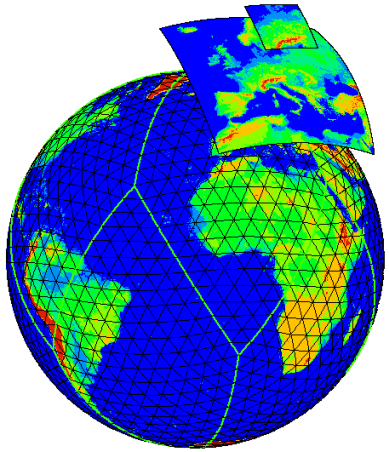
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



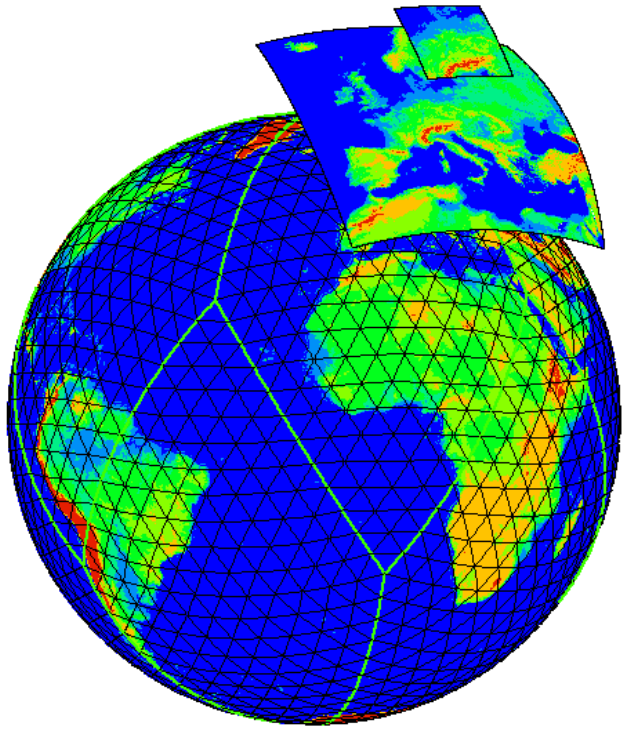
External Parameters for FLAKE in the numerical weather prediction models COSMO and ICON

Hermann Asensio

Outline

- overview external parameters for COSMO, GME and ICON
- external parameters for FLake (fraction lake and lake depth)
- consistency checks
- summary

DWD operational numerical weather prediction models



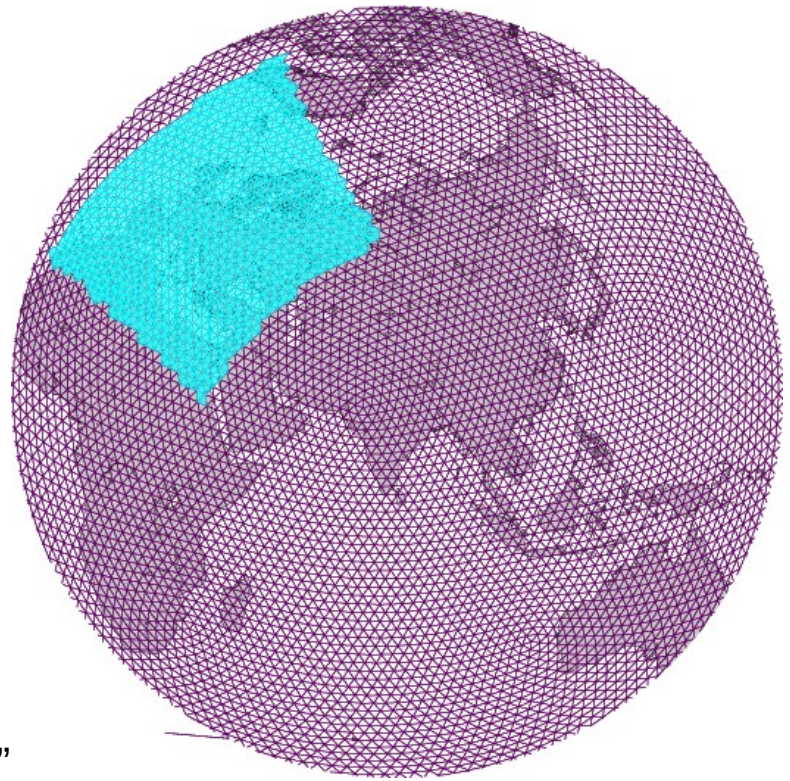
COSMO-DE:
grid spacing: 2.8 km
forecasts up to 21 hours

COSMO-EU:
grid spacing: 7 km
forecasts up to 78 hours

GME:
grid spacing: 30 km
forecasts up to 7 days

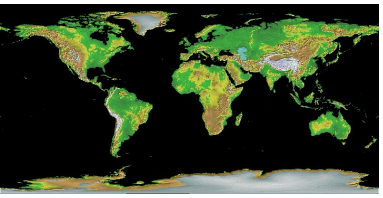
ICON (ICOsahedral Nonhydrostatic general circulation model)

- Cooperation DWD with Max Planck Institute for Meteorology in Hamburg: new global nonhydrostatic Model ICON
- ICON will replace GME and COSMO-EU grid spacing 20 km globally and 5 km over Europe

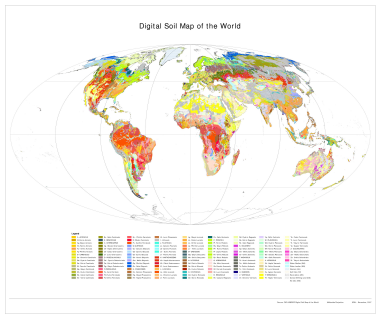


global icon grid “iconR2B04_DOM01”
and local refinement grid
“iconR2B05_DOM02”

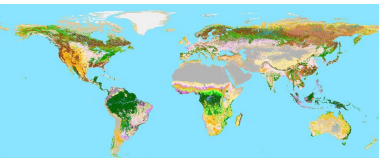
external parameters for numerical atmospheric models



