

Using the best available physiography to improve weather forecasts

Guðrún Nína Petersen

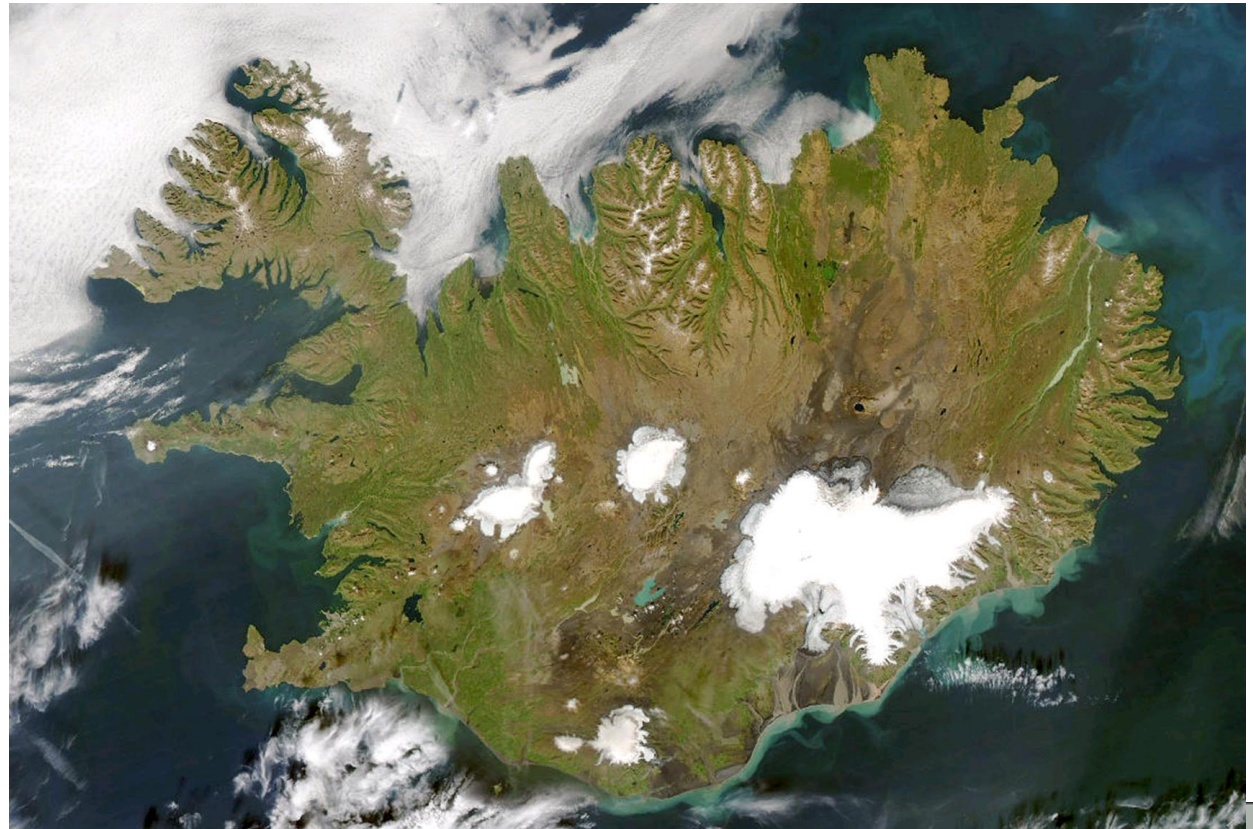
Bolli Pálmason

Sigurður Thorsteinsson

Nikolai Nawri

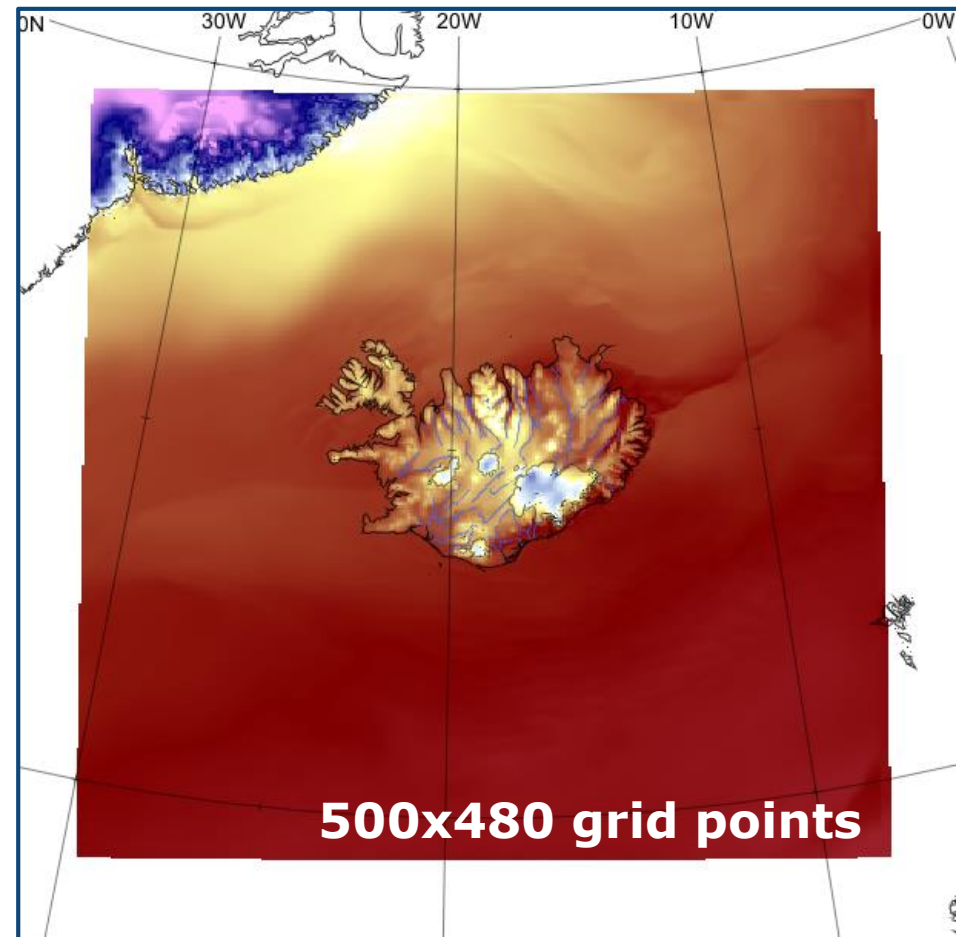
When it comes to data on local initial conditions it is worth checking if national data bases are an improvement to the global ones!

Icelandic nature is in many ways unique due to northerly location, sparse vegetation and volcanic soil.



Operational NWP: HARMONIE-AROME (38h1.2)

- ✓ **Non-hydrostatic limited area model**
- ✓ **2.5 km horizontal resolution**
- ✓ **65 vertical layers**
- ✓ **Surface modelling: SURFEX**
- ✓ **Coupled hourly to ECMWF boundary data**
- ✓ **4 runs a day for 66 hours**



- ✓ **Physiographic data generates the model domain's:**
 - ✓ Topography
 - ✓ Surface types: sea, lake, town, nature (glaciers, forests, bare land etc.)
 - ✓ Soil characteristics: sand, clay, root depth etc.

