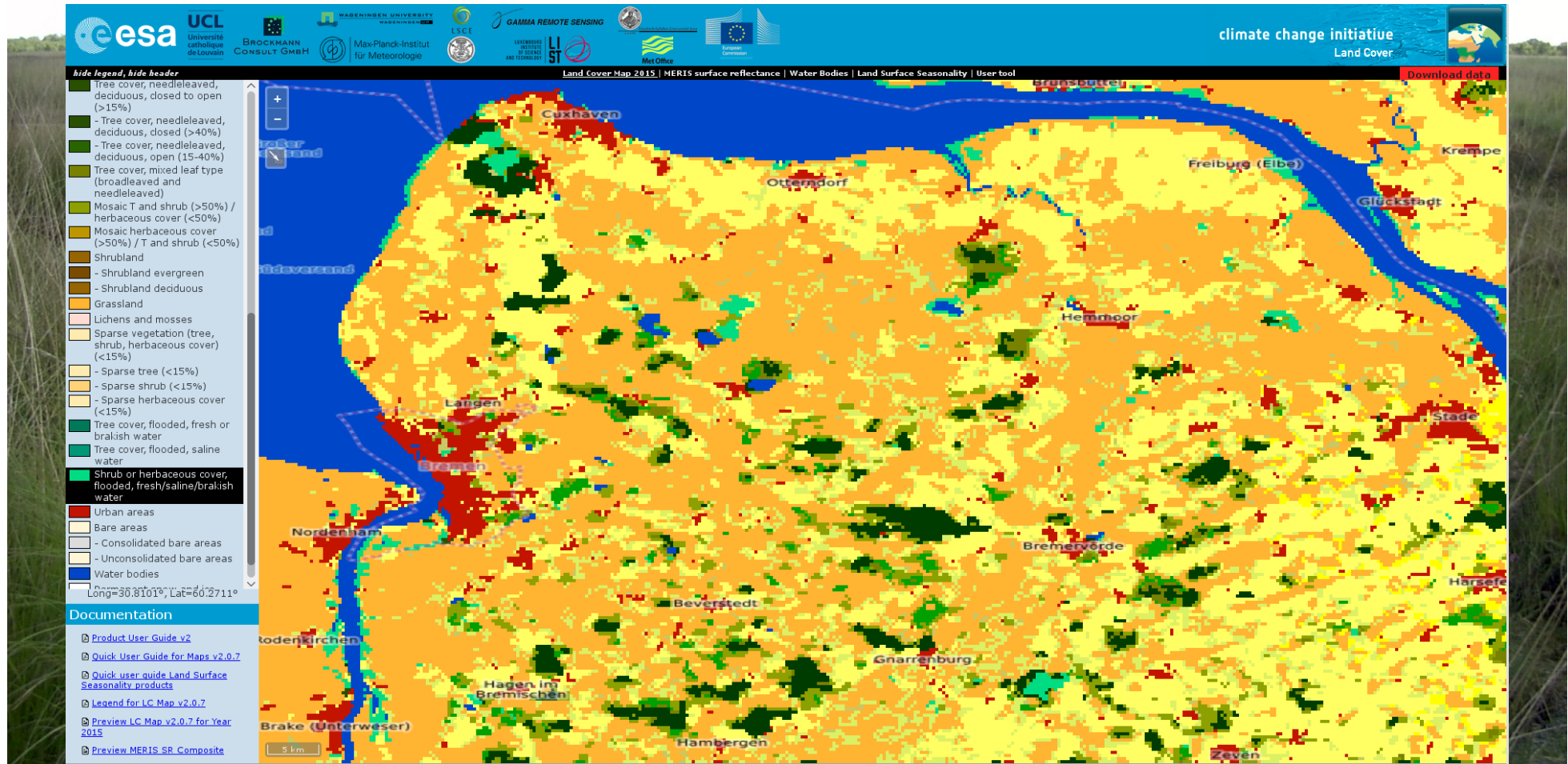
External parameter for peatlands