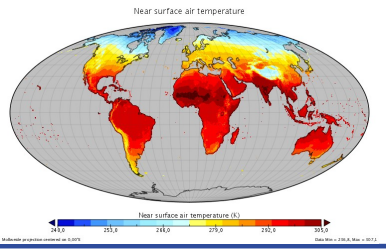
orography
GLOBE



soil data
DSMW

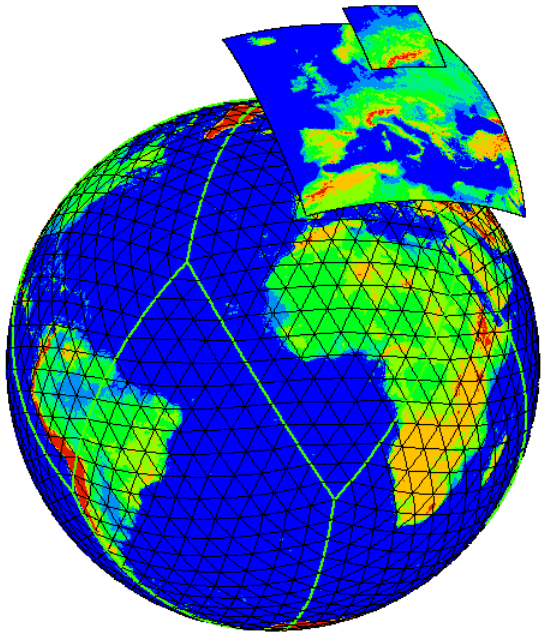


land use
GLC2000



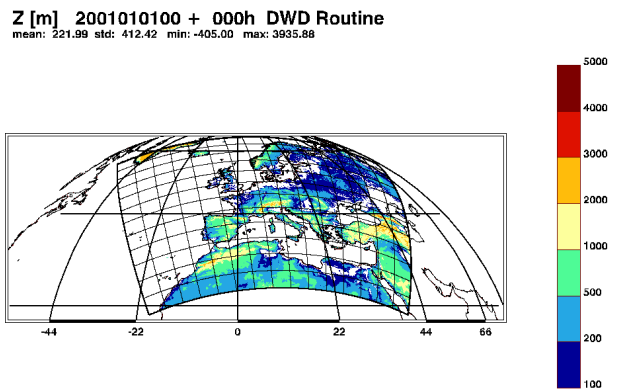
climatology
CRU

external
parameters
on
target
grid

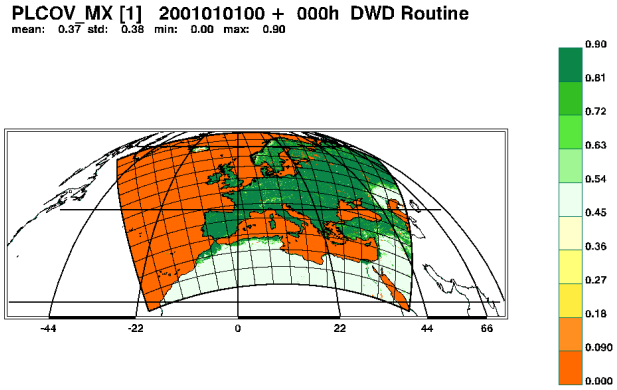


Examples for external parameters for COSMO-EU

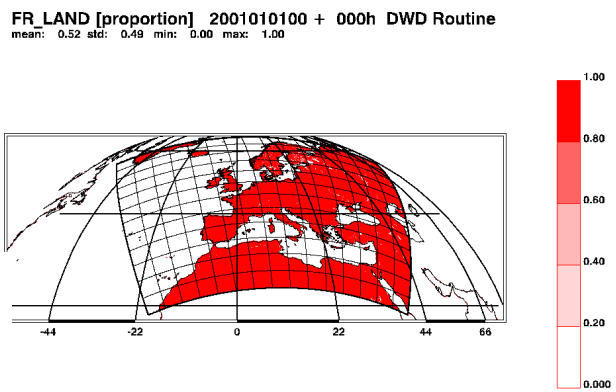
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



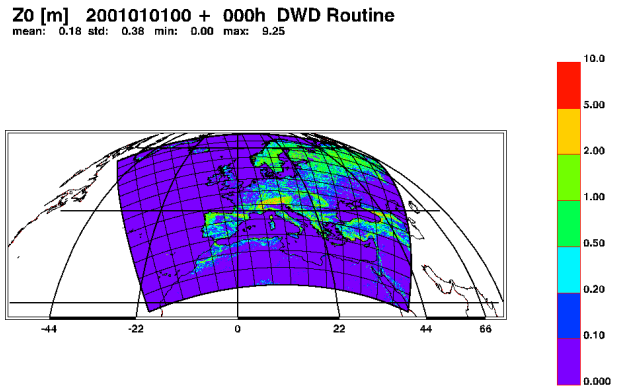
geometrical height [m]



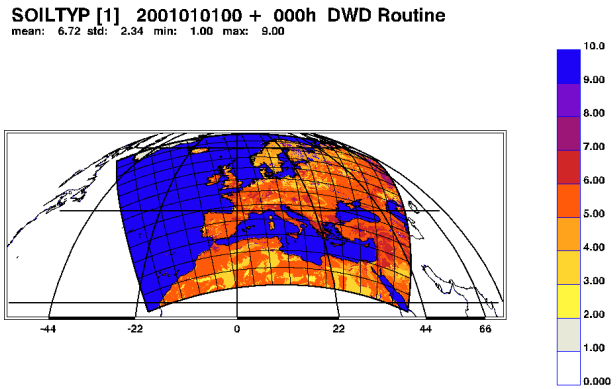
ground fraction covered by plants (vegetation period)



fraction land cover (land-sea mask)



