Highlights from the field campaigns in the frame of HARMOSNOW project

Leita að aðferð við að mæla snjó

Alþjóðleg vinnustofa um snjómælingar haldin í Reykjavík ● Ólíkum aðferðum og verkfærum er beitt við snjódýptarmælingar í hinum ýmsu löndum ● Leitast er við að samræma mæliaðferðirnar

Guðni Einarsson

Hópur erlendra vísindamanna mokaði snjó og mældi við Hellisheiðarvirkjun í gær. Þar voru þeir að gera samanburð á mismunandi aðferðum og verkfærum sem notuð eru við snjómælingar. Þetta var liður í alþjóðlegri ráðstefnu um snjómælingar sem lýkur í dag.

Alþjóðleg vinnustofa um bráðnun íss og snjós var haldin í Háskólanum í Reykjavík (HR) í fyrradag. Tækni- og verkfræðideild HR stóð fyrir vinnustofunni. Fyrirlesarar voru frá Veðurstofu Íslands, Landsvirkjun, Háskóla Íslands (HÍ), Landbúnaðarháskóla Íslands (LBHÍ) og HR. Þar var m.a. fjallað um gögn um bráðnun íss fyrir rauntímakort og vatnafræðileg líkön.

Vinnustofan var hluti af COST-verkefninu (Cooperation in Science and Technology – harmosnow.eu), sem er evrópskt samstarf um samræmdar snjómælingar í þágu rannsókna á sviði loftslagsbreytinga, vatnafræði og veðurspáa. Háskólinn í Reykjavík og Landbúnaðarháskóli Íslands eru helstu samstarfsaðilar COST-verkefnisins hér á landi.

Samræma mæliaðferðir

Pavla Dagsson Waldhauserová, nýdoktor við verkfræði- og náttúruvísindasvið Raunvísindadeildar HÍ og einnig starfsmaður við LBHÍ, er í framkvæmdastjórn COST-verkefnisins fyrir Íslands hönd. Hún og David Finger frá HR sátu í undirbúningsnefnd ráðstefnunnar.

Pavla sagði að tilgangur evrópska snjóverkefnisins væri að útbúa samræmdar leiðbeiningar um bestu aðferð við snjómælingar. Nú væru mismunandi aðferðir og verkfæri notuð við snjódýptarmælingar í hinum ýmsu löndum.

Sandurinn og snjórinn

„Þetta er nýtt verkefni sem snýst um snjómælingar," sagði Pavla. „Nú eru um tuttugu sérfræðingar á sviði snjómælinga frá Evrópu og Bandaríkjunum staddir hér á Íslandi. Þeir eru allir í fremstu röð á sínu sviði."

Pavla sagði sérfræðingana vera heppna að koma hingað þegar hér væri mikill snjór. Auk þess væri Ísland sérstakt í mörgu tilliti þegar kemi að snjódýpt og snjómagni. Hér væri til dæmis stærsta eyðimörk í Evrópu og á norðurheimskautasvæðinu. Þess vegna væri einnig rætt um áhrif þess þegar sandur fýkí yfir snjó.

Hellisheiðarvirkjun Vísindamennirnir mokuðu ráðir og skóðuðu snjóalög.

Ráðstefnugestir Þeir komu frá Evrópulöndum og Bandaríkjunum.

J. I. López-Moreno, L. Holko, L. Leppännen, P. Dagsson Waldhauserova

Quantify snow water equivalent (SWE):
snow depth & snow density

- Snow climatology
- Understand spatio-temporal dynamics of snowpack
- Quantification of water stored for the melting period
- Validating hydrological and snow models

Stations by Network

- SNOTEL
- SCAN
- SNOLITE
- Other NRCS Hydromet
- Snow Course/Aerial Marker
- Manual Precipitation
- Reservoir
- Streamflow
- ACIS
- Cooperator Snow Sensors

