

Veðurstofa Íslands



Harmonie

Sumarþing Veðurfræðifélagsins
2013

Bolli Pálmason



SRNWP Consortia in Europe



ALADIN

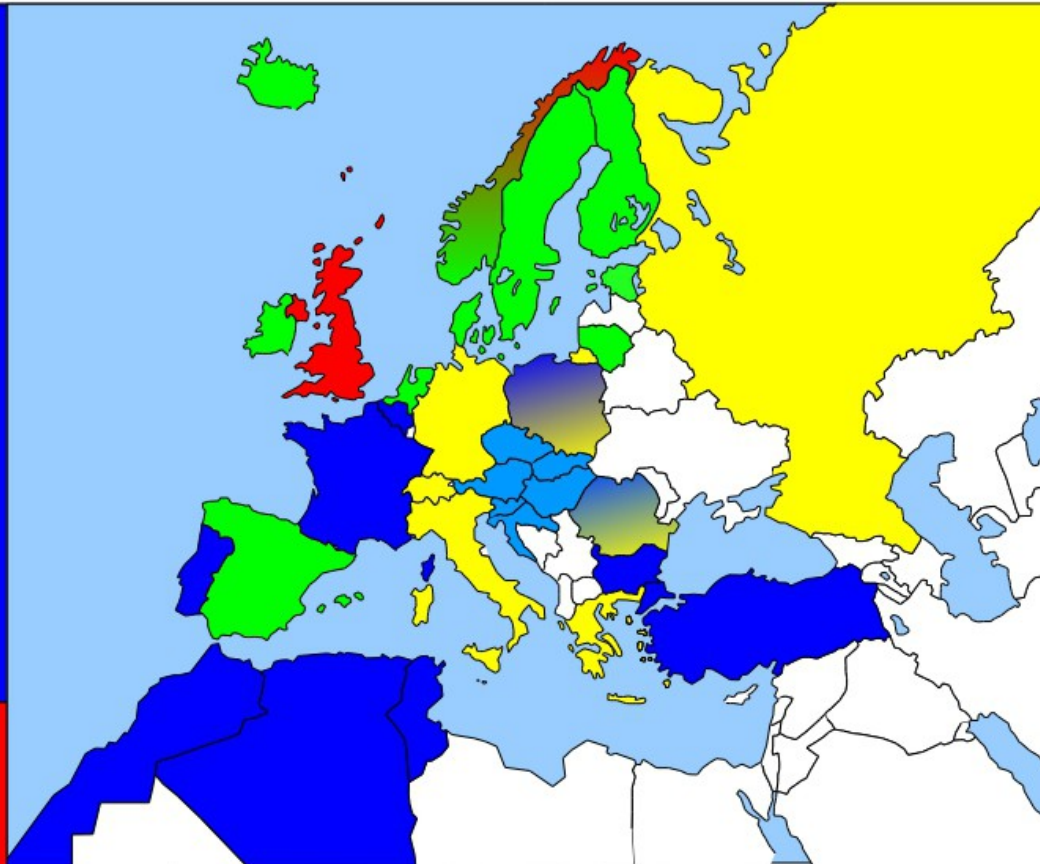
Algeria
Belgium
Bulgaria
France
Morocco
Poland
Portugal
Tunisia
Turkey

Austria
Croatia
Czech Rep.
Hungary
Romania
Slovakia
Slovenia



UKMO

United Kingdom
Norway



HIRLAM

Denmark
Estonia
Finland
Iceland
Ireland
Lithuania
Netherlands
Norway
Spain
Sweden

COSMO

Germany
Greece
Italy
Poland
Romania
Russia
Switzerland



Aflfræði:

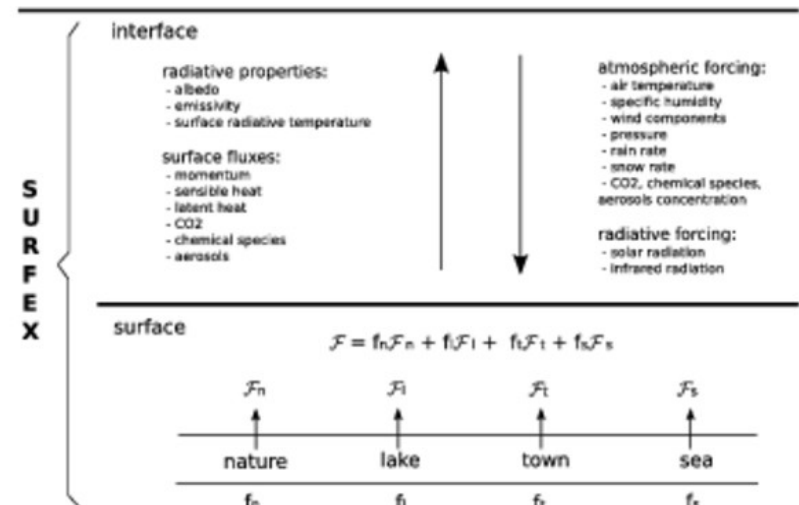
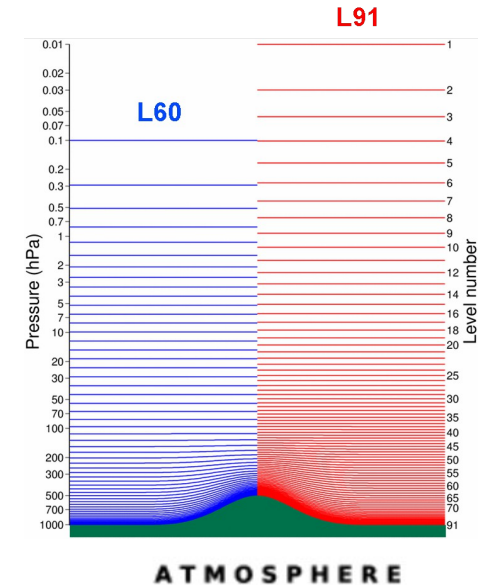
- Flotjafnvægi (hydrostatic)
- Án flotjafnvægis (non-hydrostatic)

Eðlisfræði:

- Arome (nh – 2.5 km)
- Alaro (nh/h – ca. 5 km)
- Aladin (h – ca. 10 km)

Yfirborð:

- Surfex (Météo-France)
- Sér líkan, hægt að keyra sjálfstætt
- “Samskipti” við lofthjúpin í gegnum neðsta líkanaflötin (11m hæð)
- 2m hiti, raki, 10m vindur o.fl. kemur í Surfex
- Gagnaaðlögunin gerist í Surfex (Einnig í lofthjúpinum ef 3DVAR er notað)
- Viðheldur snjómaginu milli keyrslna