- ✓ **Three databases used:**
 - ✓ GMTED2010: 250 m resolution
(Earlier GTOPO30: 30 arc sec grid spacing (~1 km resolution))
 - ✓ FAO/HSWD: Global databases for soil parameters
(sand/clay content)
 - ✓ ECOCLIMAP-I/II: Global database of land surface parameters

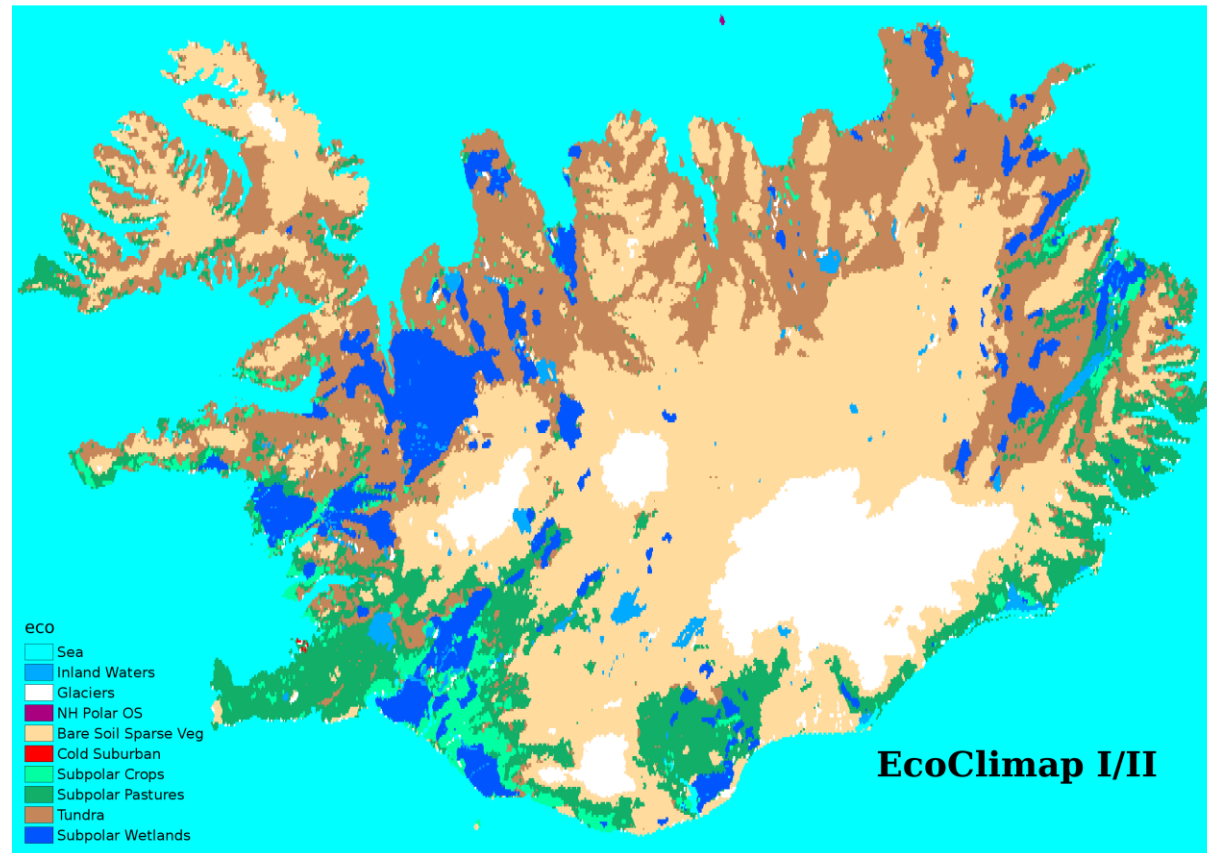
- ✓ **ECOCLIMAP is a global database of surface parameters**
- ✓ **A land cover map at 1 km resolution in lat-lon projection**
- ✓ **Fully coupled to SURFEX**

- ✓ **ECOCLIMAP I: global (215 covers)**
- ✓ **ECOCLIMAP II: Europe (except Iceland) (273 covers)**

- ✓ **10-day period surface parameters: LAI, vegetation fraction, roughness length, greenness fraction,**
- ✓ **Constant surface parameters: Visible/NIR/UV albedos, minimum stomatal resistance...**

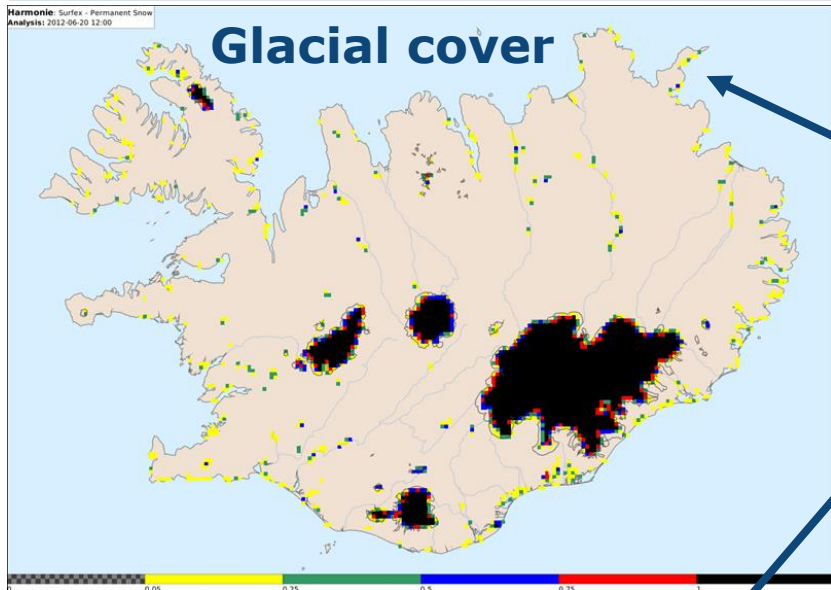
ECOCLIMAP I/II for Iceland

- ✓ **9 covers**
- ✓ **Errors in**
 - ✓ Glacier cover
 - ✓ Vegetation fraction
 - ✓ Leaf area index (LAI)
 - ✓ Soil thickness
 - ✓ Soil properties
 - ✓ Albedo