NRCS Natural Resources Conservation Service

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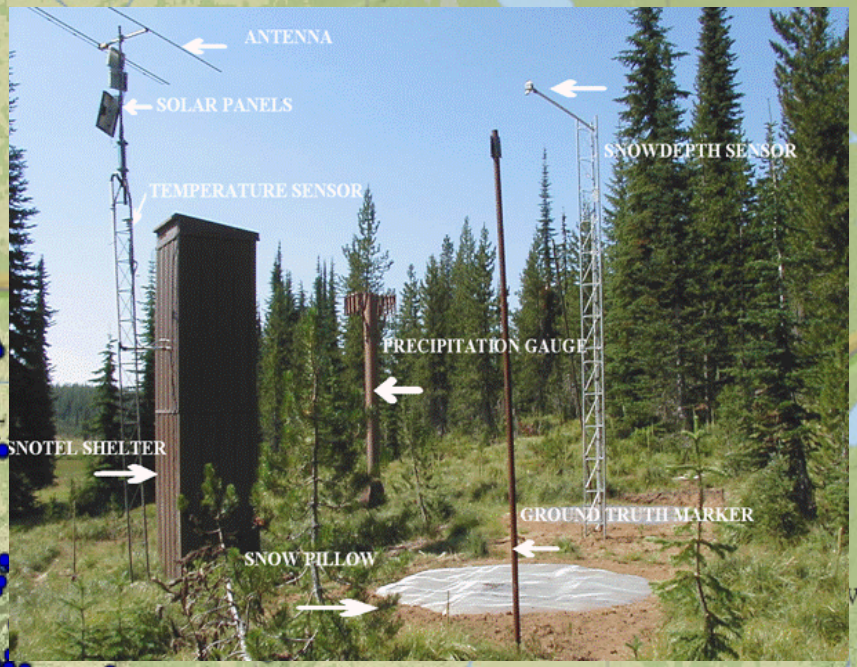
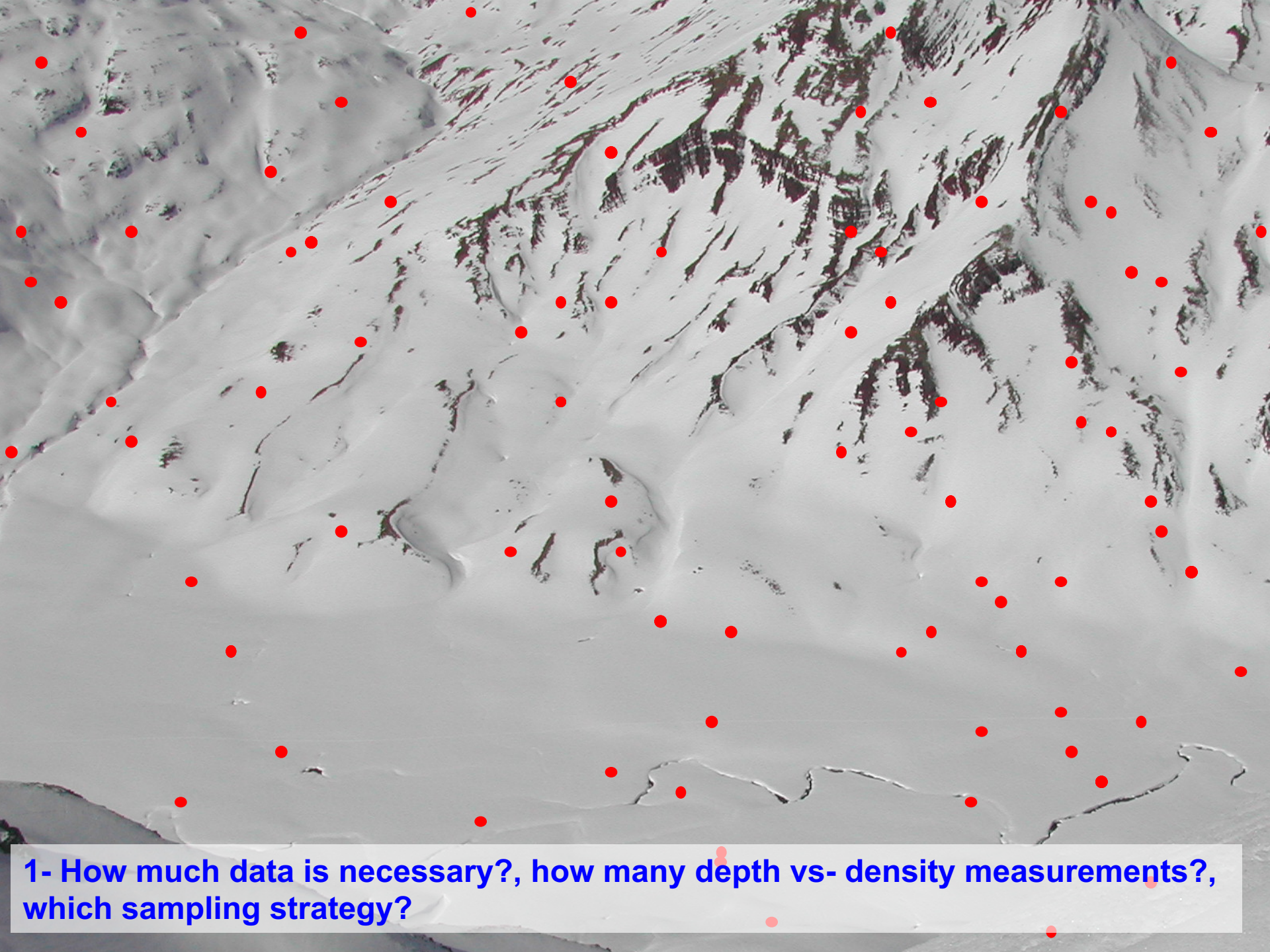
300 km