Operational HARMONIE (AROME) DOMAINS

AEMET

DMI

FMI

Met Eirann

met.no

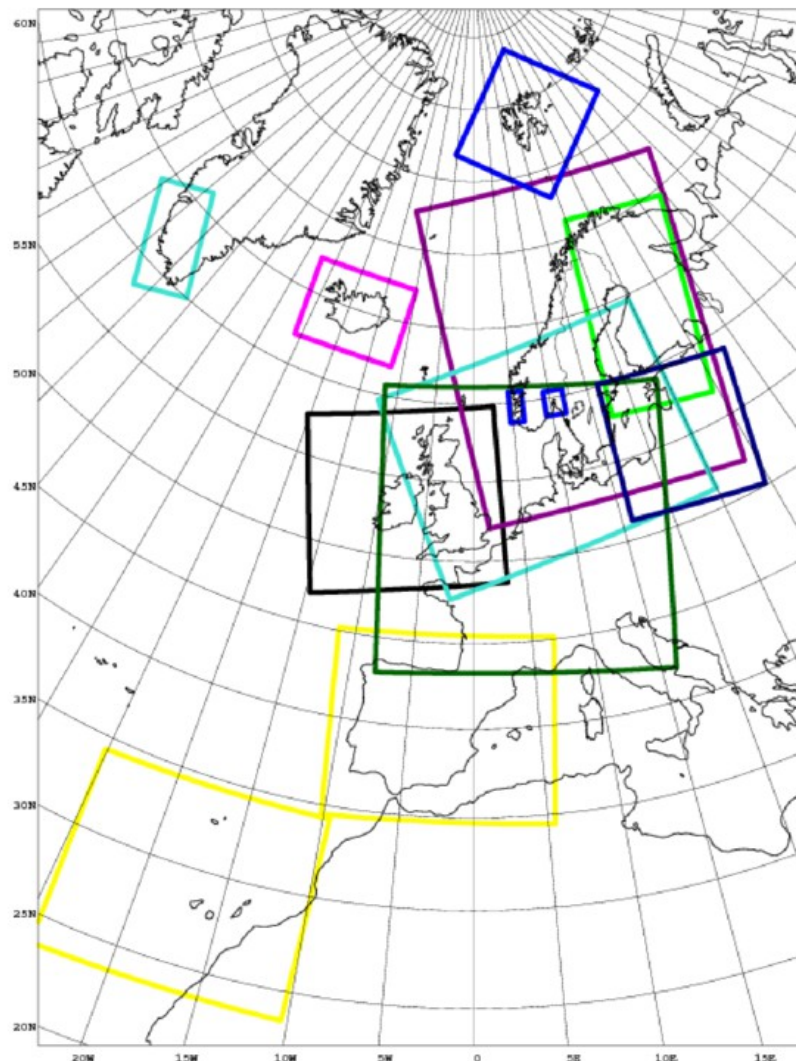
MetCoOp

IMO

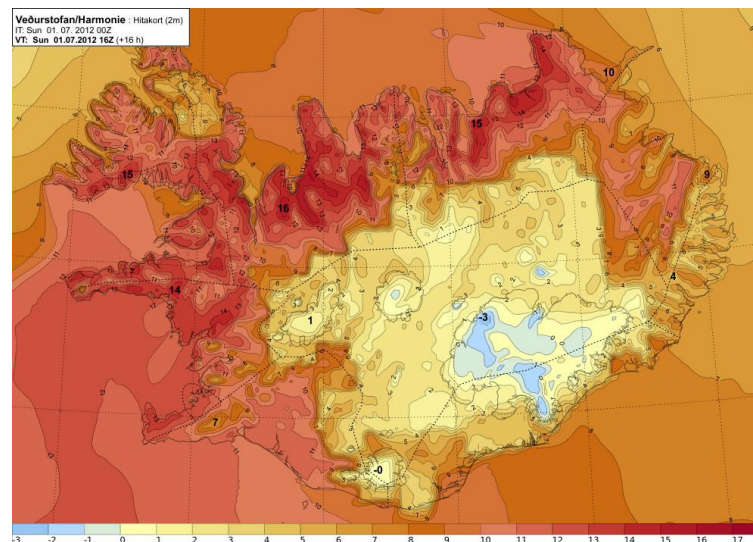
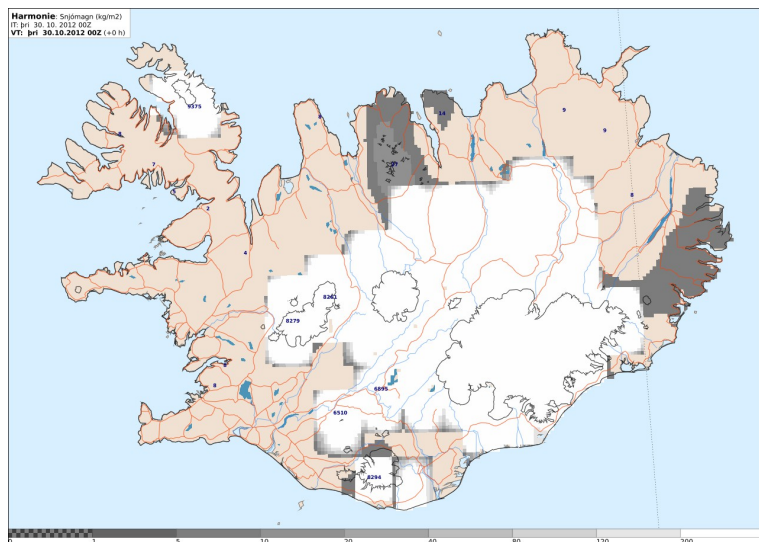
LHMS

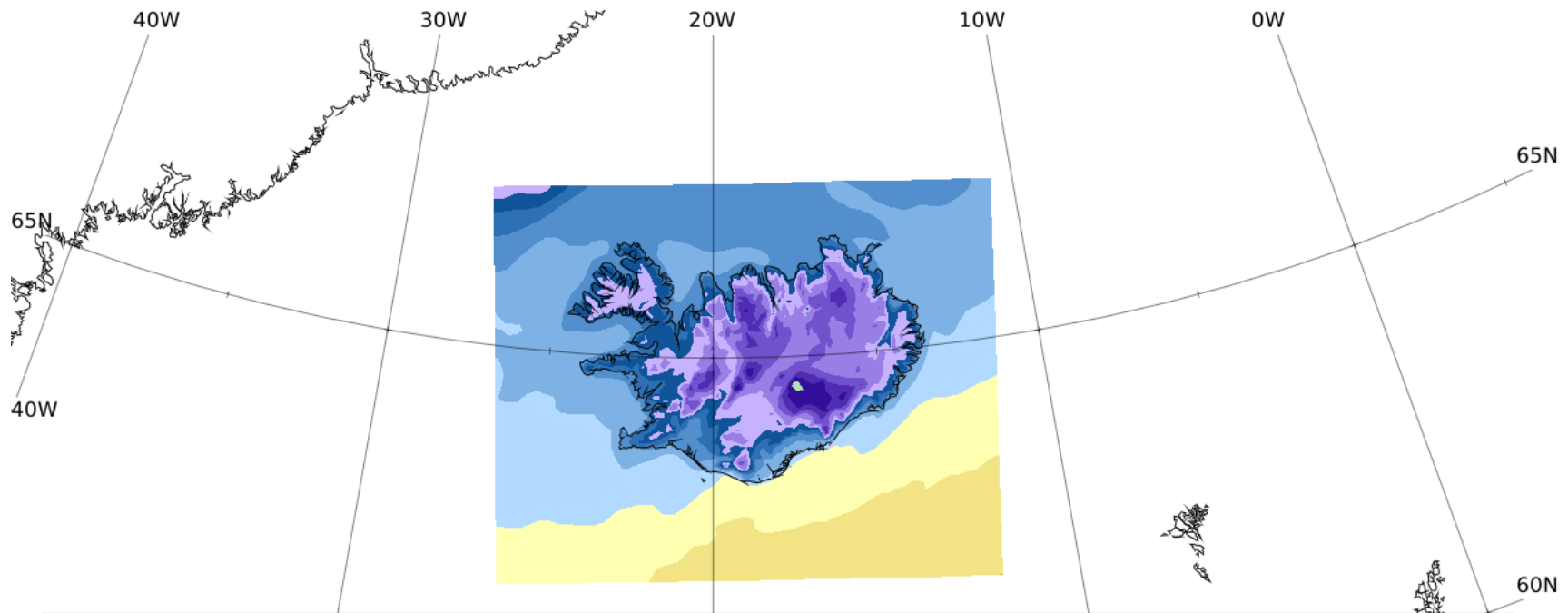
SMHI

KNMI



- 9. mars 2011: Skrifað undir samning milli VÍ og ECMWF, gerðumst þar með fullgildir meðlimir og aðgangur opnast að ofurtölvum
- 1. sept. 2011: Reglulegar tilraunakeyrslur hefjast. Harmonie útg. 36h1.4. Án gagnaaðlögunar (data assimilation). Keyrt á ecgate/c1a ofurtölvu ECMWF. Fjórum sinnum á sólarhring 48 klst spár
- 27. sept. 2012: Uppfært í útg. 37h1.1 og gagnaaðlögun fyrir yfirborð gert virkt með takmörkuðum fjölda íslenskra mælistöðva. Líkanið hitað upp frá 8.9 kl. 00. Hinum fræga ECMWF jökli hent út, allur snjór tekinn af landinu
- 13. okt. 2012: Allar mælistöðvar settar inn, ca 230 stöðvar notaðar í gagnaaðlögun. Ákveðið að sleppa snjódýptarmælingum.
- 20. jan. 2013: Uppfært í útg. 37h1.2 og byrjað að keyra á c2a, nýrri ofurtölvu ECMWF.



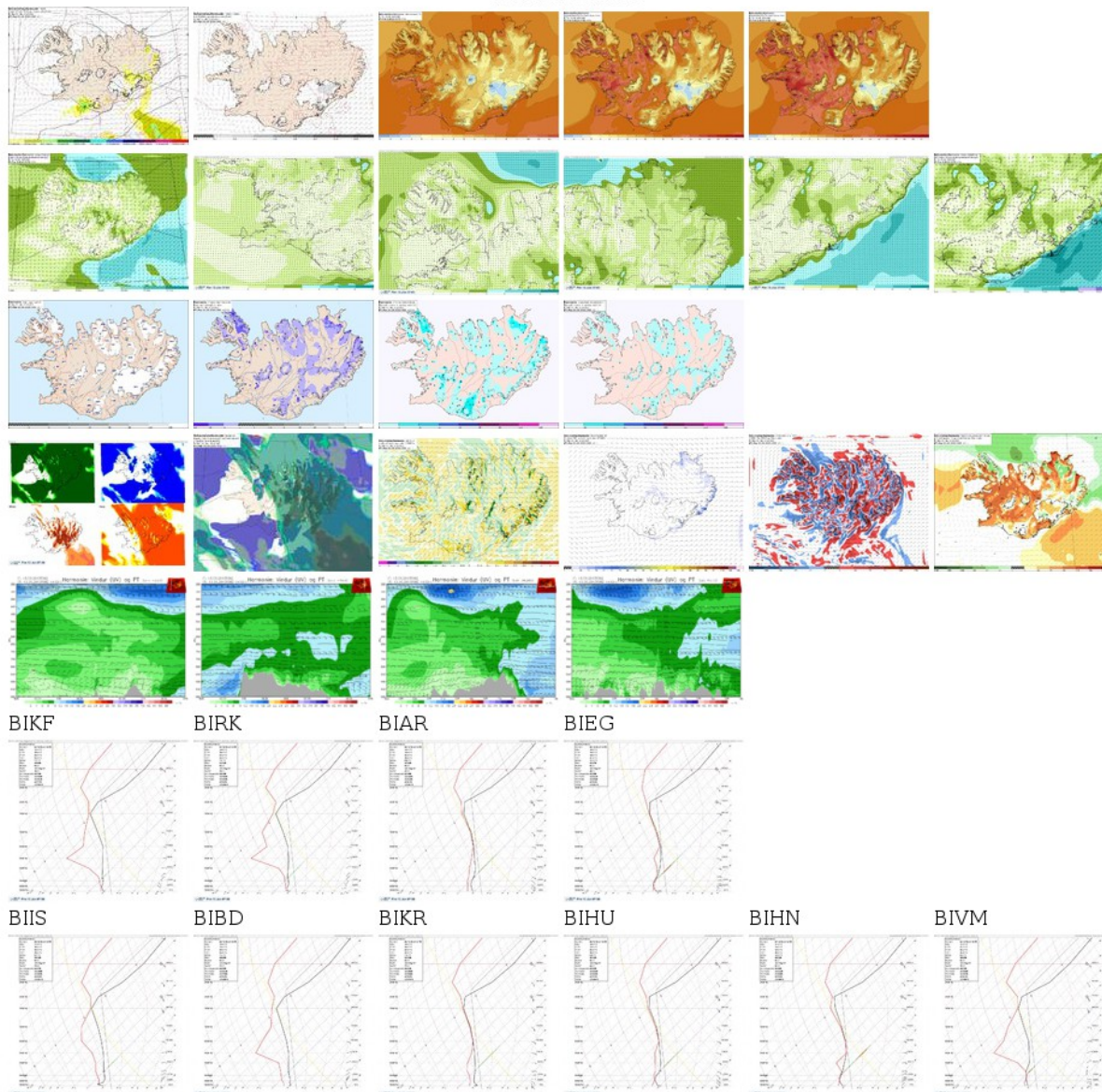


60 IMO Operational Harmonie Model
Version: 37h1.2 on the ECMWF ecgate/c2a platform
Domain: 300x240x65. Top at 10 hPa
Horizontal res.: 2.5 km. Coupled 3 hourly with ECMWF fc
Dynamics: Non-hydrostatic. Physics: Arome
Surface DA: Canari + OI_Main. Around 230 SYNOP obs.
Upper-Air DA: None. Run: 48h/4 times a day