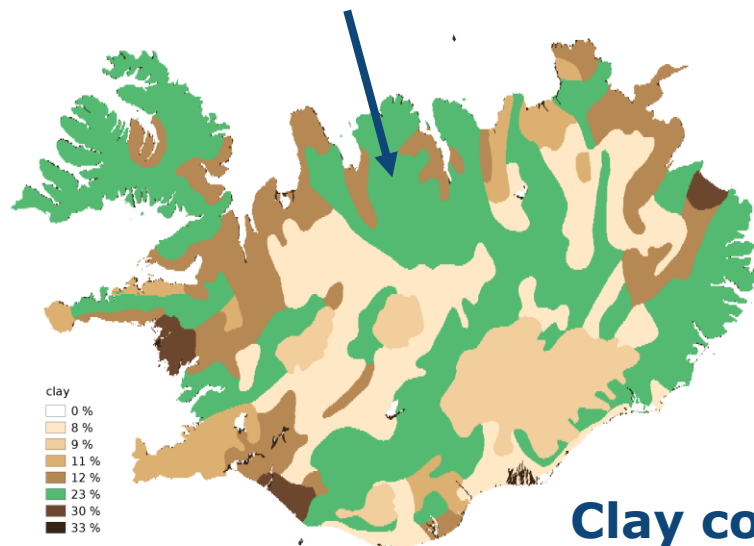
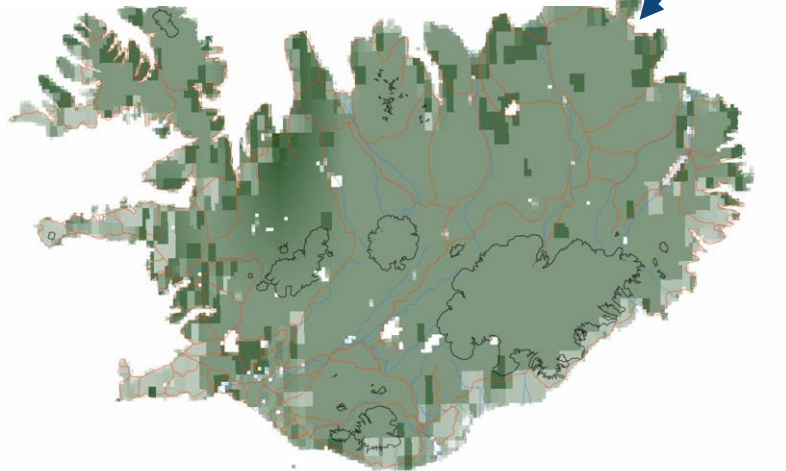
Some very obvious!

Errors clear to the "local ey"



- ✓ Some errors in the orography
- ✓ Fictional glacier cover by the coast and along rivers
- ✓ Vegetation fraction far from what locals would recognise
- ✓ The pattern of clay and sand content of the soil unrecognised by national soil experts!

Vegetation fraction



Clay content

There was a clear motivation to update the PDG!

- ✓ **Topography updated with local DEM from National Land Survey of Iceland**
- ✓ **Expertise sought at the Agricultural University of Iceland (AUI)**
- ✓ **Available data bases:**

For land cover

- ✓ Corine 2006 (later updated to Corine 2012)
- ✓ The AUI soil map – best classification of bare land
- ✓ The AUI farmland data base – best classification of vegetated land

For properties of land-cover types

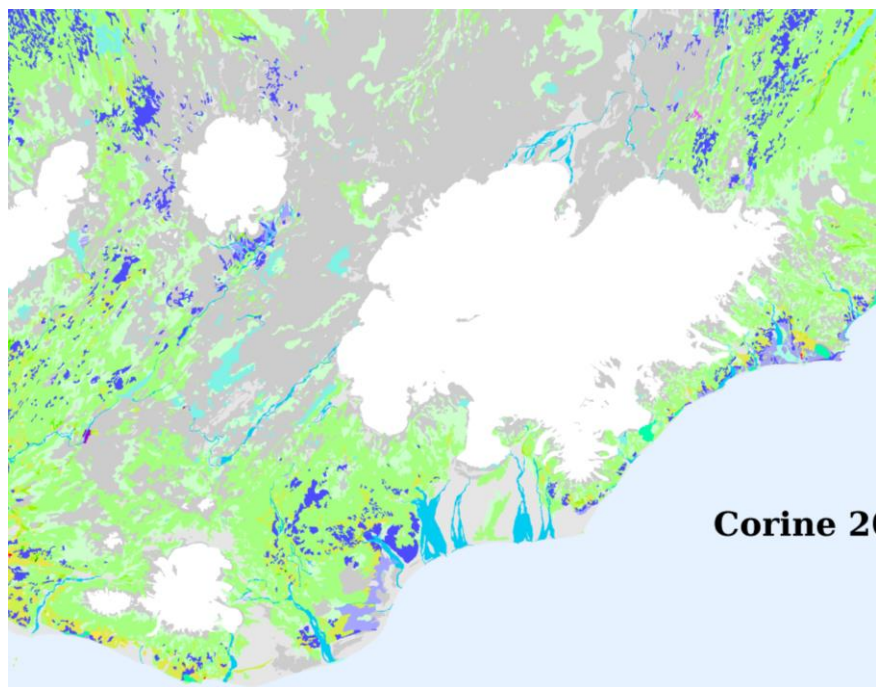
- ✓ MODIS LAI and albedo products

For soil properties (sand/clay content):

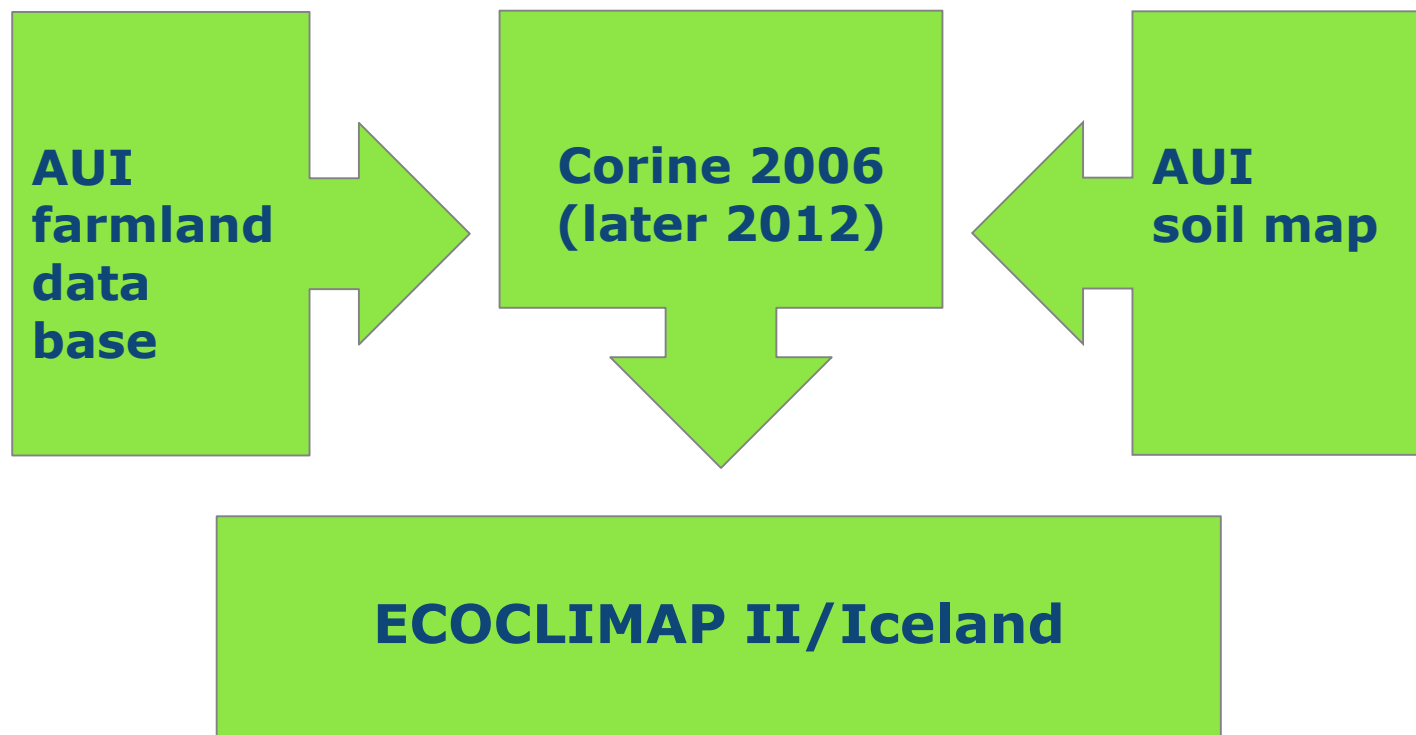
- ✓ Expert advice from AUI

Corine 2006 – good enough for the purpose?