surface roughness



soil texture

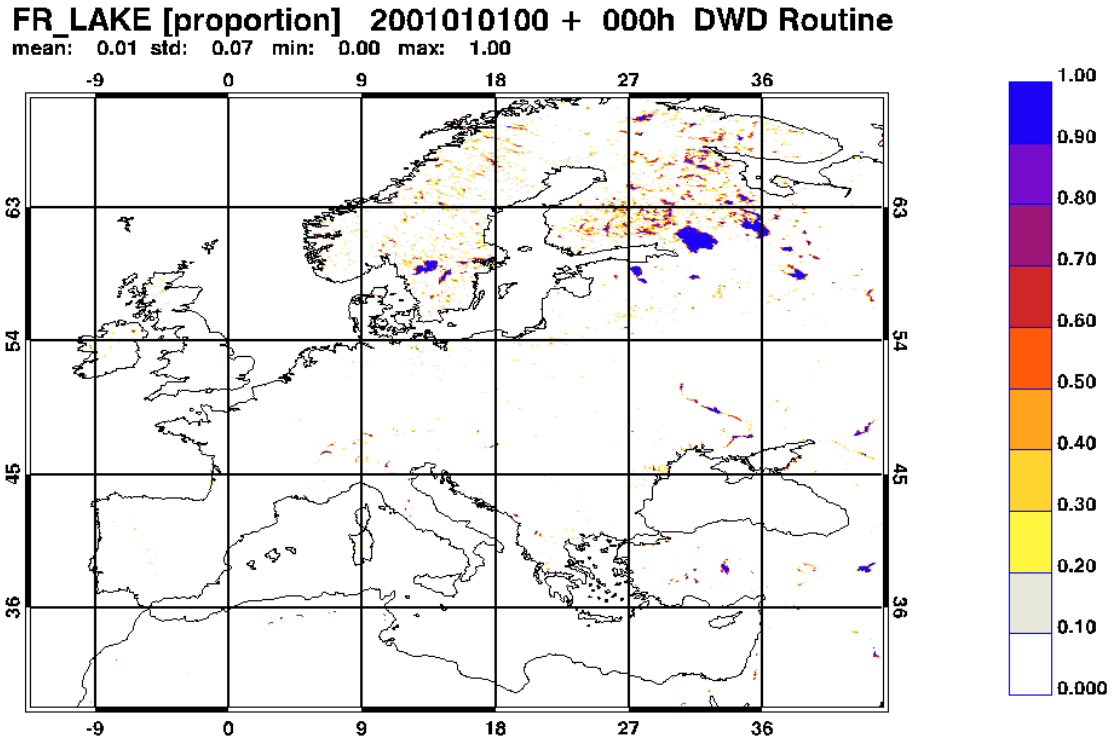
external parameters for FLake

- ➔ FLake needs geographically localized fields for lake depth and lake fraction
- ➔ global raw database for depth of freshwater lakes from Ekaterina Kourzeneva

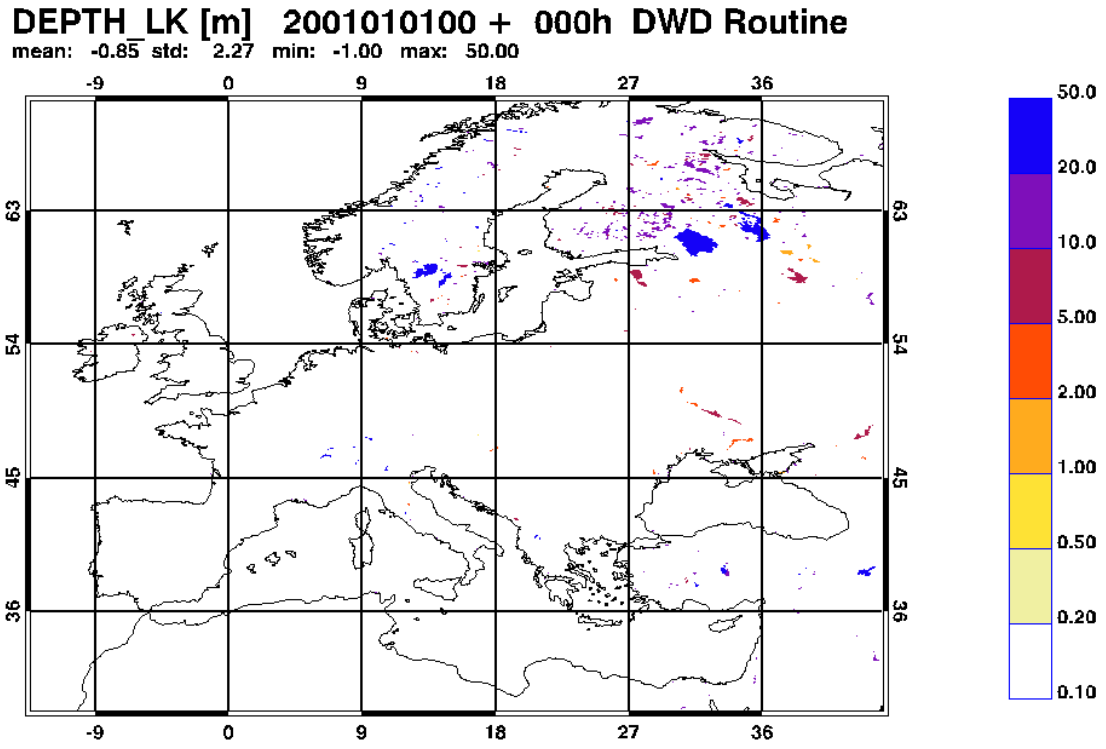
external parameters for FLake

- determine fraction area of target grid element covered by a lake (fresh water)
- aggregation of mean lake depth within target grid element,
  default depth for lakes 10 m in case of no lake given in database