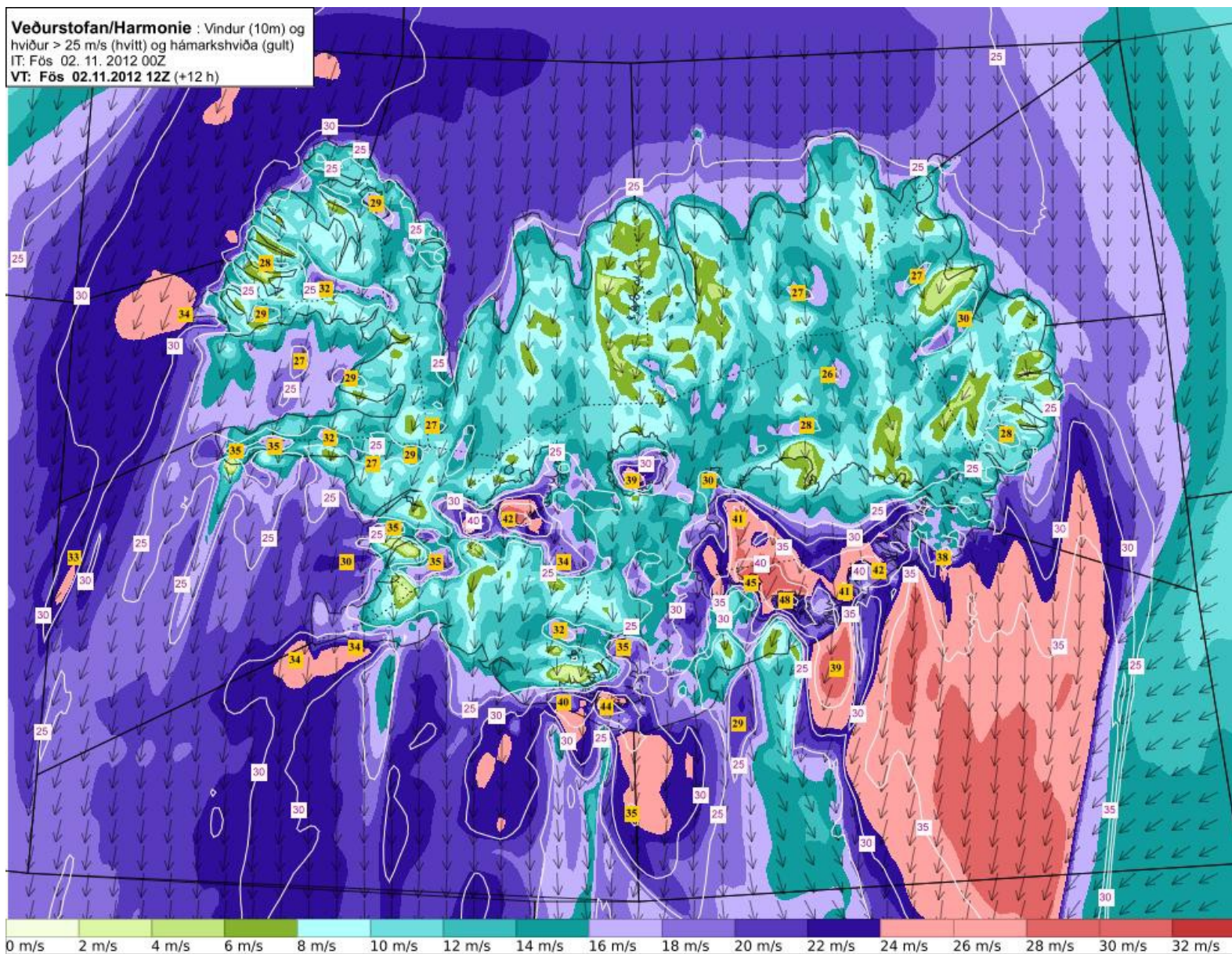
0W

Harmonie: Kortasafn á brunni

Líkan: harmonie



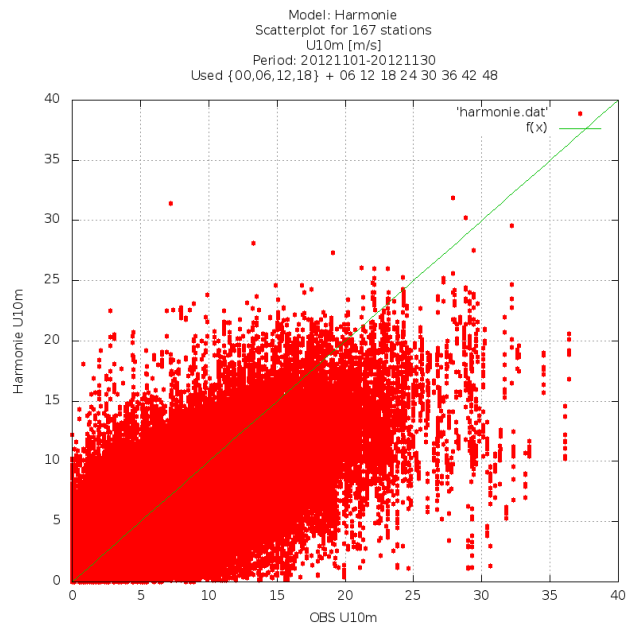
Harmonie: Vindur



Vindur: Samanburður við önnur líkön

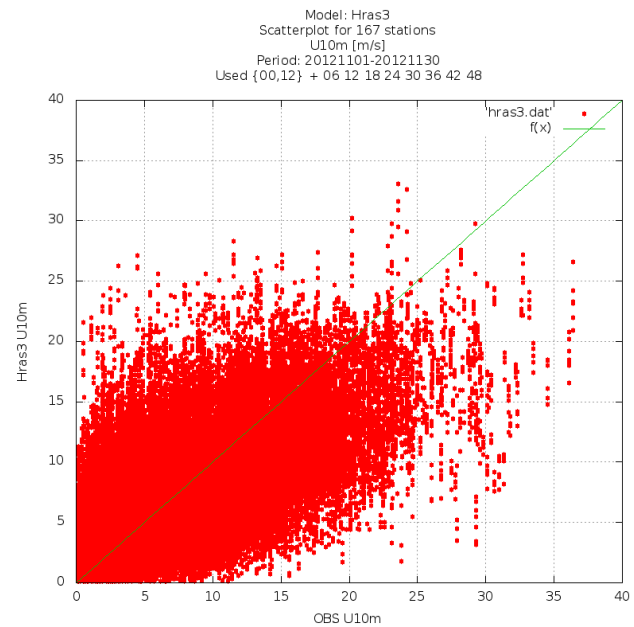
Harmonie

MAE: 2.79
RMSE: 3.88
BIAS: -1.52



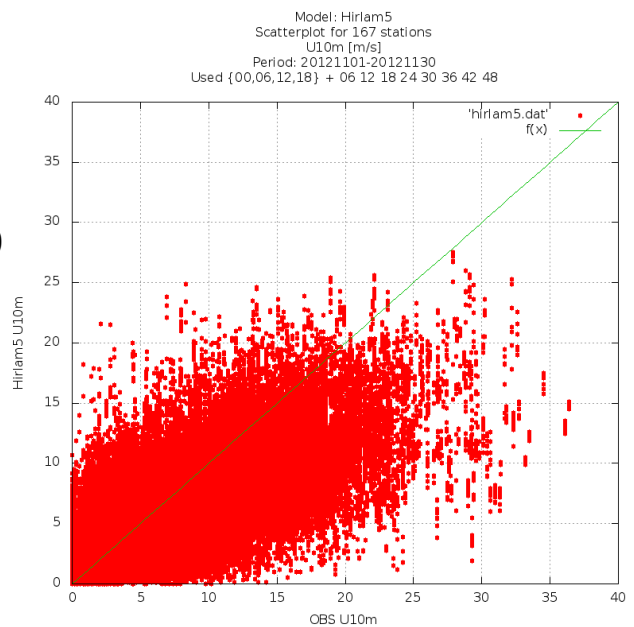
Hras3

MAE: 2.97
RMSE: 4.00
BIAS: -0.39



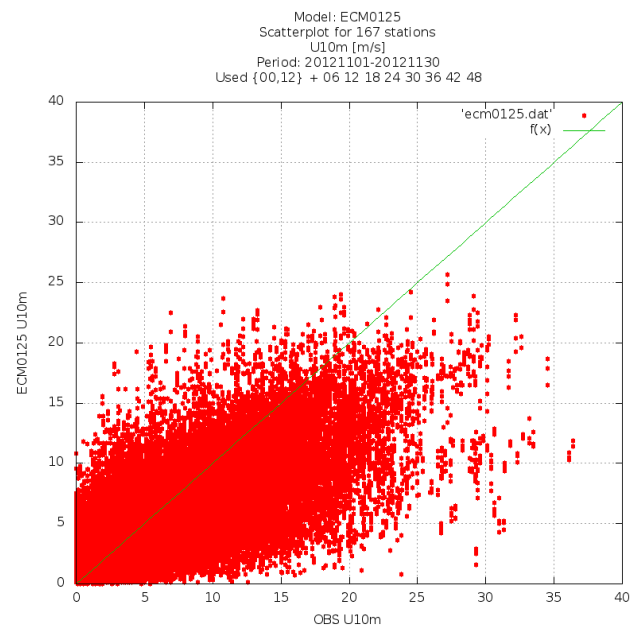
Hirlam5

MAE: 2.99
RMSE: 4.09
BIAS: -1.52



ECM0125

MAE: 3.04
RMSE: 4.21
BIAS: -1.58



Vindur: Drag formúla í Harmonie

$$\text{drag}_{Z01D} = \rho^2 \left(\frac{0.4}{\ln \frac{H}{Z_0}} \right)^2 U; \quad Z_0 = \min \left(Z_0, \frac{H}{XFRACD} \right)$$

Z_0 is orographic roughness length; ρ is density; U is wind speed. H is height of the atmospheric forcing level.