- ✓ **Corine 2006: Most of the highlands in one category – bare rock**
- ✓ **Reality is a bit more complex with (volcanic) rock, sand, gravel and volcanic pumice**
- ✓ **Different albedo (also most Icelandic sand is dark)**



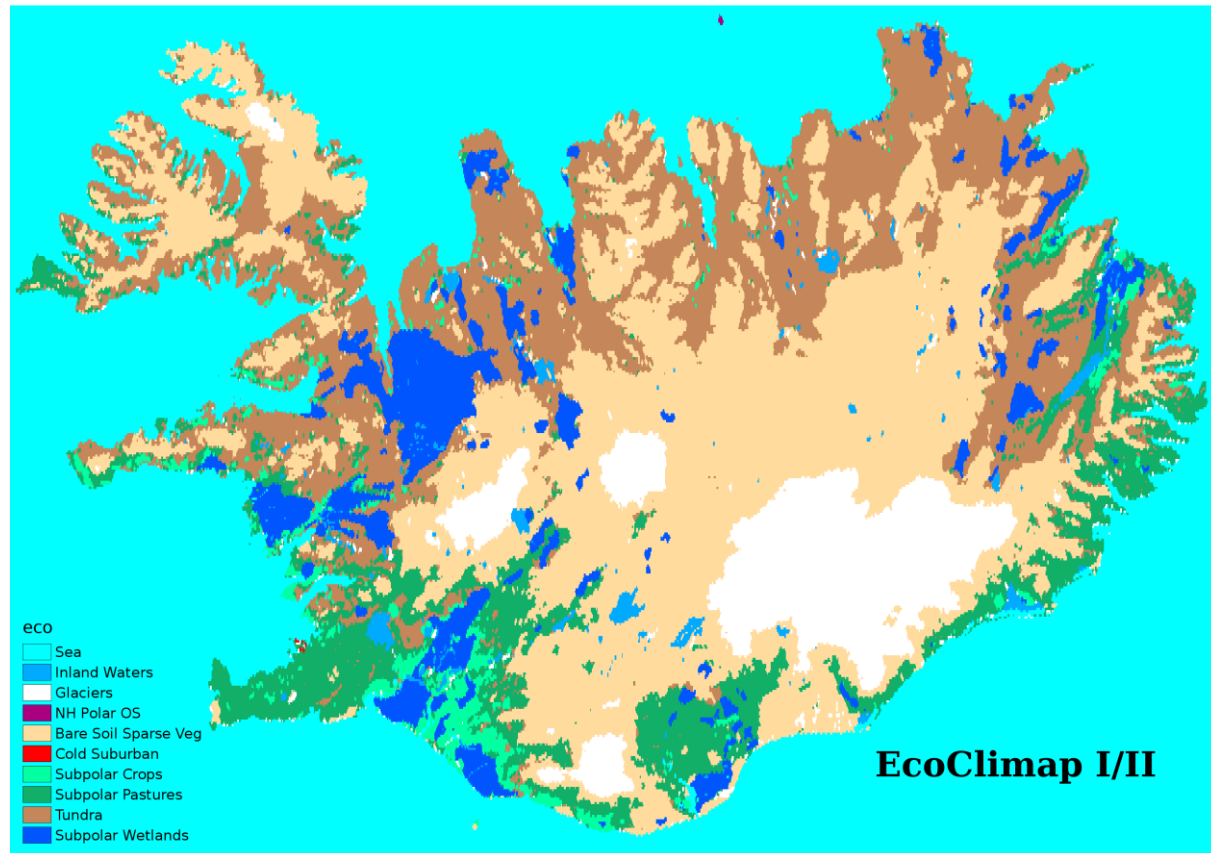
Best result when combining the data available!



- ✓ **ECOCLIMAP I:**
 - 9 land cover types
 - 1 km resolution

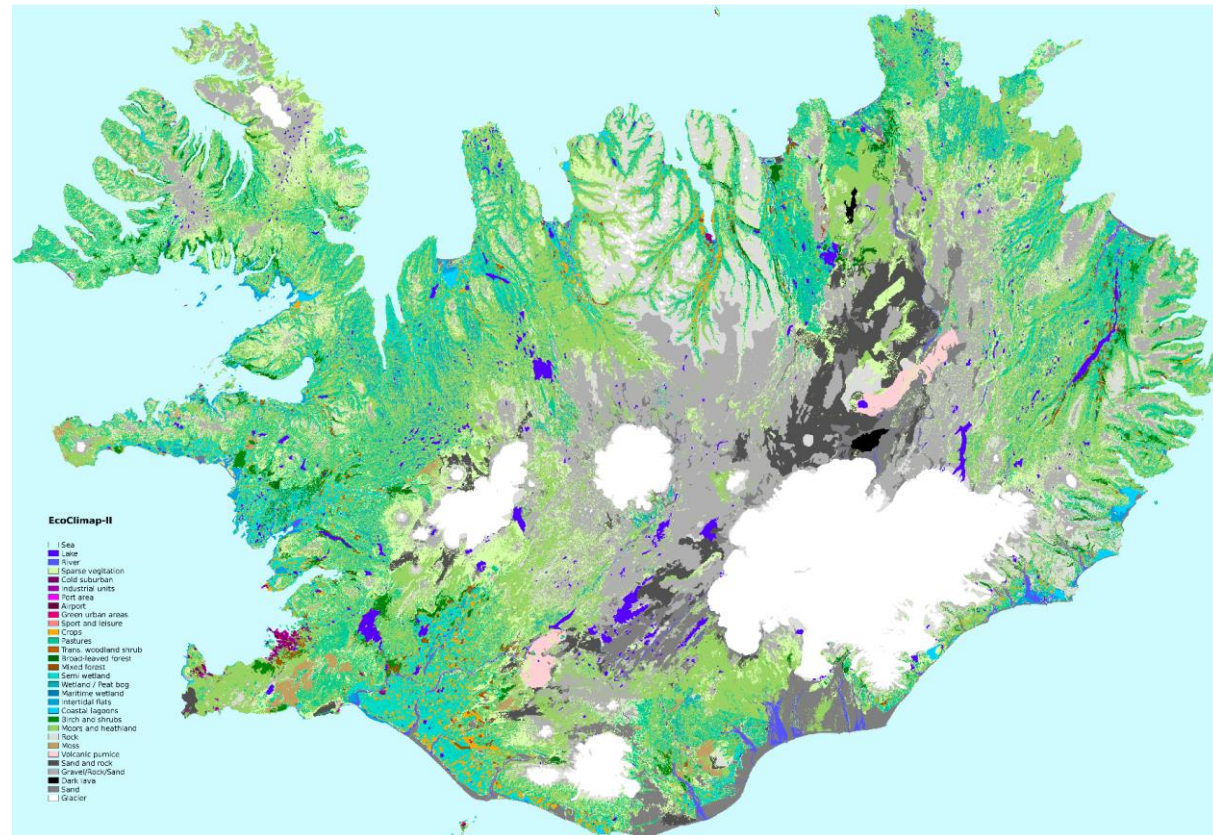


- ✓ **ECOCLIMAP II/Iceland:**
 - 29 land cover types
 - 100 m resolution
 - Sand is (mainly) black