Fraction Lake FR_LAKE, COSMO-EU



Lake Depth DEPTH_LK, COSMO-EU



consistency checks

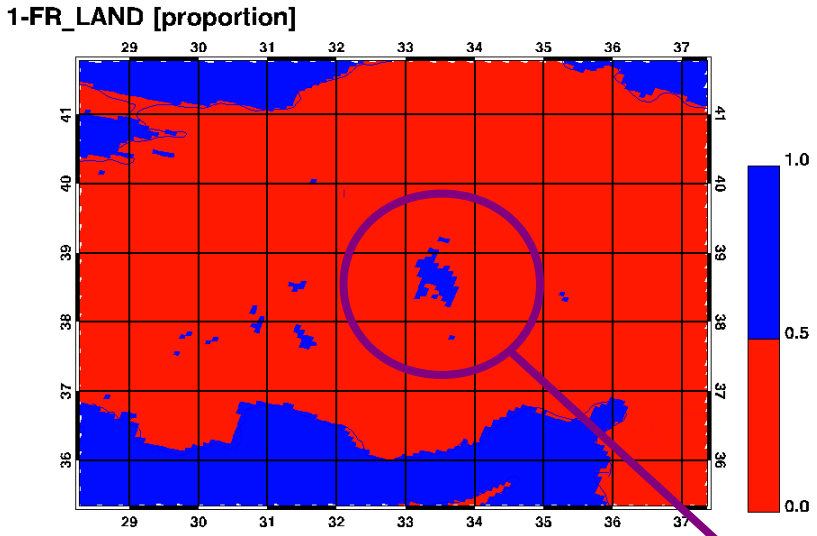
- lake fraction of target grid element derived from “Global Land Cover Characterization” (GLCC) land use data, based on “Advanced Very High Resolution Radiometer” (AVHRR) data
- fraction of land for the target grid element of the operational models at DWD derived from “Global Land Cover 2000” (GLC2000) land use data, based on »Haute Résolution dans le Visible et l’Infra-Rouge» (HRVIR) data

GLC2000 does not distinguish between fresh water and ocean!

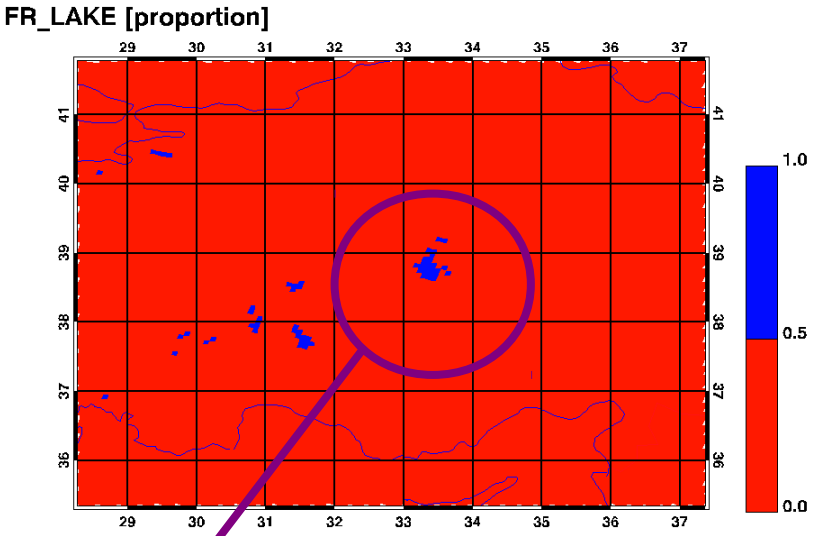
Conflicts occur! Consistency checks necessary!

