



## TERRA and EXTPAR at DWD

Jürgen Helmert and colleagues from FE1





- Reformulation of land-surface processes (implicit approach, skin layer, canopy)
- Revision of TERRA hydrology including new transport formulation  $\rightarrow$  EXTPAR
- Further steps towards land-use based physics (e.g. MIRES see later)
- Cooperation with **AEVUS** on urban model in ICON
- Cooperation with **SAINT** on implementation of a new snow pack model in ICON
- Cooperation with VAINT on implementation of a vegetation model in ICON
- Implementation of COSMO software for EXTPAR at DWD



#### **ESA CCI\* Land-use data in ICON**



#### \*climate change initiative

DWD 10101 0000 0-0 h surface 0 SOILTYP Numeric mean: 8.00 std: 0.00 min: 8.00 max: 8.00



ICON 0026\_R03B07\_G ESA CCI LU\_CLASS\_FRAC 32



Outcome from COSMO-D2 experiments with MIRE

parameterization:

• New land-use data (ESA CCI) can provide improved

representation of active mires compared to FAO

- Advantages of ESA CCI:
  - Higher resolution (compared to FAO soil)
  - Higher granularity compared to GlobCover2009 (38

vs. 23 land-use classes and full global coverage)

• Periodic updates (advantage in reanalysis projects)



#### **ESA CCI for peatlands**

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- Implementation of ESA CCI in EXTPAR (Q1/2020)
- Global ICON R03B07 with ICON-EU Nest R03B08
- 3 months 2018-06-15 to 2018-09-15
- Free forecasts at 00 and 12 UTC, started from operational analysis
- Using the same code basis from gitlab (except for land-use adaptions)
- Experiment **11029** (**ESA CCI** with 38 land-use classes)
- Experiment **11079** Reference **Globcover/GLCC** (**GCV**) with 23 land-use classes







J. Helmert et al., COSMO GM 2020











ast time [h]



















### **Difference in ETS:**

• GUSTS









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## Upper air verification Antarctica: Using ESA CCI: 11029

- Warming of boundary layer
- For reason see following slides

























#### Surface albedo – EXTPAR GlobCover/GLCC







#### Surface albedo – EXTPAR ESA CCI











- Implementation of ESA CCI land-use data into EXTPAR and ICON
- Running global ICON free forecasts experiments for 3 months at 13 km with ICON-EU nest
- Verification showed for most parameters neutral impact of ESA CCI compared to GlobCover/GLCC
- Problems arised for Antarctica due to very different land-sea mask
- Main difference seen for temperature
- Could explain to some part upper air cold bias in ICON as

reported by G. Zängl, see following slides



### First Summary &

#### **Conclusions:**

#### **ICON retuning experiments**

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#### **ICON retuning experiments**

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#### **Global distribution of radiosondes**

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Antarctic sea ice extent in December 2013 (white) compared to the 1981-2010 median (orange line). Land is dark gray, and ice shelves—floating ice platforms connected to land—are light gray. Waters with sea ice concentration less than 15% are dark blue. Commonwealth Bay was unusually ice-choked.



Radiosondes stations close to shoreline, where polynyas reside











- WG3b projects at DWD on track
  - Reformulation of land-surface processes, Mires in ICON
  - Revision of TERRA hydrology including new transport formulation
- Cooperation with projects **AEVUS**, **SAINT**, **VAINT**
- Useful development benefits between EXTPAR and TERRA, e.g. ESA CCI
- More improvements to come soon (global hires orography by MERIT)
- Working on improvements of ICON for Antarctica (ESA CCI, Sea-Ice, Polynya)





- Working on improvements of ICON for Antarctica (ESA CCI, Sea-Ice, Polynya)
  - Experiments using ESA CCI created artificial polynyas
  - Warming of boundary layer observed compared to radiosondes near shoreline
  - Could explain in parts ICON's cold bias
  - Adaptions in sea-ice scheme and sea-ice analysis needed for consistent

treatment of land-sea mask in analysis and forecast







# Thank you very much

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