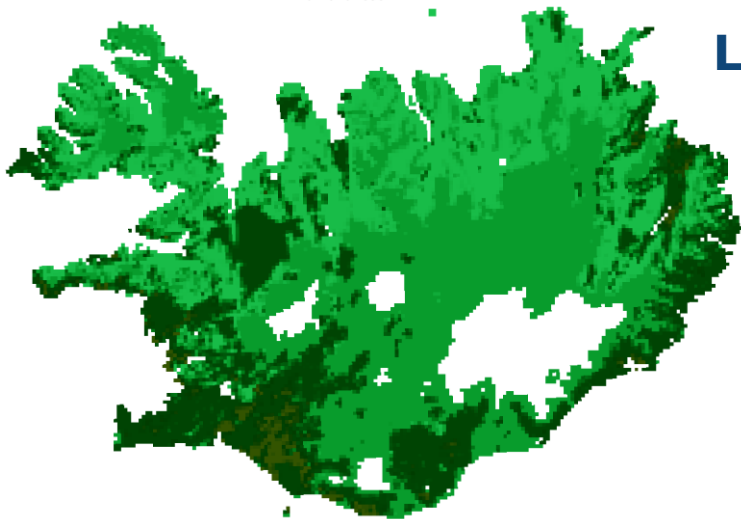
- ✓ **ECOCLIMAP I:**
 - 9 land cover types
 - 1 km resolution

- ✓ **ECOCLIMAP II/Iceland:**
 - 29 land cover types
 - 100 m resolution
 - Sand is (mainly) dark



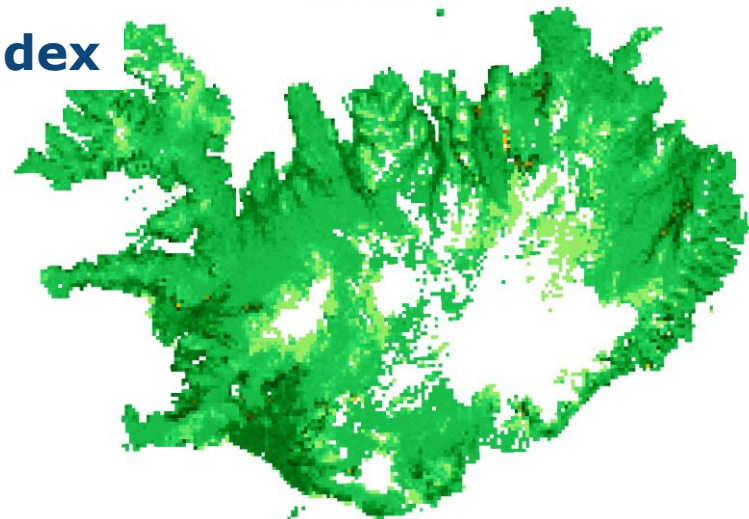
Old vs New

Harmonie ECOCLIMAP-I LAI

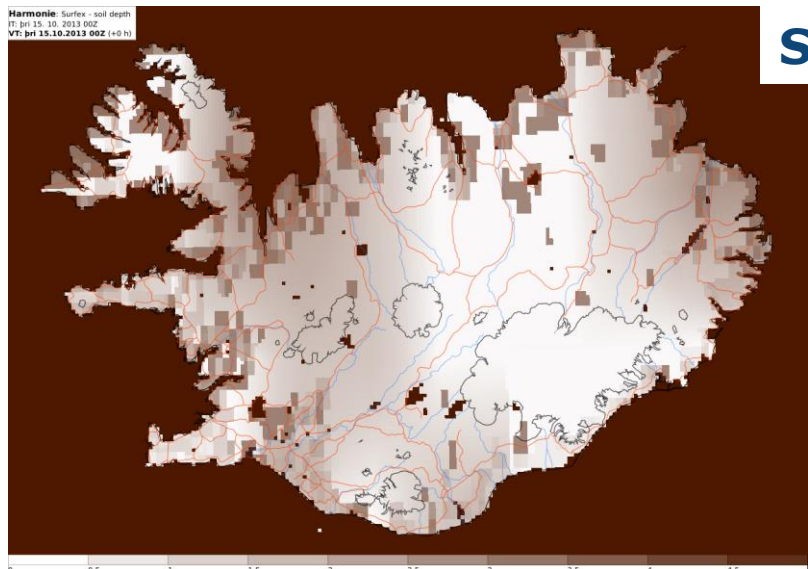


Leaf area index

Harmonie ECOCLIMAP-II LAI

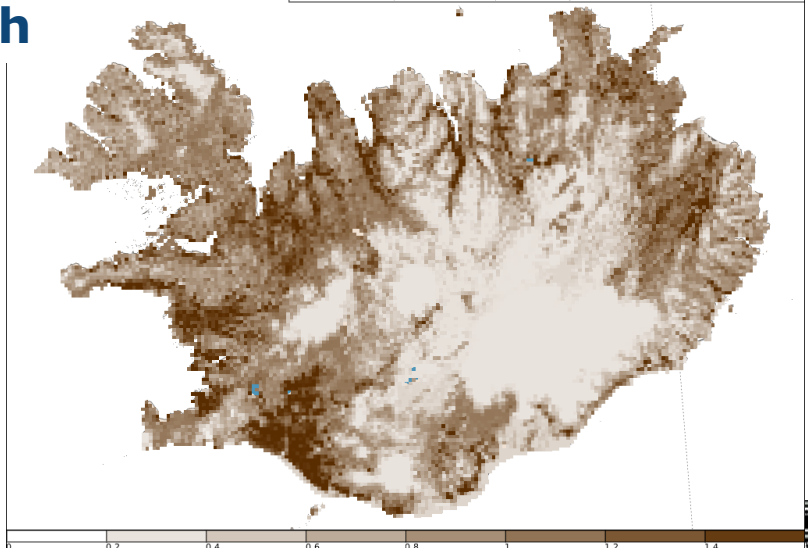


Harmonie Surfex - soil depth
IT: Fri 15. 10. 2013 00Z
VT: pri 15.10.2013 00Z (+0 h)

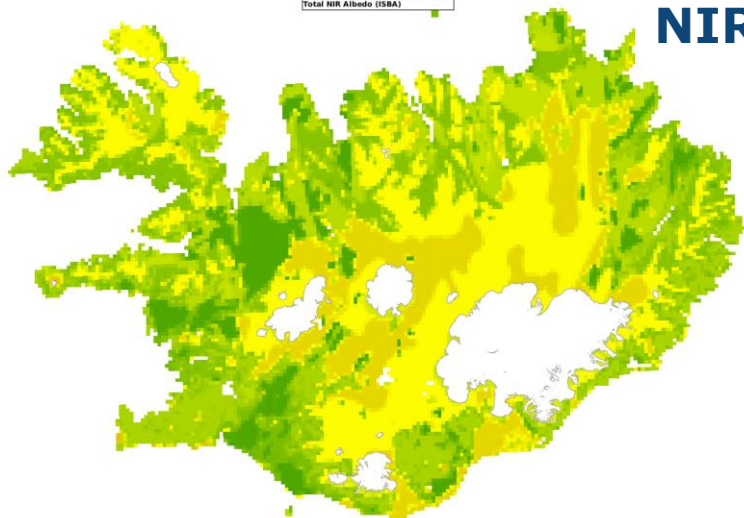


Soil depth

USER [centre=233/255 process=38]GRIB Temperature anomaly/300m/15.08.2014 00:00->15.08.2014 03:00 (+3h)