consistency checks

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



FR_LAND based on GLC2000

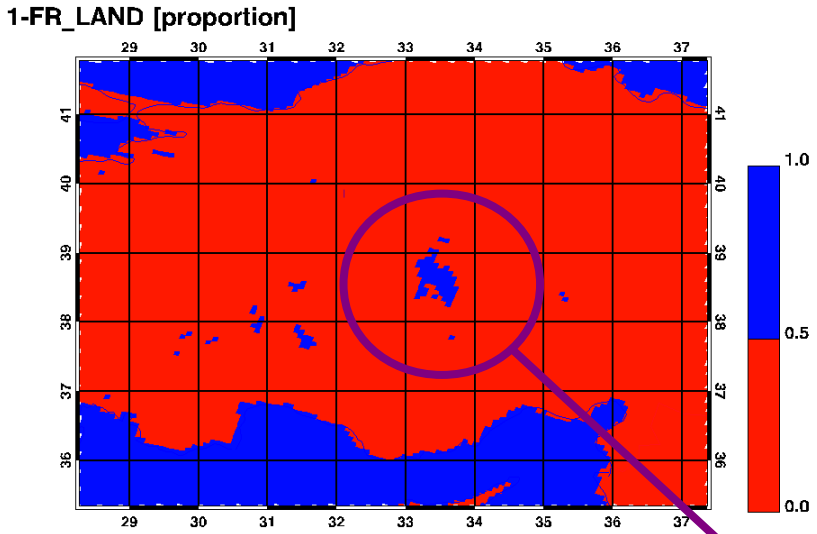


FR_LAKE based on GLCC

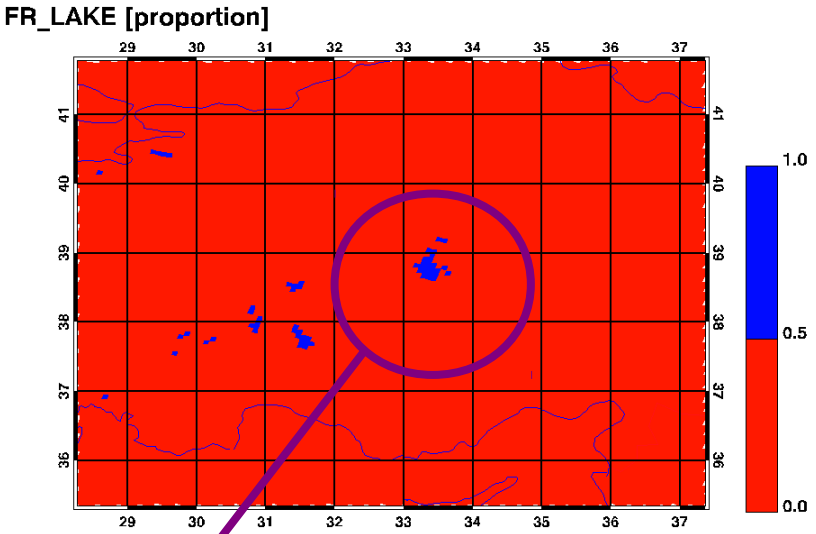
Lake Tuz, Turkey

consistency checks

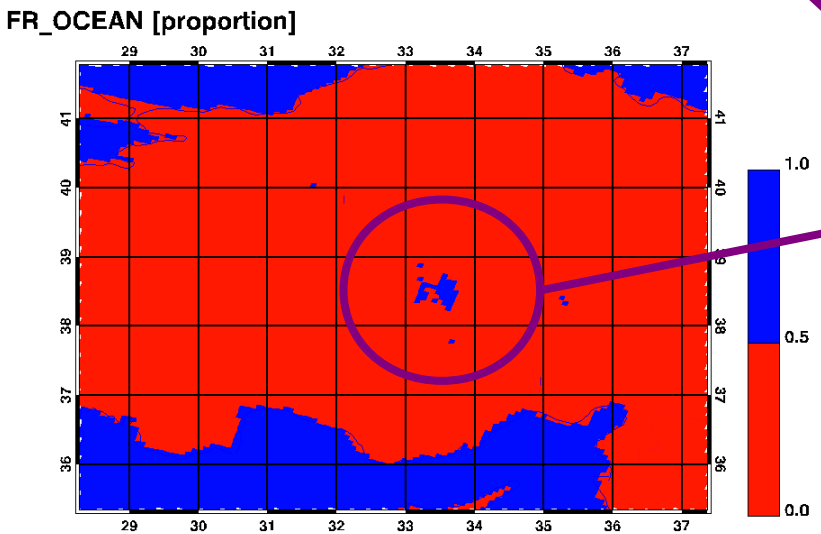
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



FR_LAND based on GLC2000



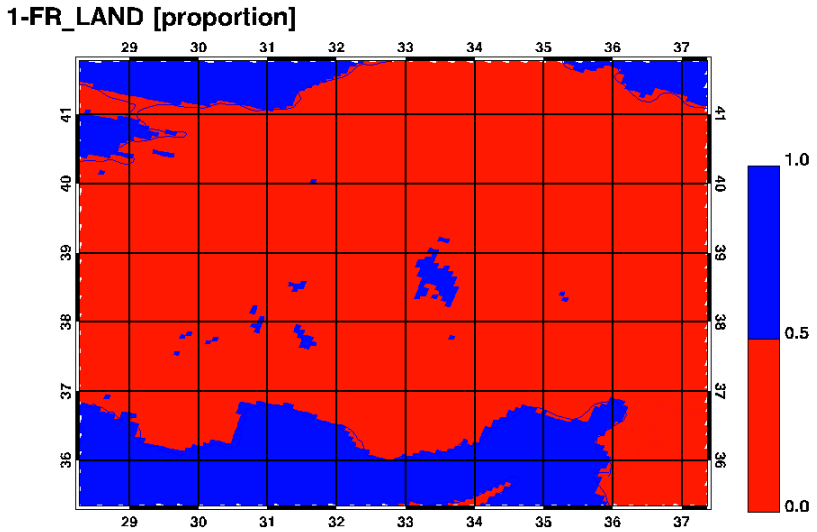
FR_LAKE based on GLCC



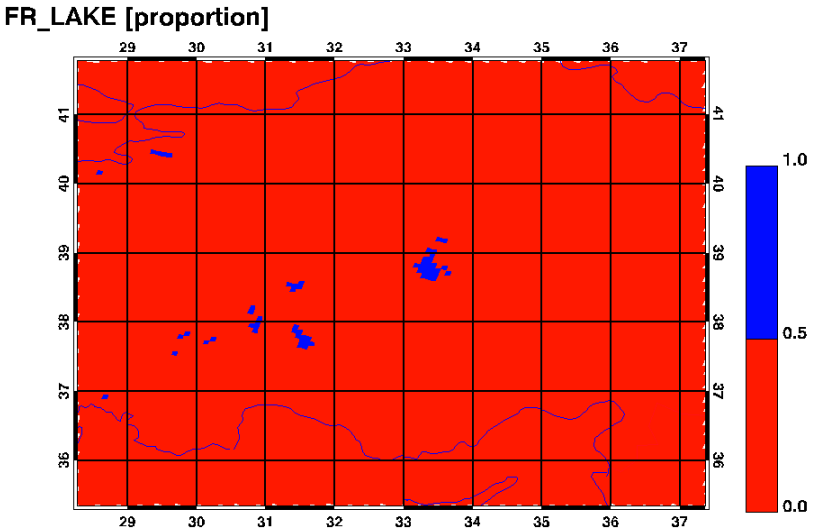
Lake Tuz, Turkey

consistency checks

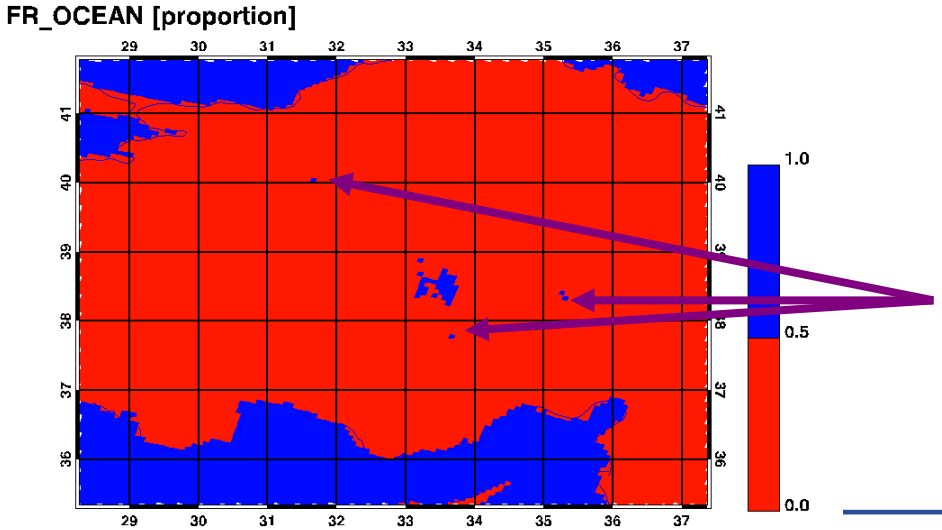
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