$XFRACD$ is chosen to minimize the bias and RMSE.

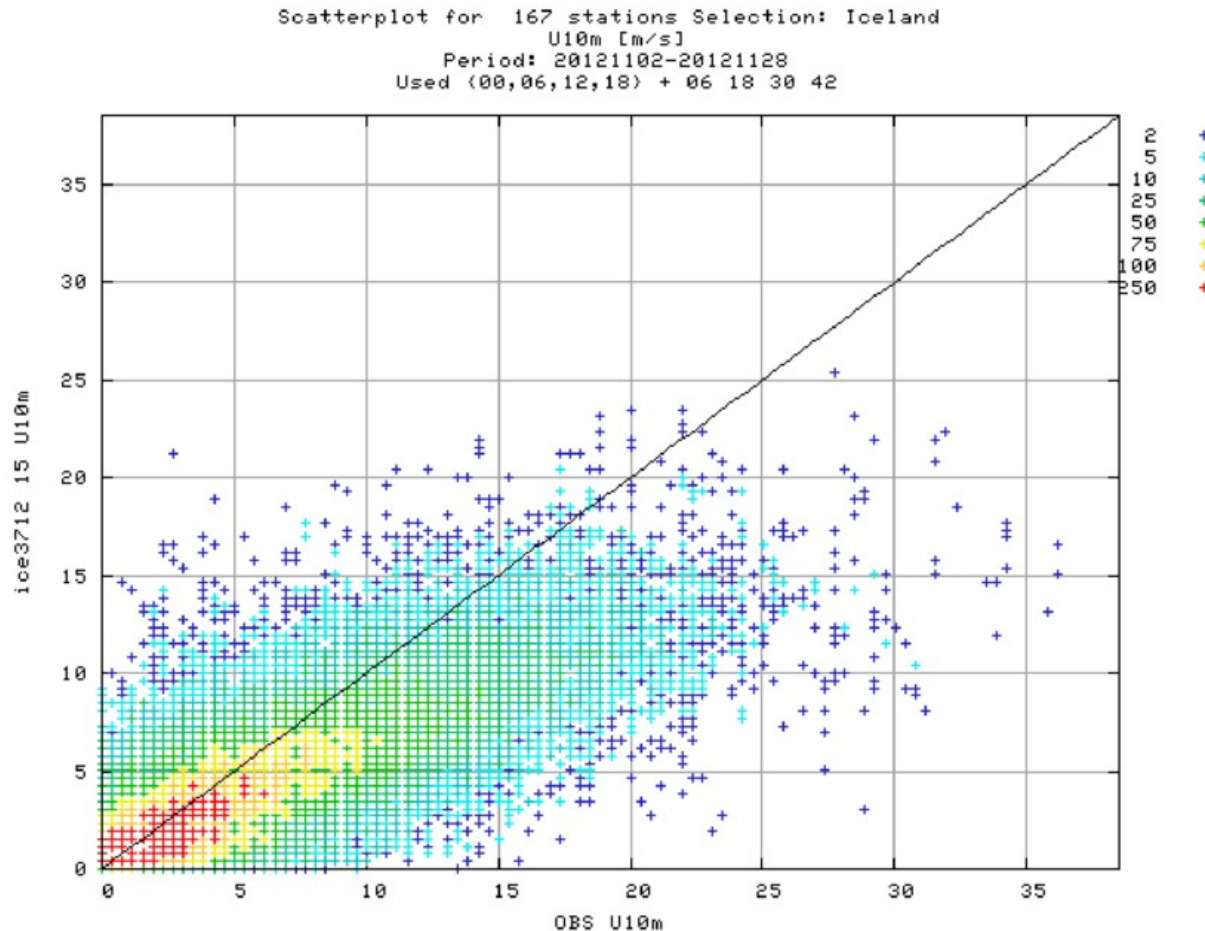
See Y. Seity, C. Lac, V. Masson: About orographic drag options in SURFEX. Tech. Report.

$$\text{drag}_{BE04} = 2\alpha\beta C_{md} C_{corr} C_a S_{st}^2 H^{-1.2} (e^{-H/1500})^{1.5} U$$

H is the altitude; S_{st} is the subgrid orography standard deviation; Other variables are constants.

See A. C. M. Beljaars, A. R. Brown, N. Wood 2004: A new parameterization of turbulent orographic form drag. QJRMS

Vindur: Sjálfvalið XFRACD

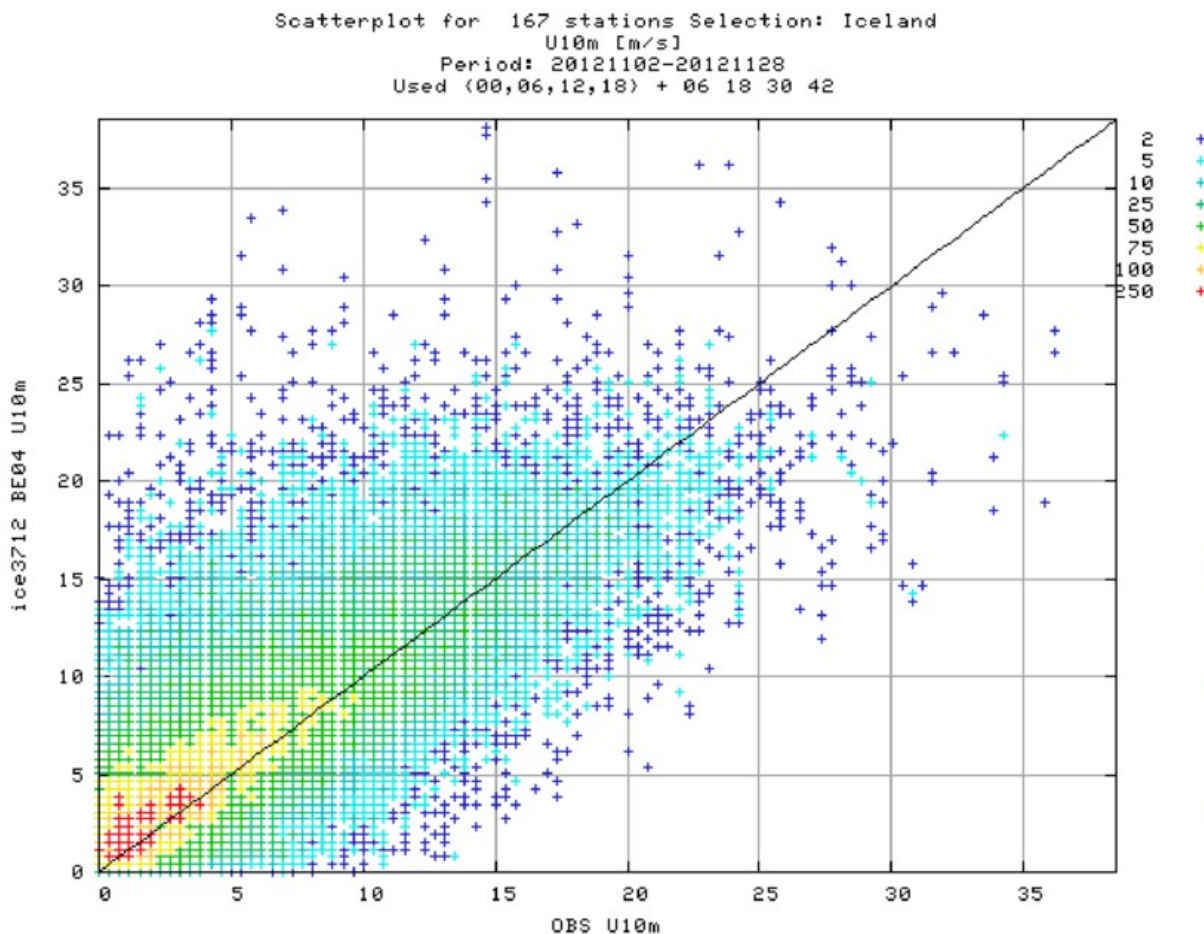


Default Z_0
XFRACD=15

We chosed to tune
up Z01D rather than
tune down BE04

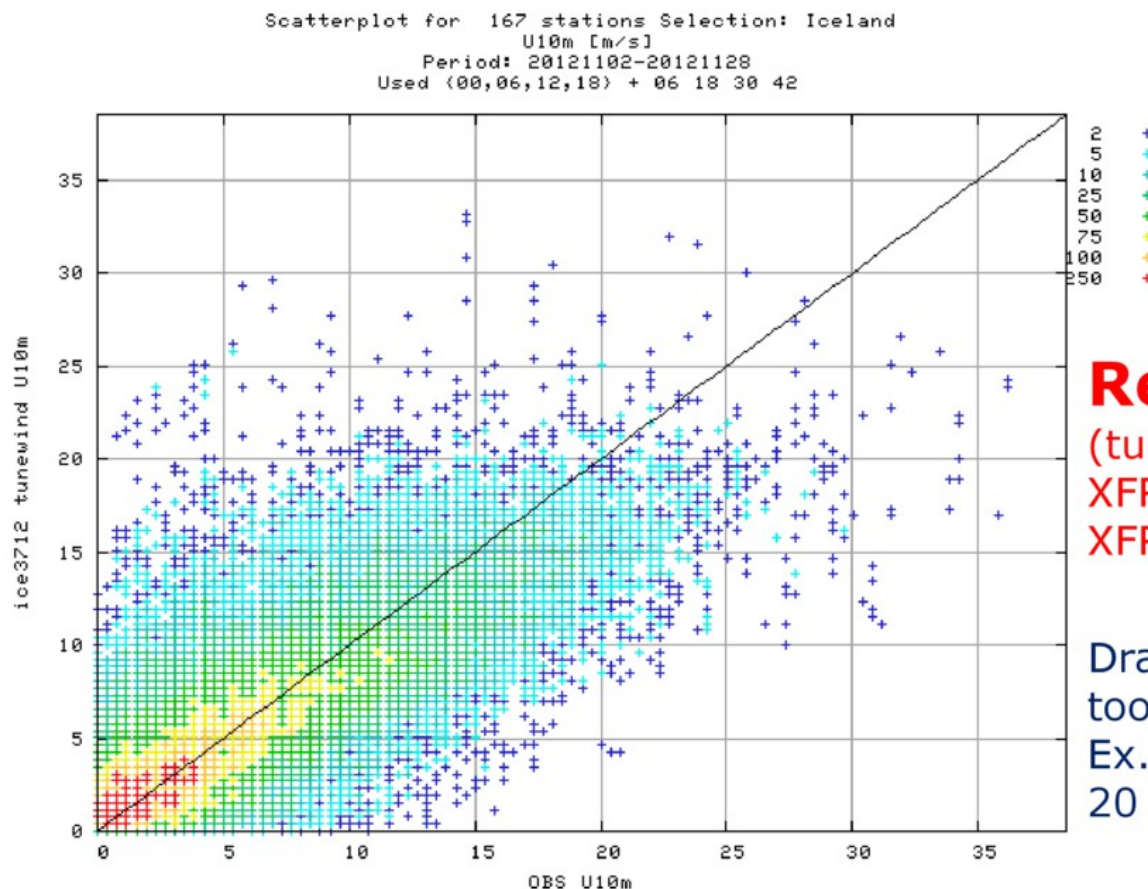
Vindur: BE04 og fx (met.no)