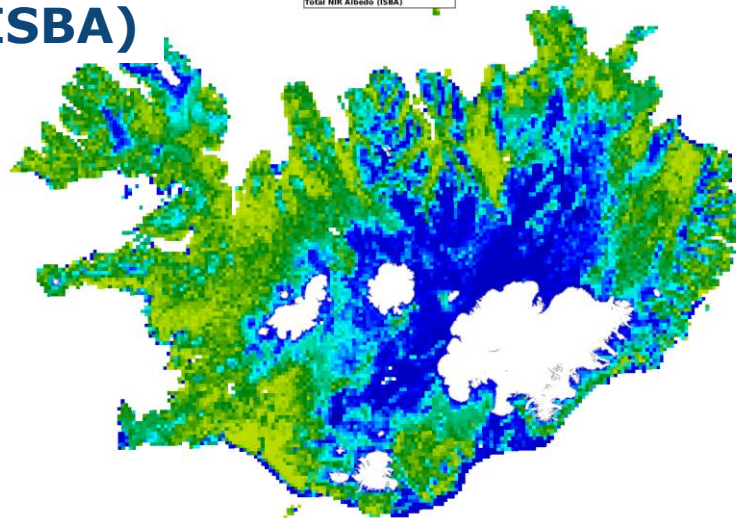


Harmonie 38h1.2 (old EcoClimap2)
Total NIR Albedo (ISBA)

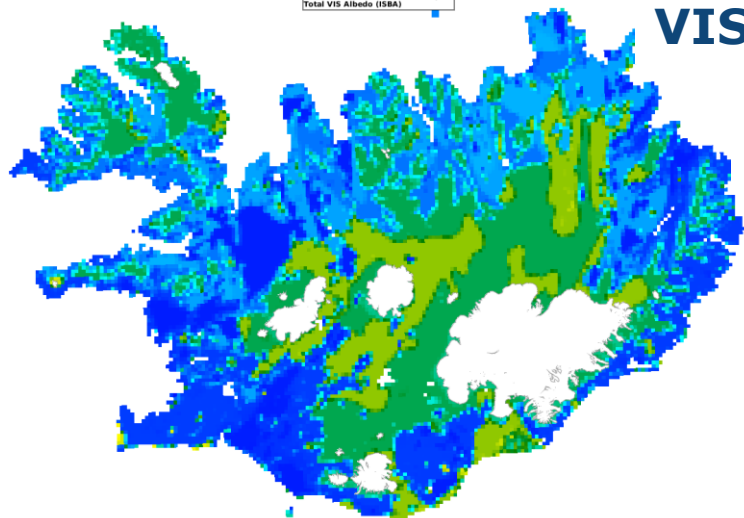


NIR albedo (ISBA)

Harmonie 38h1.2 (new EcoClimap2)
Total NIR Albedo (ISBA)

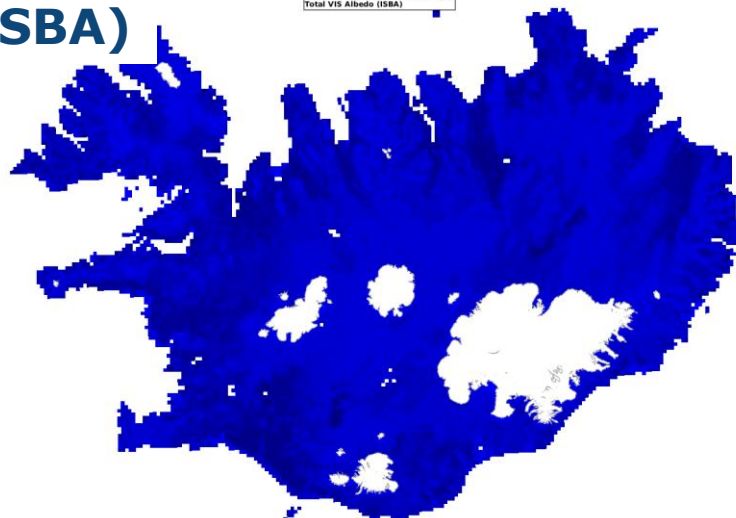


Harmonie 38h1.2 (old EcoClimap2)
Total VIS Albedo (ISBA)



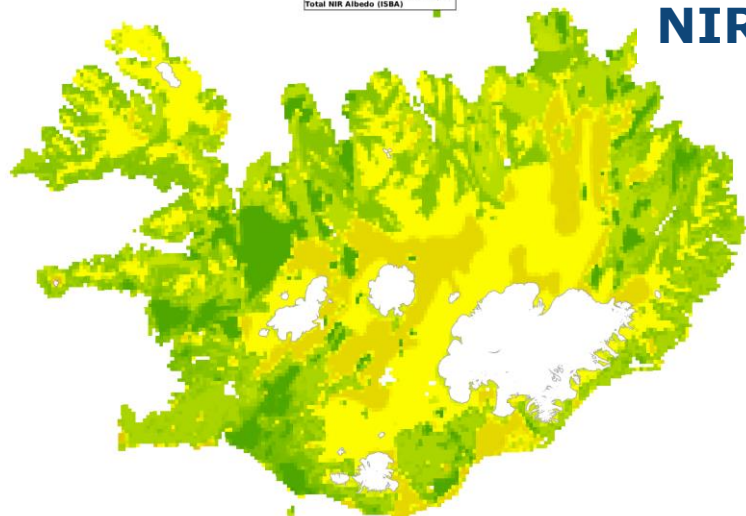
VIS albedo (ISBA)

Harmonie 38h1.2 (new EcoClimap2)
Total VIS Albedo (ISBA)