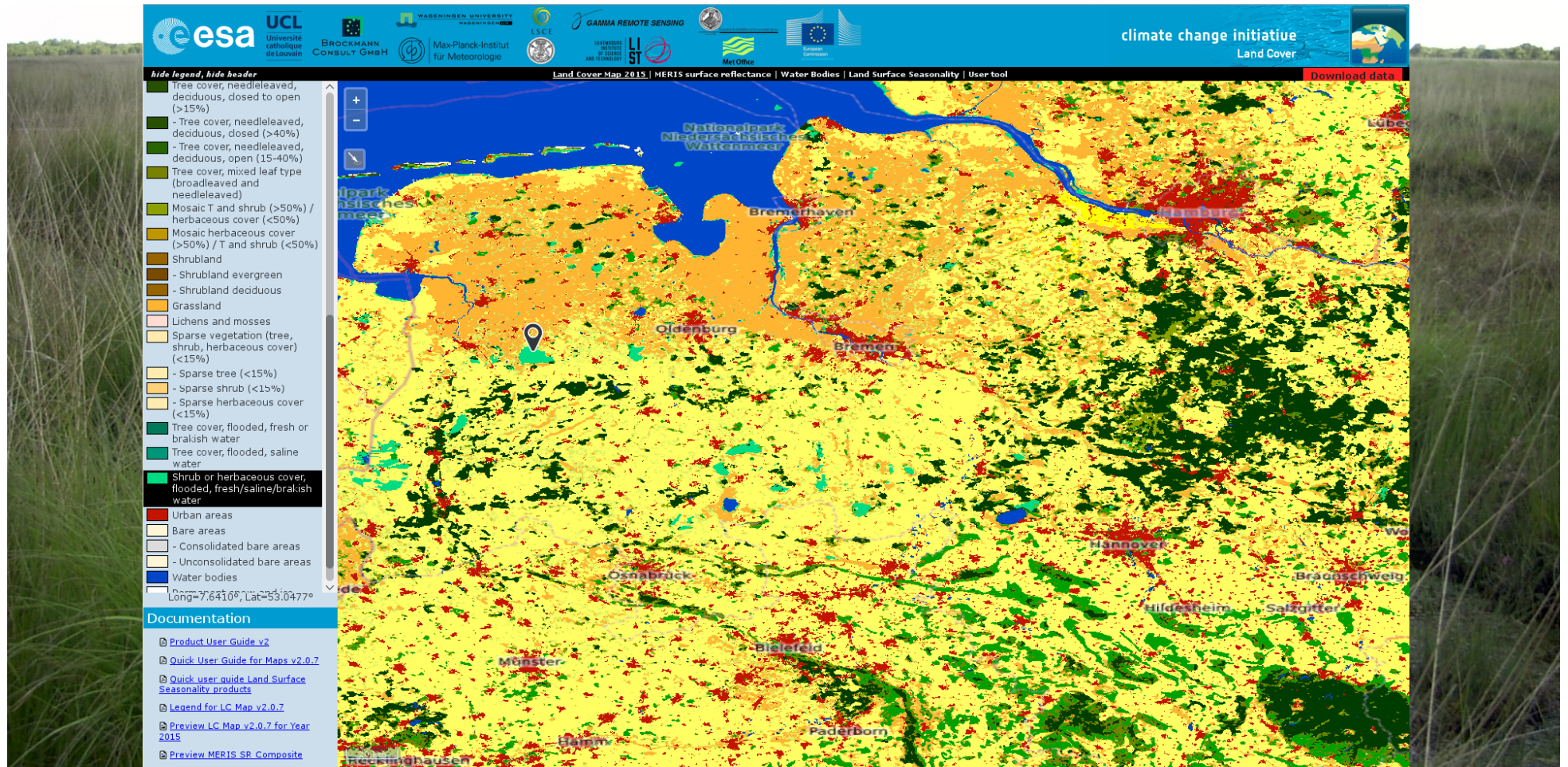
External parameter for peatlands



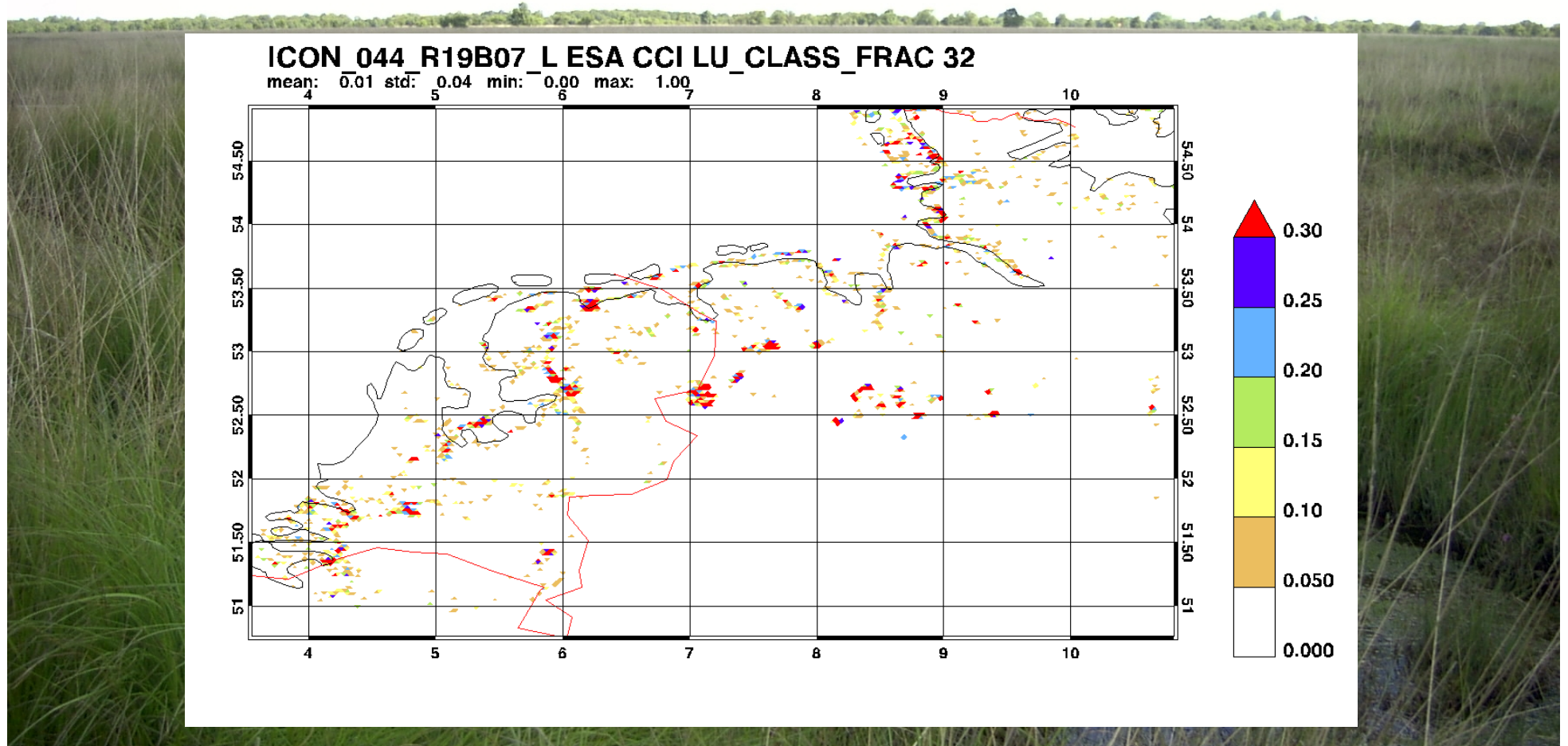