- Norðmenn nota BE04 og bera saman við fx (svindl?)
- Vilja veðurfræðingar á vakt gera það sama?
- Það þyrfti að bremsa BE04 eitthvað niður.



Default BE04

Surface winds are systematically overestimated for lower wind speed and has pos. bias



Reduced Z_0

(tunewind)

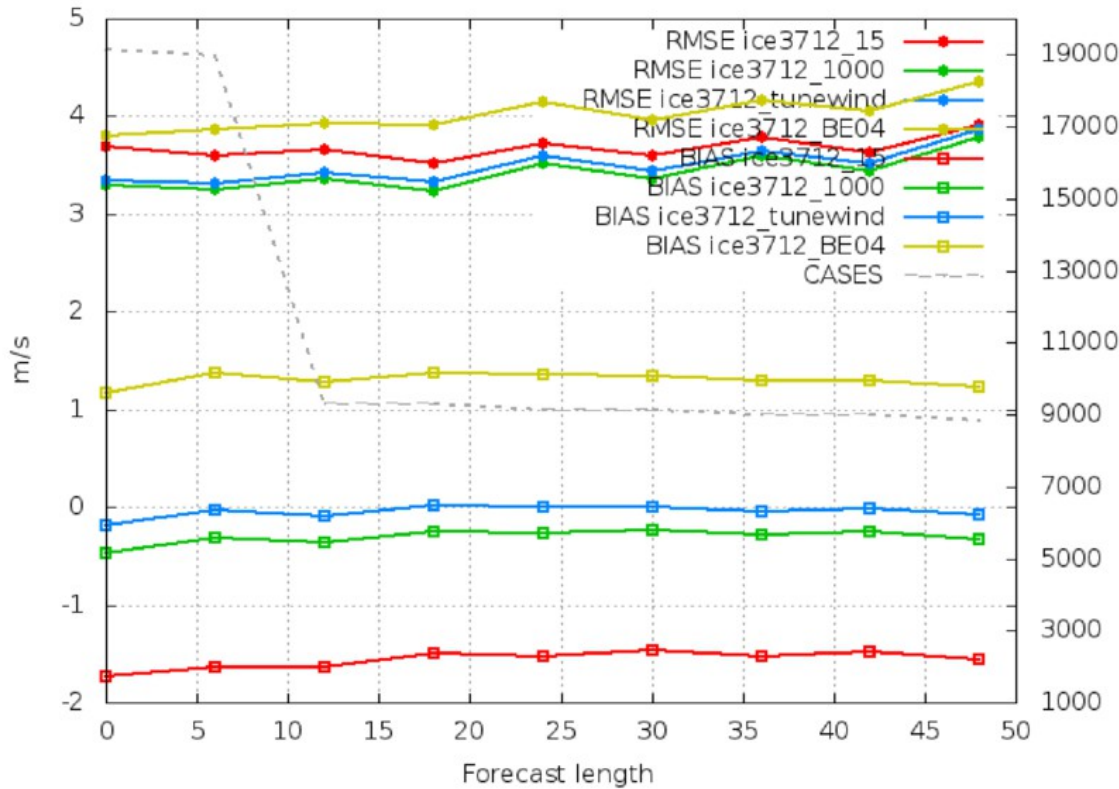
XFRACD=2500 for $f < 13$ m/s

XFRACD=10000 for $f > 13$ m/s

Drawback: Reducing Z_0 gives too strong winds at $f_{obs} < 3$ m/s.
Ex. obs. 5 m/s when forecasted 20 m/s is not good

Vindur: Tunewind RMSE/BIAS

Selection: Iceland using 189 stations
 Period: 20121102-20121130
 U10m Hours: {00,06,12,18}

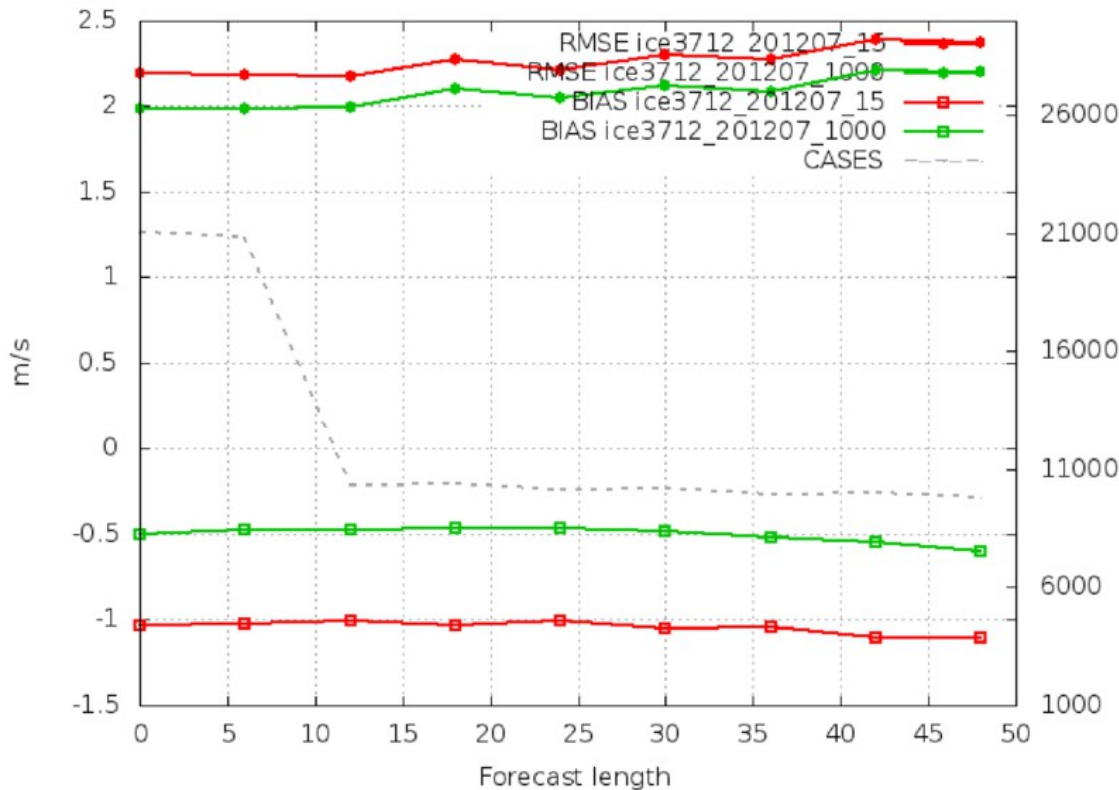


XFRACD 15 1000
 tunewind BE04

Reduced Z_0
 leads to
 improved
 BIAS and
 RMSE fit to
 U10m data

Vindur: Sannprófun fyrir júlí 2012

Selection: Iceland using 171 stations
Period: 20120701-20120731
U10m Hours: {00,06,12,18}

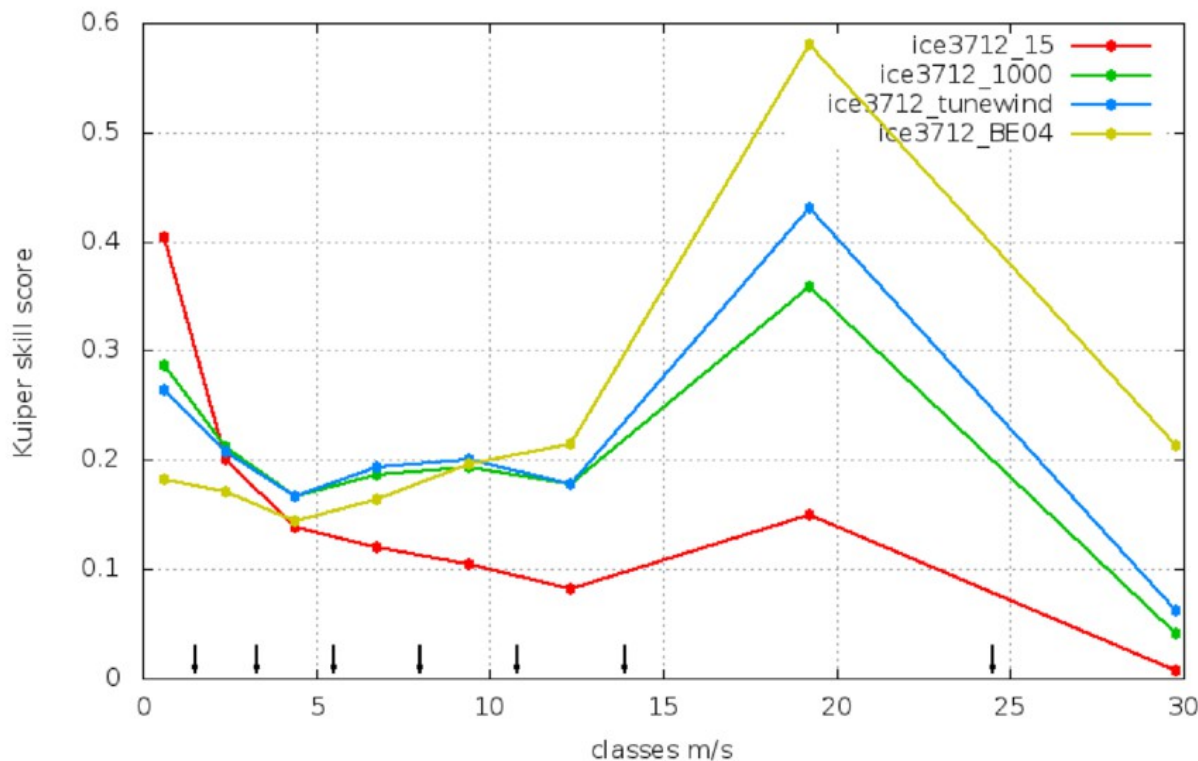


XFRACD 15 1000

Reduced Z_0 leads also to improved BIAS and RMSE fit to U10m obs. in summer

Vindur: Kuiper Skill Score

Kuiper skill score for U10m (m/s)
Selection: Iceland 167 stations
Period: 20121102-20121130
Used {00,06,12,18} + 06 18 30 42