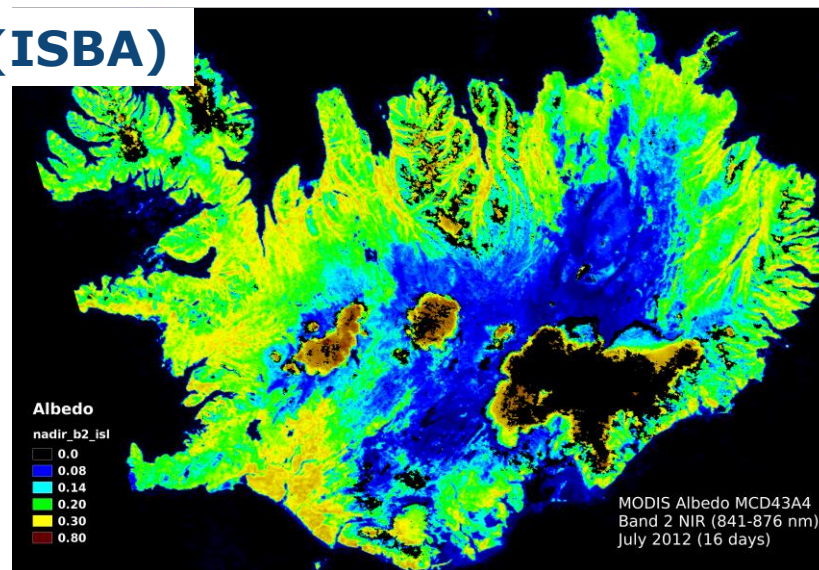


Old vs MODIS

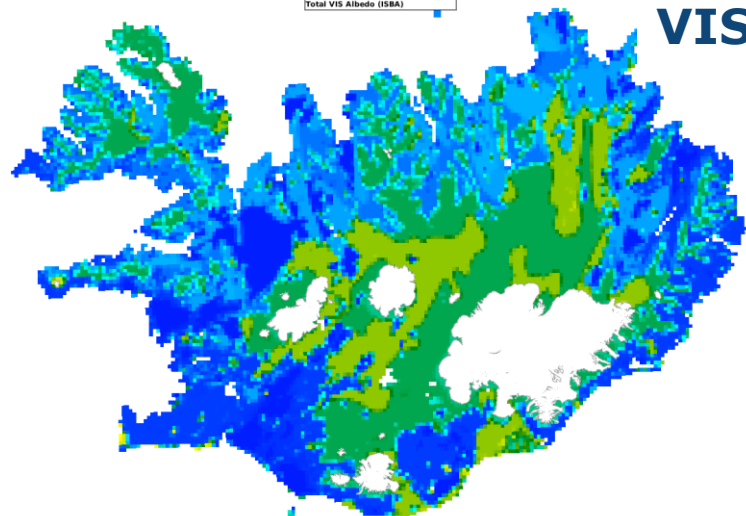
Harmonie 38N1.2 (old EcoClimap2)
Total NIR Albedo (ISBA)



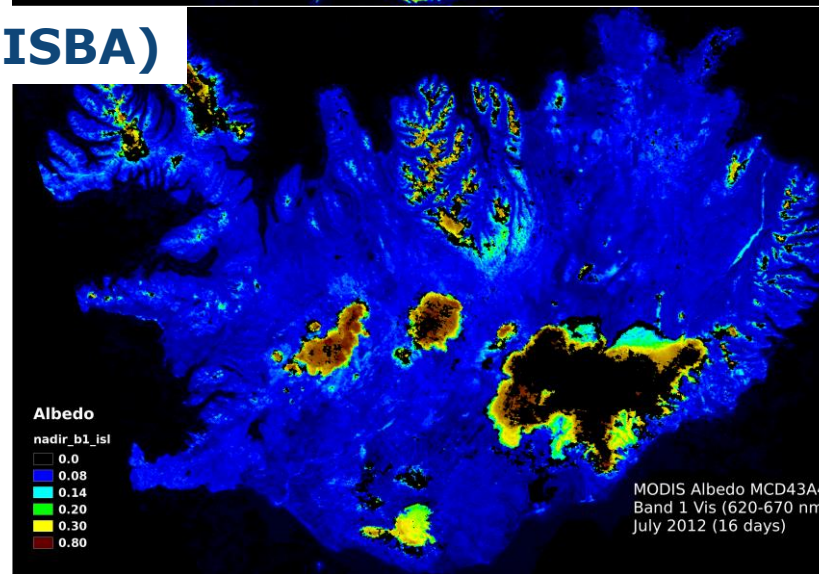
NIR albedo (ISBA)



Harmonie 38N1.2 (old EcoClimap2)
Total VIS Albedo (ISBA)

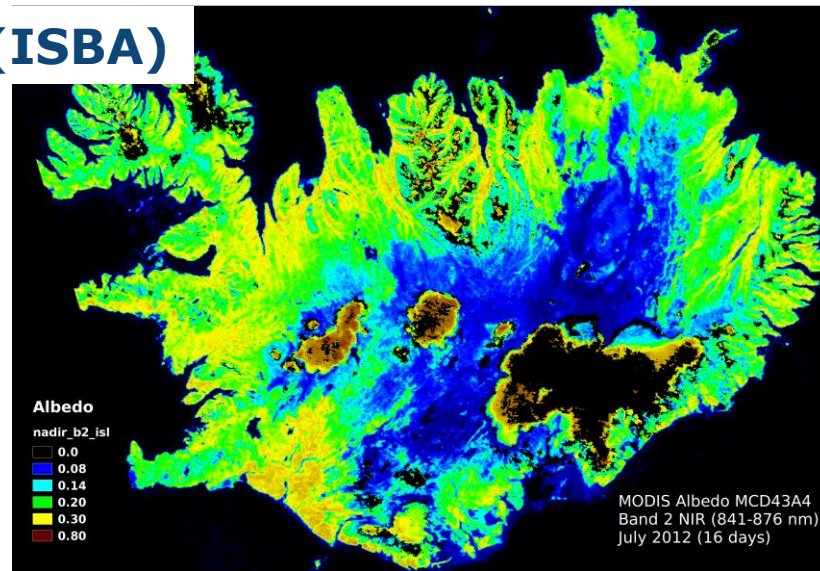
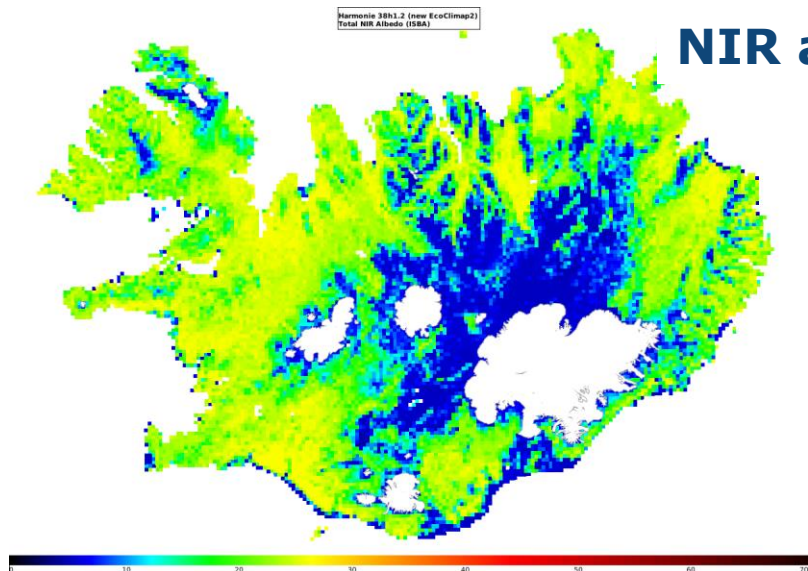


VIS albedo (ISBA)