200 mi


ANTENNA
SOLAR PANELS
SNOWDEPTH SENSOR
TEMPERATURE SENSOR
PRECIPITATION GAUGE
SNOTEL SHELTER
GROUND TRUTH MARKER
SNOW PILLOW

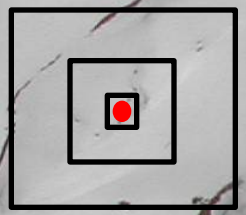
FRASER PLATEAU
Calgary
Vancouver
Seattle
Portland
Sacramento
San Francisco
Fresno
Mt Whitney
Las Vegas
Los Angeles
San Diego
Tijuana
Phoenix
Tucson
Salt Lake City
Denver
Kansas City
Oklahoma City
Dallas
WYOMING
NEBRASKA
IOWA
CALIFORNIA
NEVADA
COLORADO
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
ARIZONA
NEW MEXICO
UNITED STATES
GREAT BASIN
COLORADO PLATEAU
GREAT PLAINS
OZARK PLATEAU
Colorado
Arkansas
OCEAN

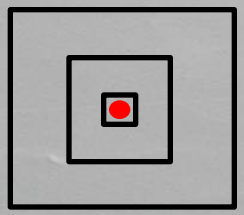


1- How much data is necessary?, how many depth vs- density measurements?, which sampling strategy?

1- How many measurements do we need?

Importance of local snow variability for snow sampling





2- Is a single measurement representative of the immediate surroundings?

Different sizes (length and diameter)
Different materials
Different procedures to be weighted

3- Does the device to measure SWE or the skill of the observer matters?

Natural spatial variability vs. observer/device induced variability
How to reduce the latter??

Different sizes (length and diameter)
Different materials
Different procedures to be weighted

3- Does the device to measure SWE or the skill of the observer matters?

Natural spatial variabili… …vice induced variability

…e latter??

A European network for a harmonised monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction

ESSEM COST Action ES1404

…ngth and diameter

…aterials

…ent procedures to be weighted

3-Does the device to measure SWE or the skill of the observer matters?

Field campaigns in HARMOSNOW:

Focussing on snow water equivalent field campaigns aimed to quantify the impact of using different devices on the estimation of SWE.

Possibility to provide guidelines for bettter SWE mesurements and comparability of measurements in different sites

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Aditionally:

-To serve as an space to teach unexperienced (less experienced) observers to use tools they did not use previously

- To illustrate data users (i.e. modellers) the nature of the data they are using and different sources of uncertainty. Observations are not necessarily ground truth.