External parameter for peatlands



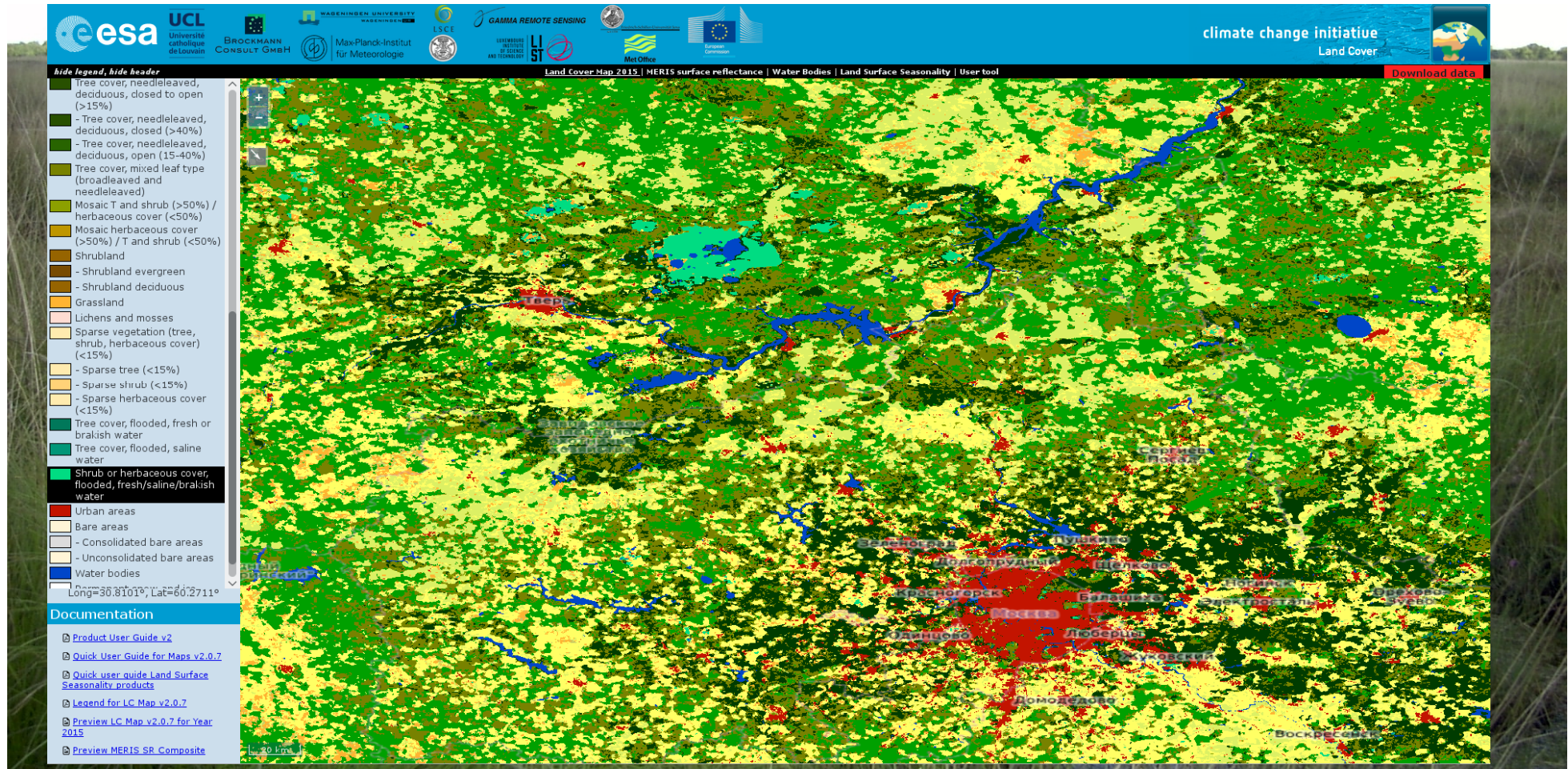