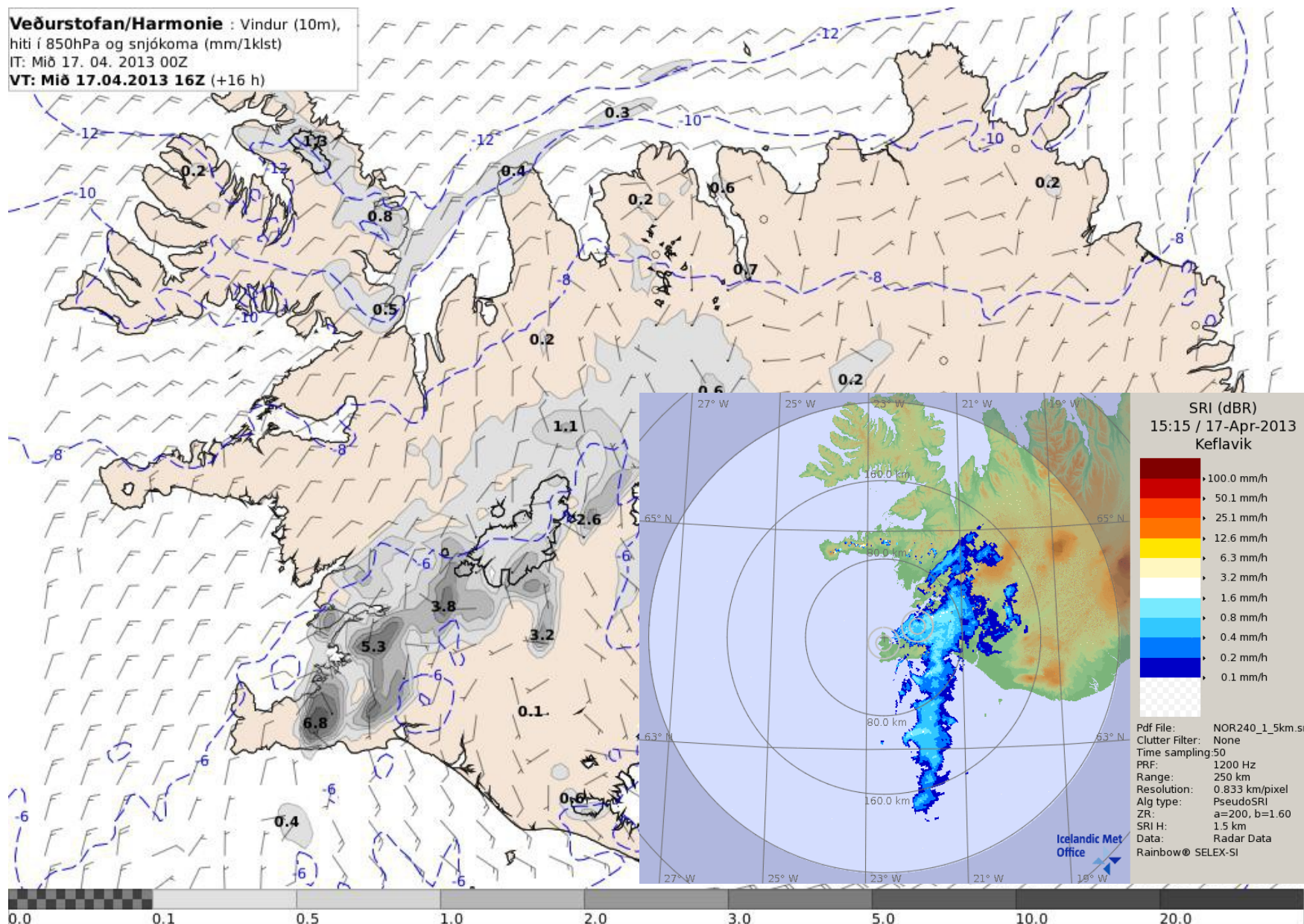


XFRACD 15 1000
tunewind BE04

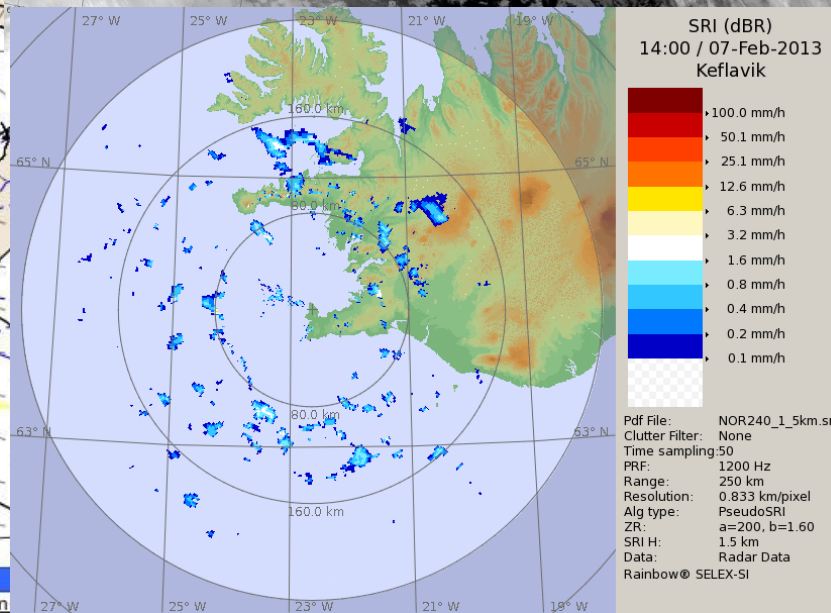
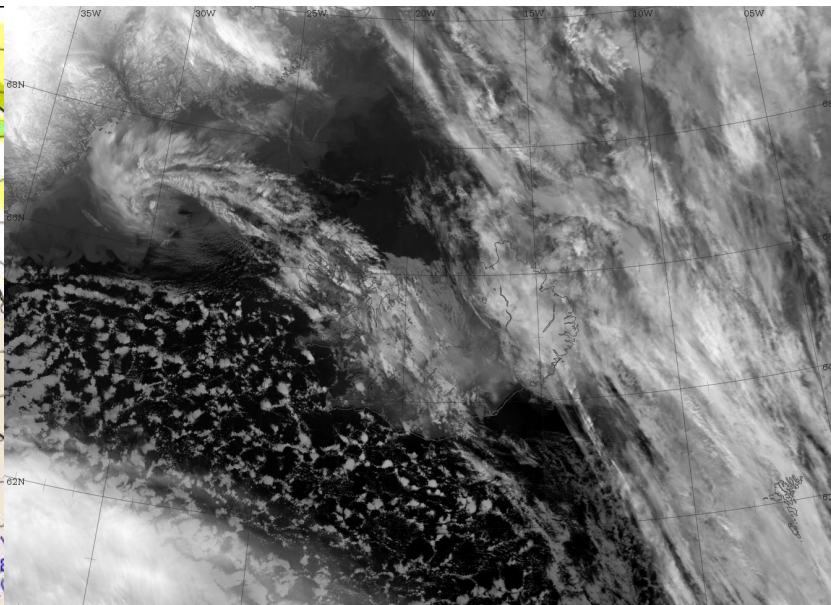
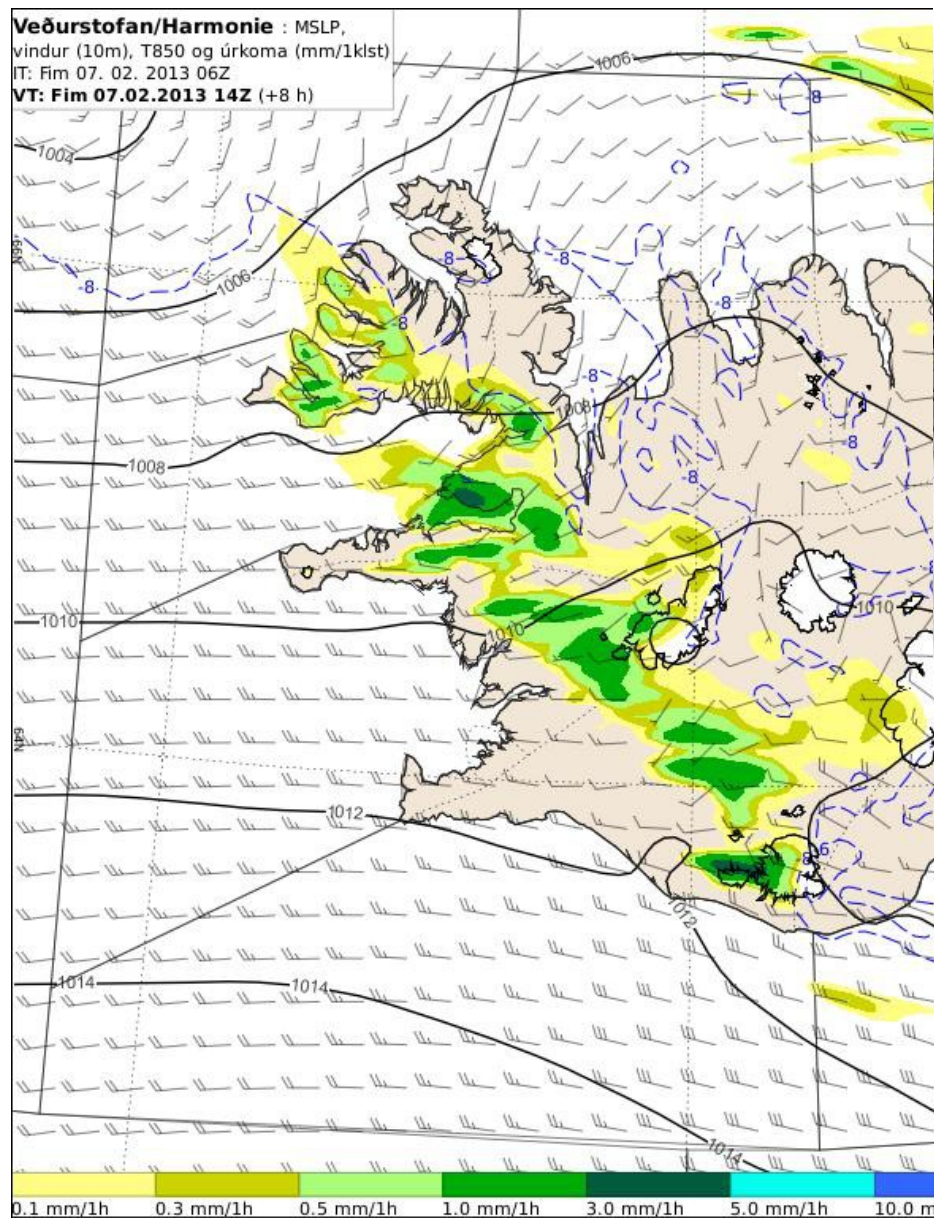
Drawback: Reducing Z_0
gives too strong winds
at $f_{obs} < 3$ m/s