FR_LAND based on GLC2000



FR_LAKE based on GLCC



also isolated “ocean” grid elements occur due to inconsistencies in raw data sets GLCC and GLC2000

consistency check

condition for each target grid element:

FR_LAND + FR_LAKE + FR_OCEAN = 1

possible conflicts due to different water masks in GLC2000 and GLCC:

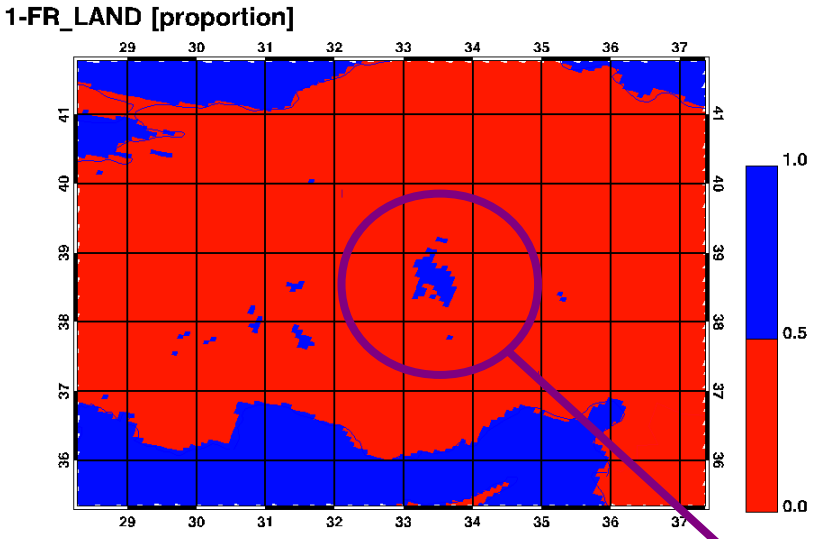
- FR_LAKE + FR_LAND > 1.0
- FR_LAKE > 0.5 and FR_LAND > 0.5
- Lake Depth > 0 and FR_LAKE < 0.5
- Lake Depth > 0 and FR_LAND >= 0.5
- isolated “ocean” points surrounded by land

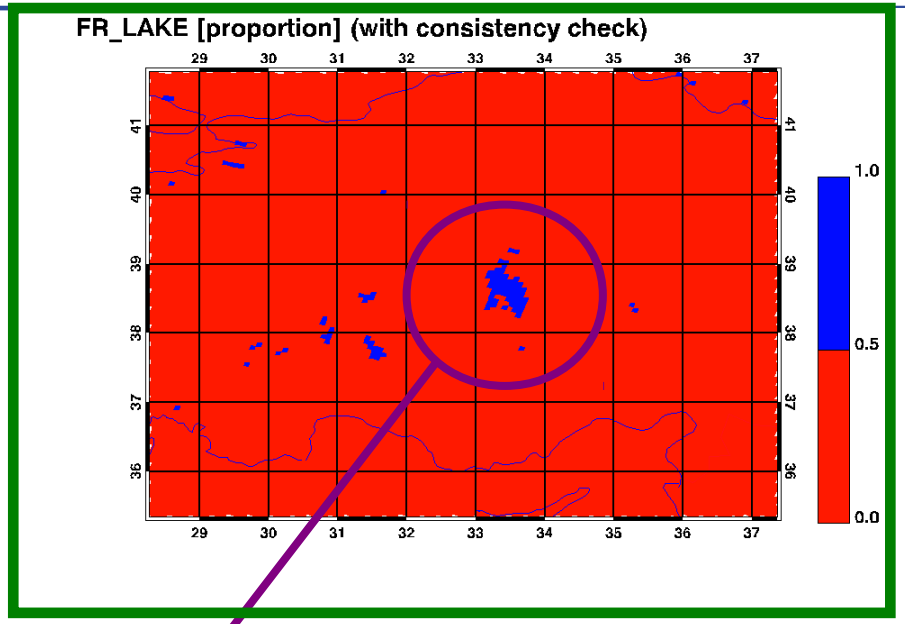
consistency check

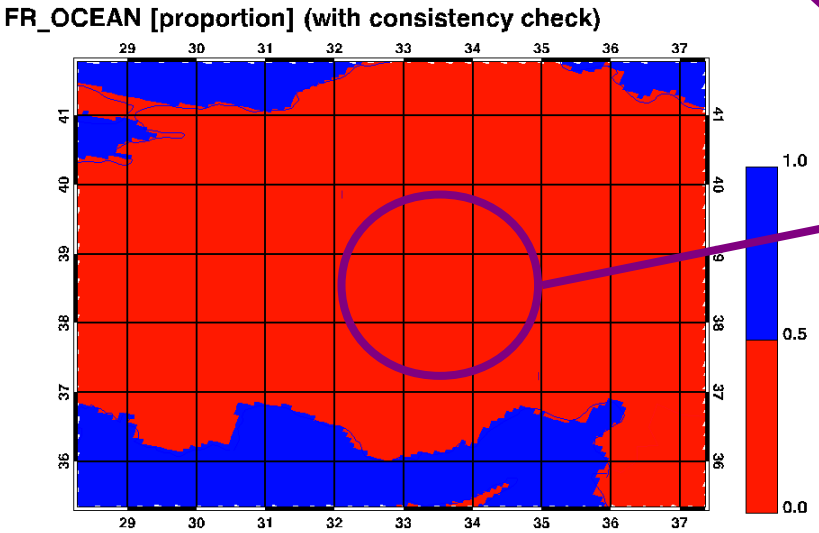
1. Consider water mask of GLC2000 as most decisive and adjust FR_LAKE (and take care for the parameter Lake Depth) for each target grid element with a conflict to be consistent with FR_LAND
2. Search for isolated “ocean” grid elements and switch to “lake” grid elements with the default lake depth of 10 m