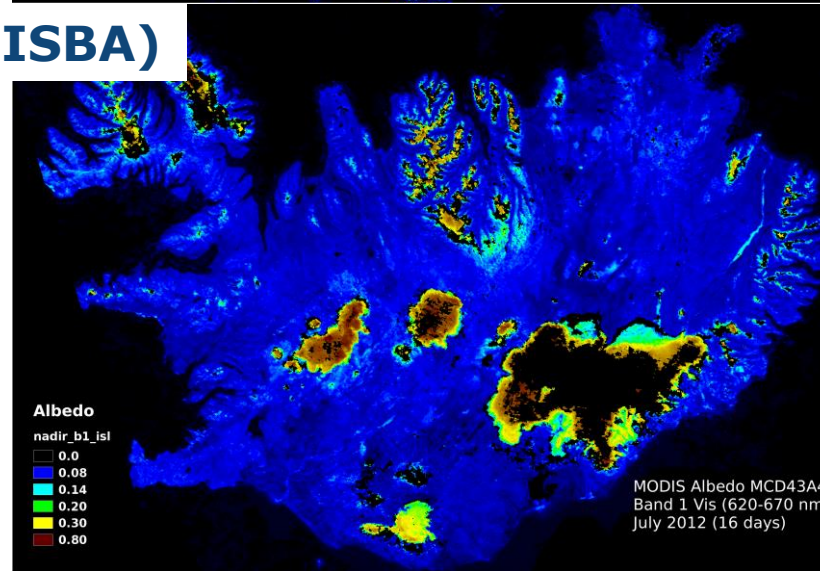
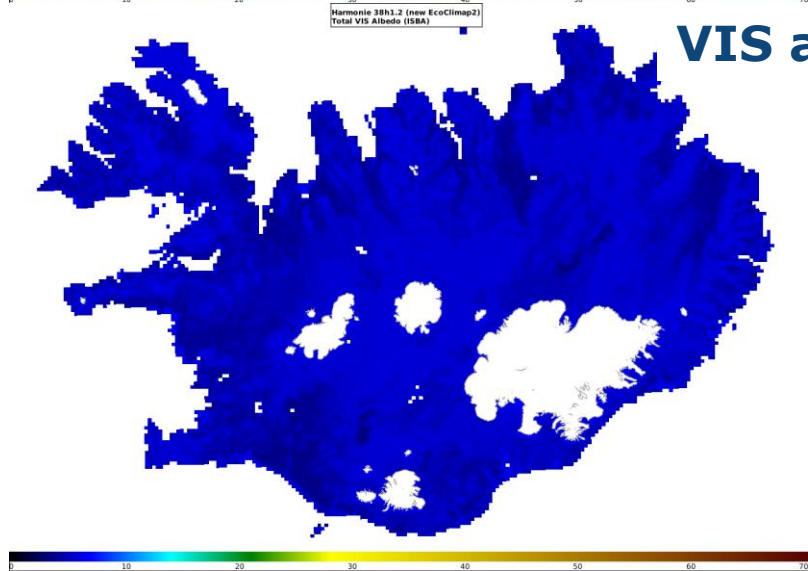


New vs MODIS

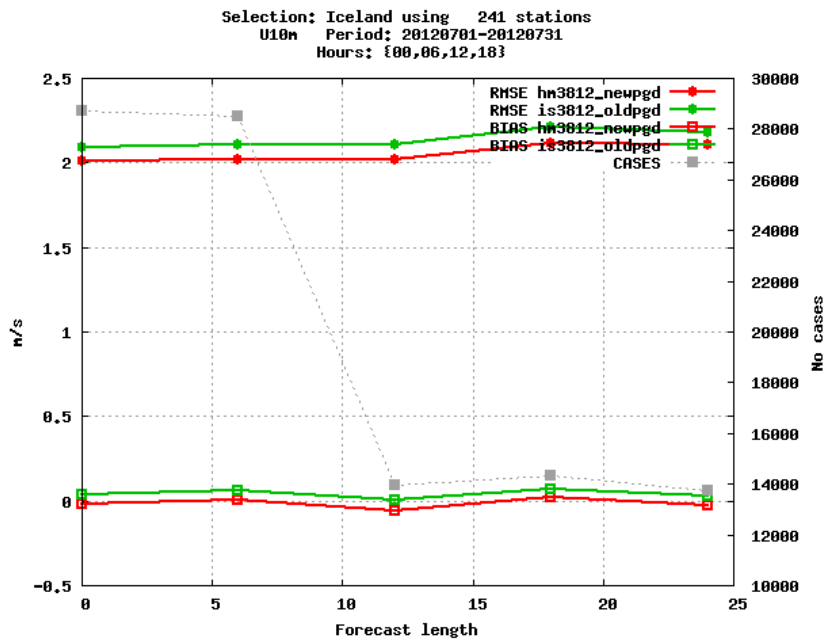
NIR albedo (ISBA)



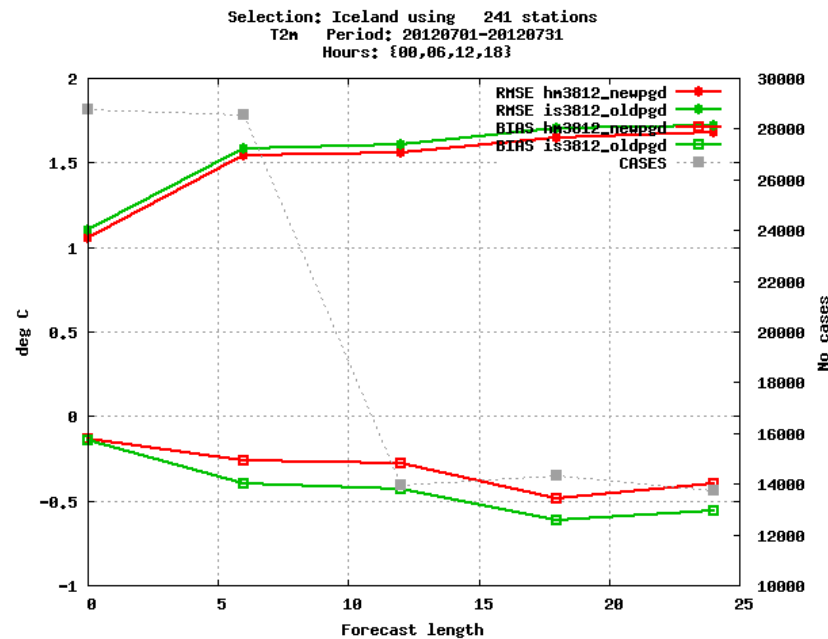
VIS albedo (ISBA)



Improvement in all key parameters, especially in summer



10-metre wind speed (m/s)



2-metre temperature (°C)

A more correct PGD means that related forecast errors are minimised

Other errors remain....

Conclusions

- ✓ An investigation of the physiographic data used to initialise the topography, surface types and soil characteristics of the global ECOCLIMAP I/II showed huge inconsistencies for Iceland
- ✓ It has now been updated using the state-of-the-art national databases (a LOT of help from the Agricultural University of Iceland!)

✓ Lessons learned:

- ✓ Make time to familiarise yourself with all boundary data of your system
- ✓ Get help and advice from national experts
- ✓ National data may often improve on global datasets

ecoclimapll-v5



Thank you

ecoclimapll-v5

- Sea
- Lake
- River
- Sparse vegetation
- Cold suburban
- Industrial units
- Port area
- Airport
- Green urban areas
- Sport and leisure
- Crops
- Pastures
- Trans. woodland shrub
- Broad-leaved forest
- Mixed forest
- Semi wetland
- Wetland / Peat bog
- Maritime wetland
- Intertidal flats
- Coastal lagoons
- Birch and shrubs
- Moors and heathland
- Rock
- Moss
- Volcanic pumice
- Sand and rock
- Gravel/Rock/Sand
- Sand
- Glacier