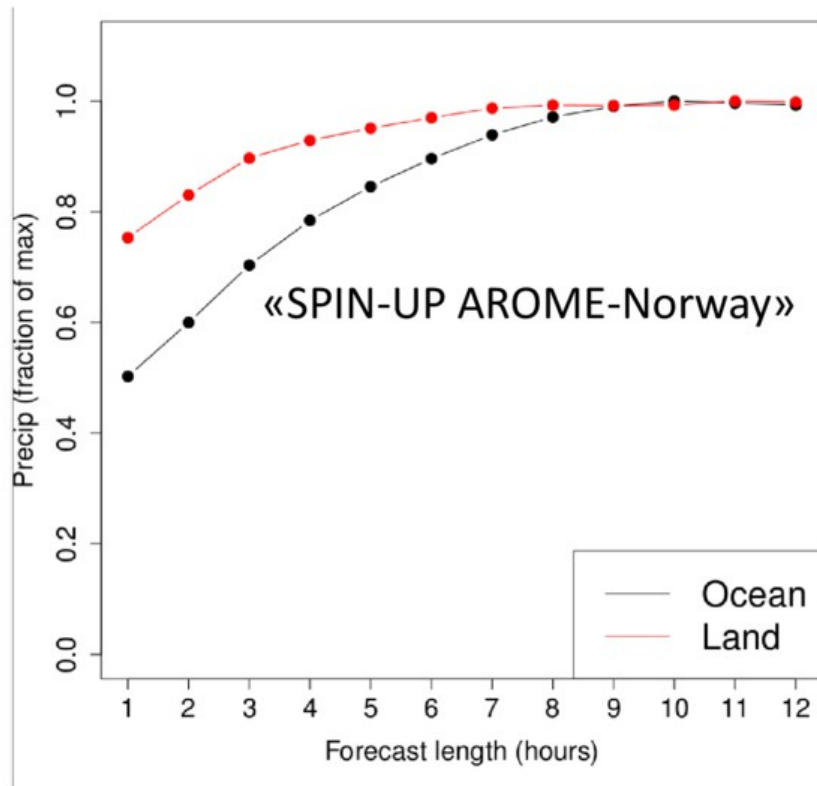
Harmonie: Úrkoma

Veðurstofan/Harmonie : Vindur (10m),
hiti í 850hPa og snjókoma (mm/1klst)
IT: Mið 17. 04. 2013 00Z
VT: Mið 17.04.2013 16Z (+16 h)



Harmonie: Klakkaúrkoma yfir sjó vandamál



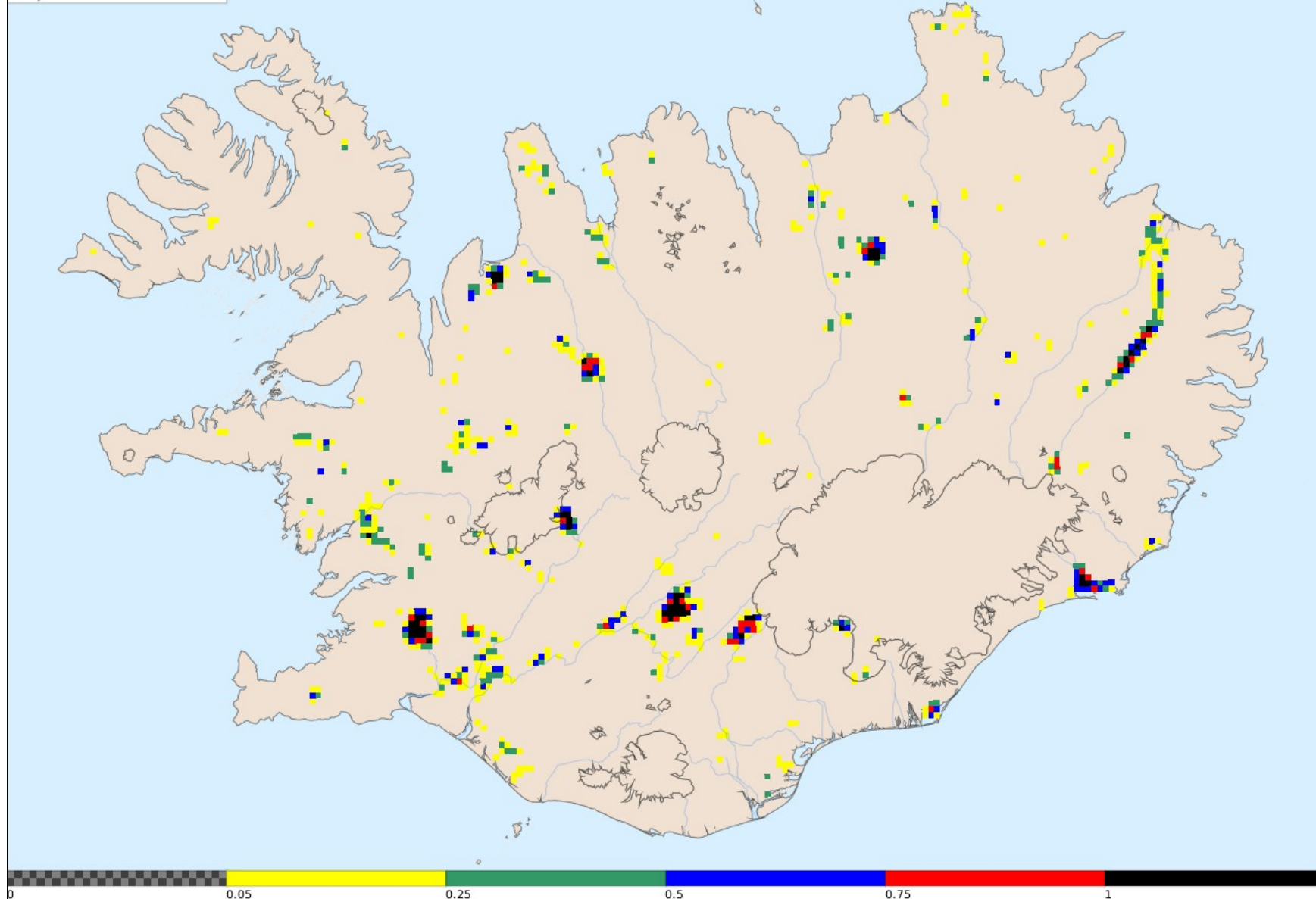


Long spin-up time over ocean in winter.
(no differences between land/ocean
spin-up in summer)

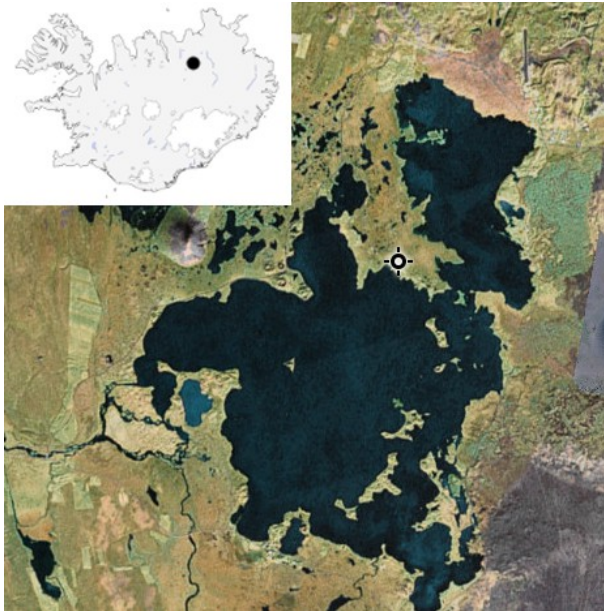
- Þekkt vandamál hjá met.no (fengið af glærum Trygve Aspelien)
- Norðmenn eru að keyra sam-bærilega uppsetningu á Harmonie og við (Upper-Air Blending)
- Harmonie notar EDMFm (Eddy Diffusivity Mass Flux Scheme) fyrir smáklakkamyndun (shallow convection), þróað af KNMI
- Til þess að líkanið nái þróun smáklakka yfir í háreista þurfa margar einingar að spila vel saman, hugsanlega þarf að stilla einhverja stika fyrir norðlægar slóðir
- Athugasemd frá starfsmanni KNMI á fundinum gaf til kynna að Blending væri hugsanlega um að kenna, 3DVar gæti virkað betur