consistency check

Deutscher Wetterdienst
Wetter und Klima aus einer Hand







Lake Tuz, Turkey

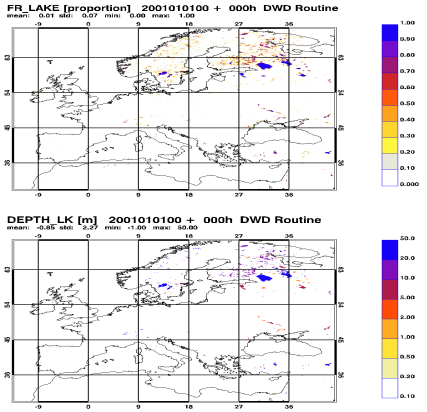
a consistency check can eliminate inconsistencies due to differences in raw data sets

open questions

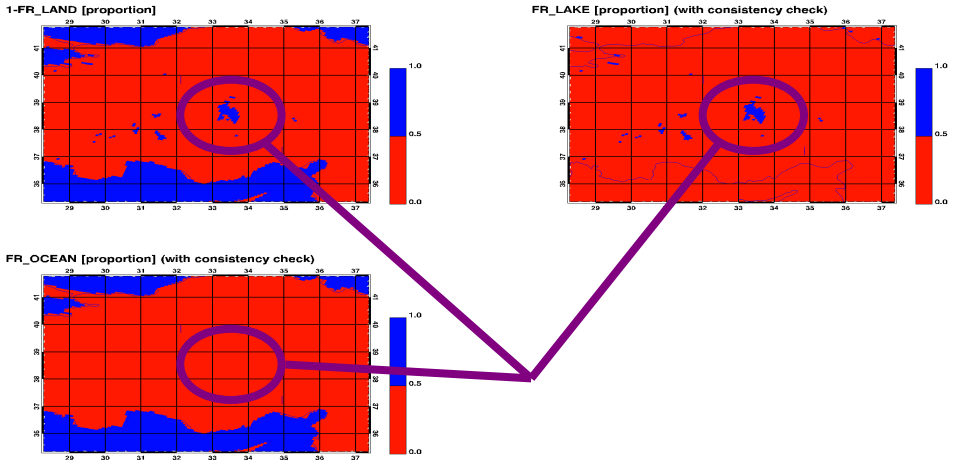
- ➔ alternatives to GLC2000 as decisive land-water mask?
- ➔ use other raw datasets for land use?
- ➔ improve consistency of different raw data sets?
- ➔ use of shoreline data (GSHHS - A Global Self-consistent, Hierarchical, High-resolution Shoreline Database) as basis of a point in polygon test?

Summary

- generate external parameters lake_fraction and lake depth for target grid on the basis of lake database from Ekaterina Kourzeneva



- perform consistency checks to avoid conflicts with different land-water masks from different raw data sets



Thank you for your attention!

Caveats

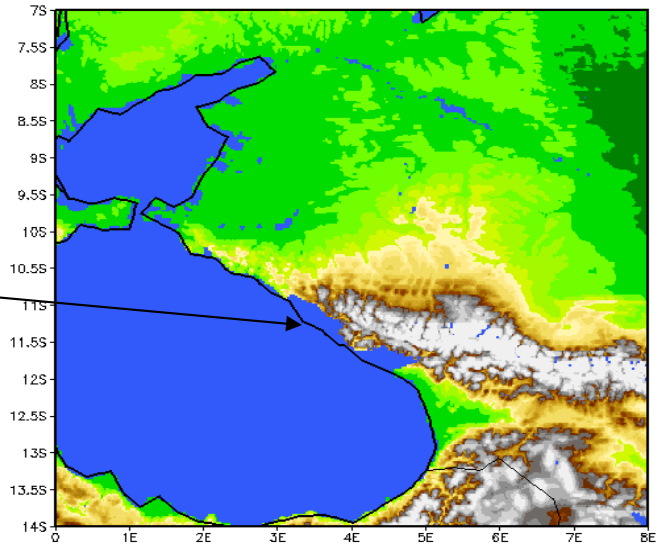
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Problem: The Olympic Winter Games 2014 in Sochi, Russian Federation:

The map

Sochi

The external parameters



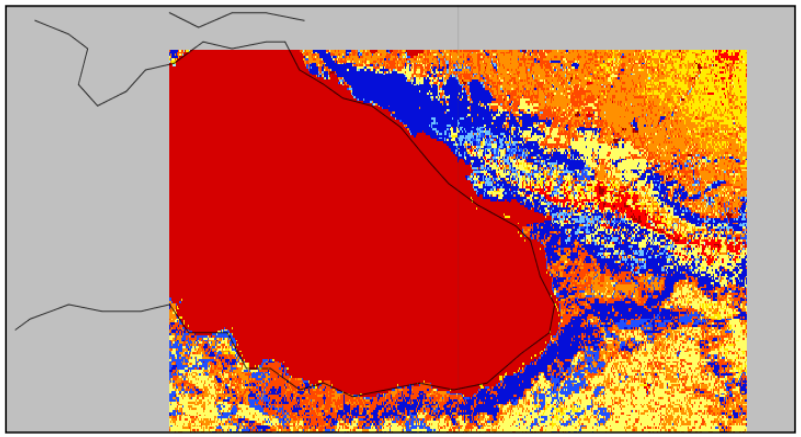
Most raw data sets provide values (for soiltype etc.)
But the land-sea-mask of the GLC2000 data set gives sea water!