External parameter for peatlands



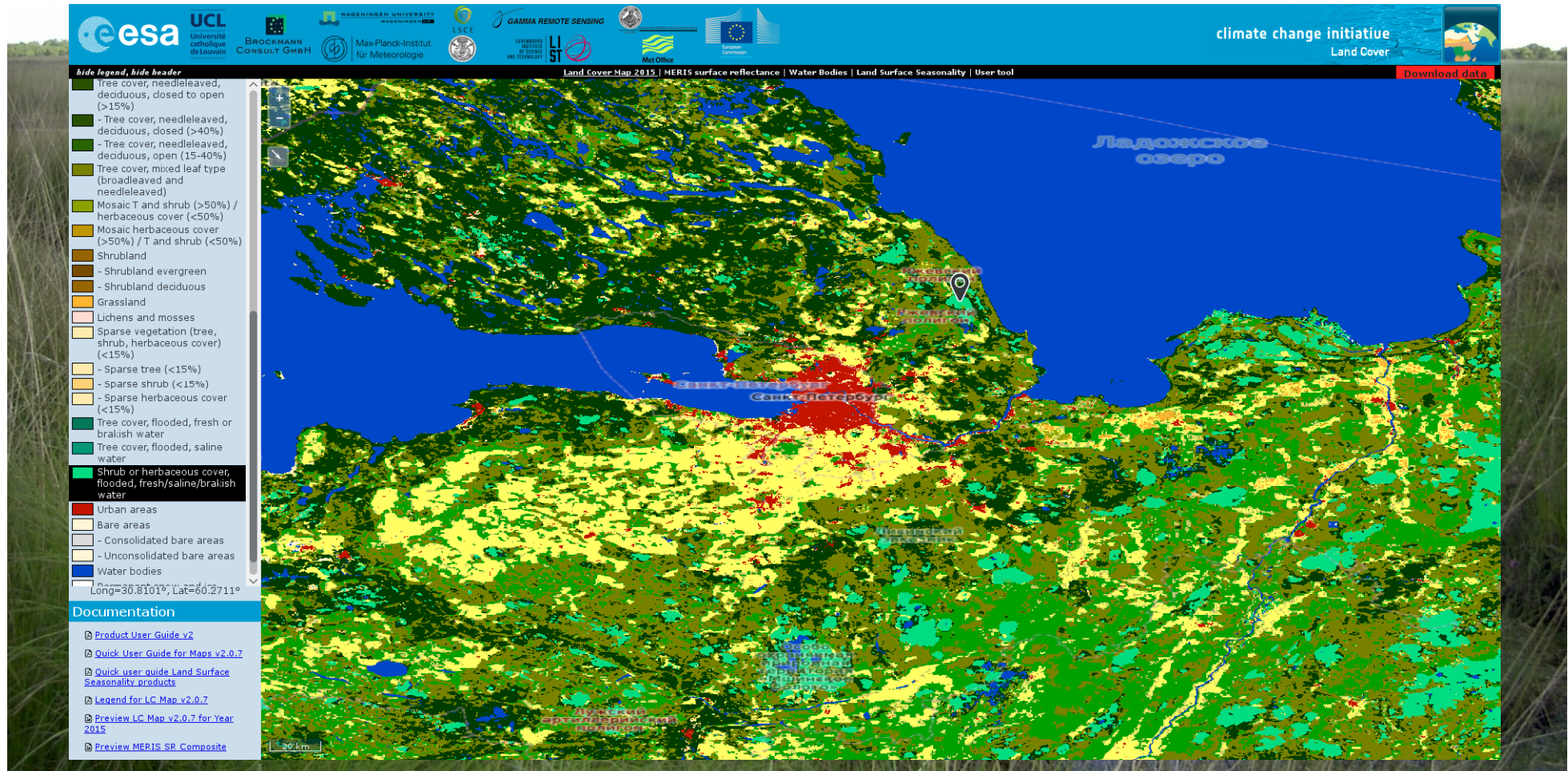
Peatlands – ICON R19B07



External parameter for peatlands



External parameter for peatlands



Peatlands – ICON R03B07