Hiti: Vötn í Surfex

Harmonie: Surfex - Inland Waters
Analysis: 2012-06-20 12:00



Hiti: Alltof kalt yfir vötnum - Mývatn



- Hitaspá yfir vötnum sýnir mjög neikvæðan bias
- Þrátt fyrir mjög lágan yfirborðshita (T_s) á Mývatni í Surfex, þá leggur vatnið aldrei, allavega engin snjóhula yfir vatninu í allan vetur (stillingaratriði?)
- Finnar þekkja þetta vandamál vel í Harmonie, vatnalíkan (FLake) orðið partur af Surfex útg. 7.2 sem kemur með næstu uppfærslu á Harmonie í haust
- Vonandi verður þetta betra næsta vetur með nýrri útgáfu

Models compared with obs. (black line) for Feb. 2013

2013-02-01-01 : 2013-03-01-00

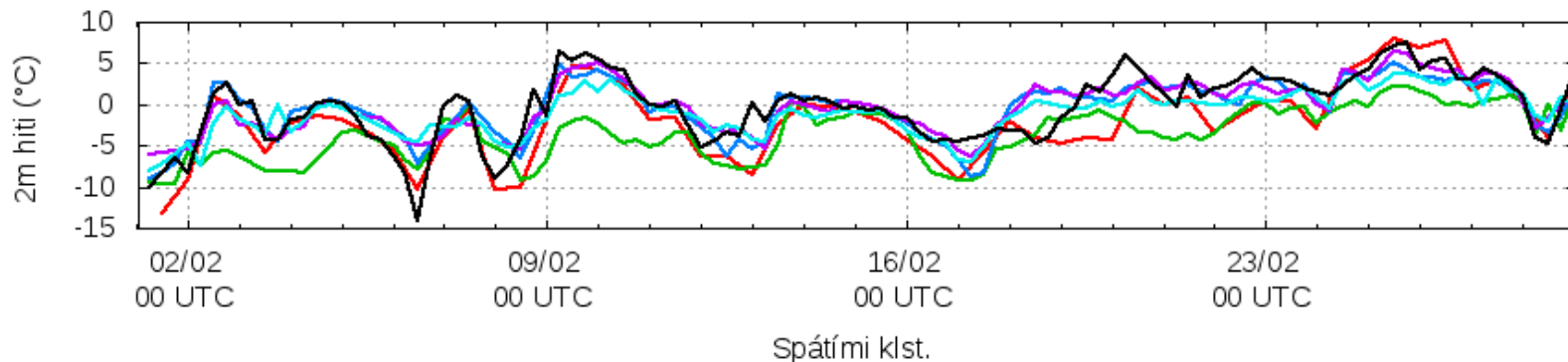
Mývatn - Hiti

ME Harmonie: -3.2, Hras3: -0.7, Hirlam5: 0.02, ecm0125: -1.8

MAE Harmonie: 3.92, Hras3: 2.18, Hirlam5: 1.68, ecm0125: 2.26

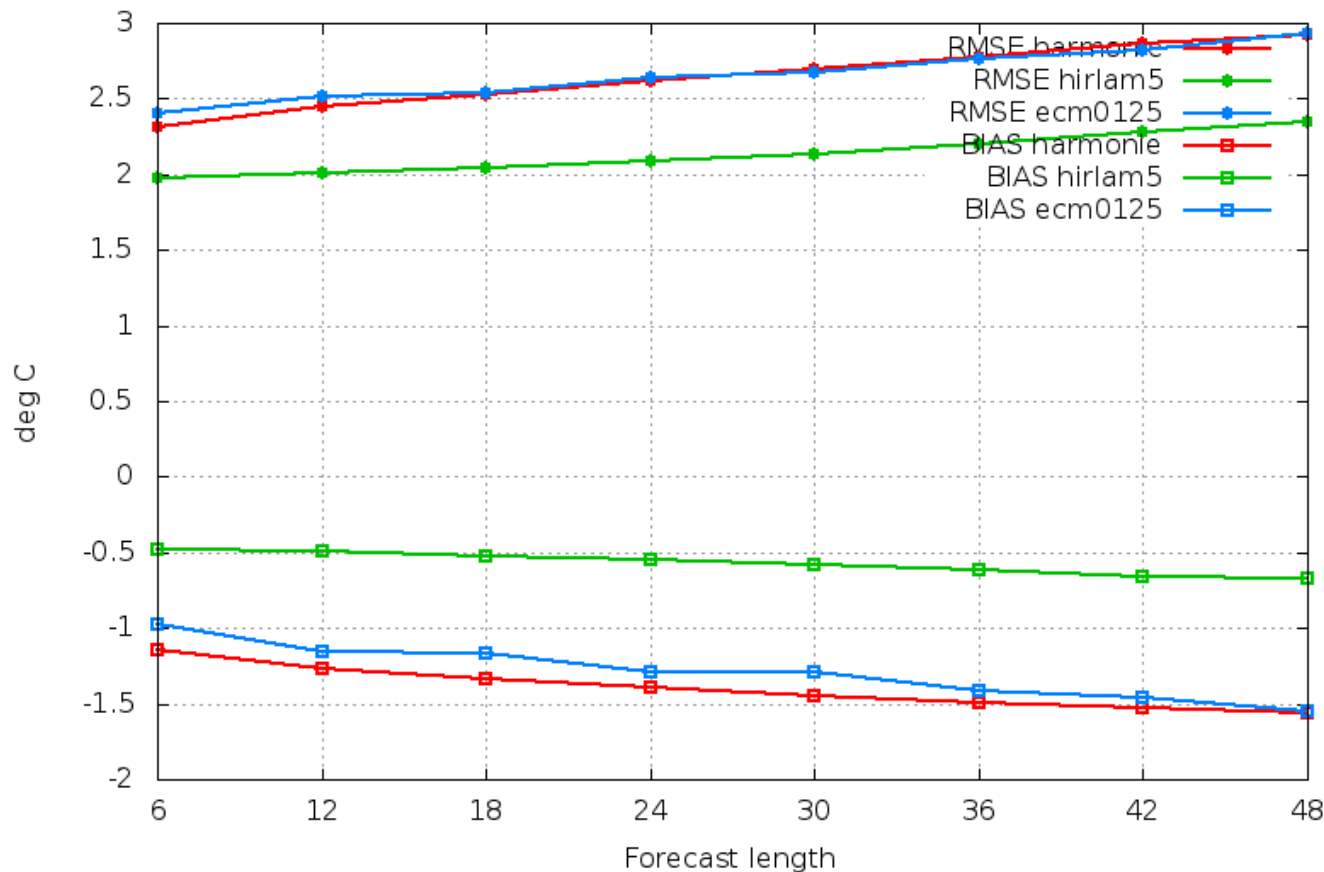
RMSE Harmonie: 4.55, Hras3: 2.72, Hirlam5: 2.39, ecm0125: 2.95

hras3 — cyan
athugun — black
hirlam3 — blue
hirlam5 — magenta
ecm0125 — red
harmonie — green



Hiti: Samanburður við önnur líkön

Selection: Iceland using 147 stations
Period: 20121201-20130228
T2m Hours: {00,06,12,18} ecm0125={00,12}



Harmonie skorar svipað og ECM0125

Hirlam5 mun betra

Harmonie með verri bias en hin líkönin, hversu mikil áhrif hafa vötnin?

Hiti: Samanburður - stakar stöðvar

IT: 01.12.2012 00:00 – 28.02.2013 18:00 FC: 06,12,18,24,30,36,42,48

Stöð - Nafn	Harmonie MAE / RMSE / BIAS	Hirlam5 MAE / RMSE / BIAS	ECM0125 MAE / RMSE / BIAS
1475 - Reykjavík	1.2 / 1.58 / -0.8	0.98 / 1.28 / -0.2	1.74 / 2.11 / -1.6
2050 - Stykkishólmur	0.9 / 1.2 / -0.15	1.09 / 1.44 / 0.53	1.4 / 1.72 / -1.19
1919 - Gufuskálar	0.88 / 1.19 / -0.05	0.94 / 1.24 / -0.19	1.19 / 1.50 / -0.49
3317 - Blönduós	1.55 / 2.10 / -0.74	1.64 / 2.18 / 0.07	2.23 / 2.56 / -1.80
4300 - Mývatn	3.91 / 4.96 / -3.38	1.86 / 2.85 / 0.86	1.87 / 2.49 / -1.02
4271 - Egilsstaðaflugvöllur	3.18 / 3.91 / -2.89	1.91 / 2.67 / -0.10	2.82 / 3.25 / -2.04
4193 - Dalatangi	0.88 / 1.24 / -0.11	0.99 / 1.36 / -0.41	0.94 / 1.32 / -0.27
5544 - Höfn í Hornafirði	1.34 / 1.68 / -0.81	1.20 / 1.64 / 0.76	1.16 / 1.48 / -0.42
6272 - Kirkjubæjarkl. Stj.	1.42 / 1.88 / -0.68	1.14 / 1.47 / -0.57	1.96 / 2.54 / -1.74
6310 - Kálfhóll	1.33 / 1.70 / -0.75	1.23 / 1.64 / 0.11	1.20 / 1.60 / -0.39
6935 - Hveravellir	1.81 / 2.48 / -1.44	1.20 / 1.62 / -0.14	1.11 / 1.52 / -0.29

- Almennt stendur líkanið sig nokkuð vel
- Það er mikilvægt að þekkja veikleikana til að geta bætt líkanið
- Við höfum þegar náð árangri í að bæta 10m vind
- Vonandi verður búið að laga hitavandamál yfir vötnum fljótlega
- Líkanateymið mun einbeita sér á næstunni að landgerðinni í undirliggjandi Surfex-líkaninu.

Þakka ykkur!

?