Caveats

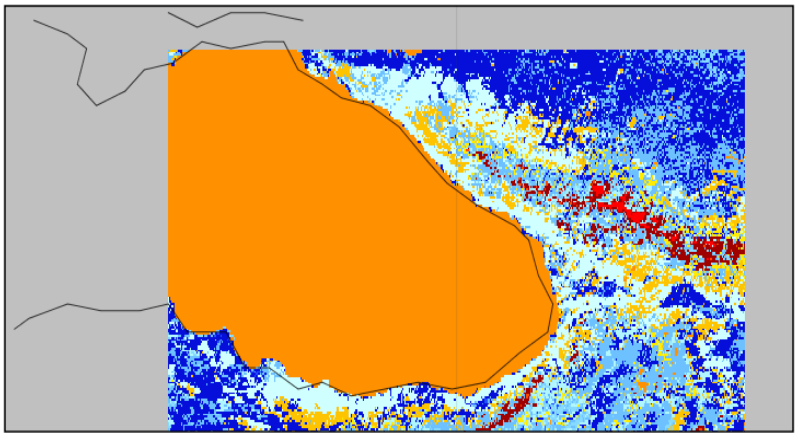
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

The external parameters are only as good as the available raw data sets.

GLC2000 land use classes

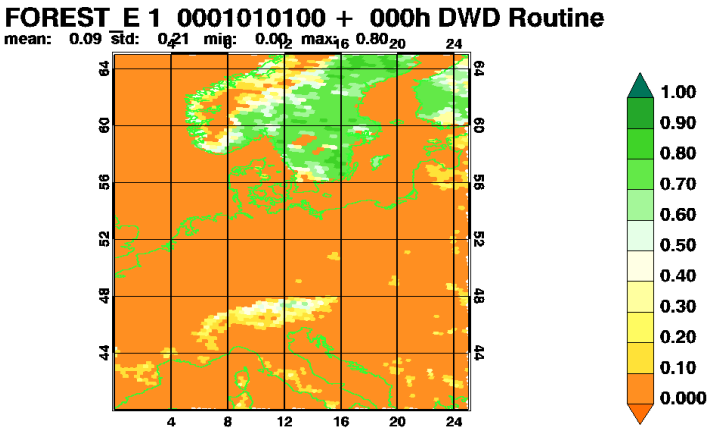


GLCC USGS land use / land cover system

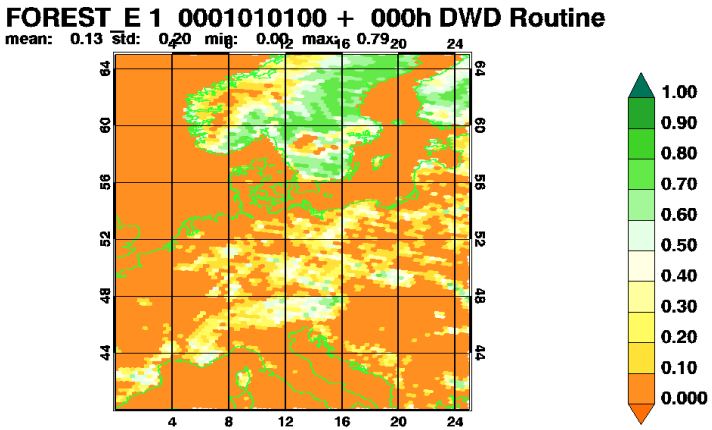


Evergreen Forest: GLC2000 vs. GLCC

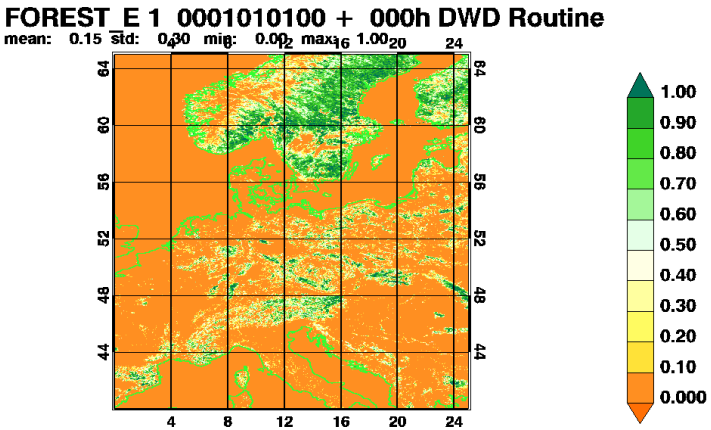
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



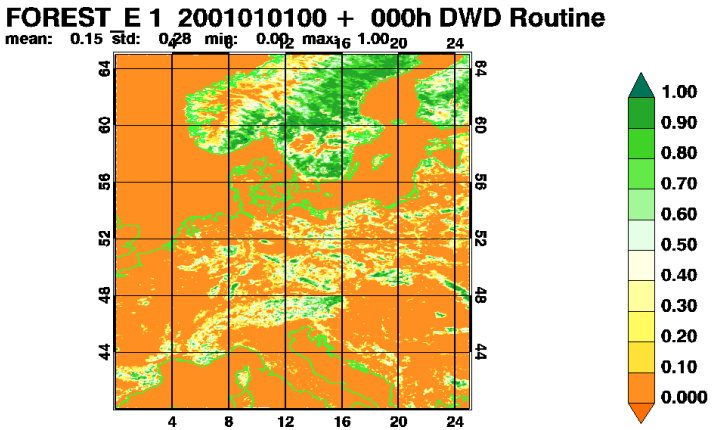
GME ni 256 based on GLCC



GME ni 256 based on GLC2000



COSMO-DE based on GLC2000



COSMO-EU based on GLC2000

Icon grid

- The grid is based on refinements of the icosahedron
- triangular grid (red lines)
- corresponding „dual grid“ forms hexagons and 12 pentagons at the corners of the icosahedron (blue lines, used in GME)