Field campaigns 2016 (1) and 2017 (2):
1- Erzurum (Turkey): 1st March 2016

a)

b)

Guzelyayla site

c)

Senyurt site

1- Erzurum (Turkey): 1st March 2016

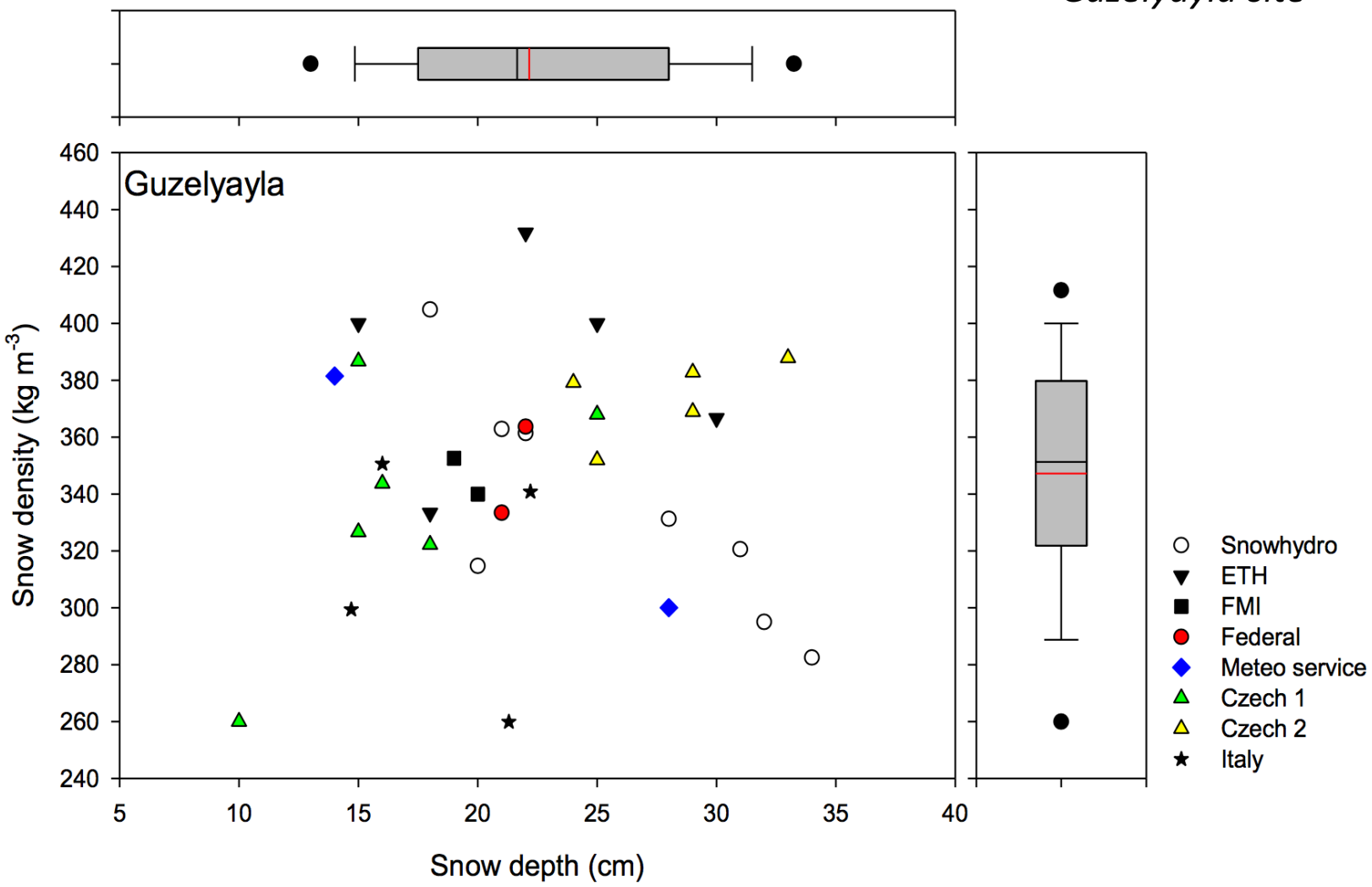
It was not an intercomparison, but a demonstration to many people who was not familiarized with field measurements

2 sites near SNOTEL around 20*10 meters, people who uses different SWE samplers did transects and people had the opportunity to observe and measure snow with all of them

Around 1h30min in each site

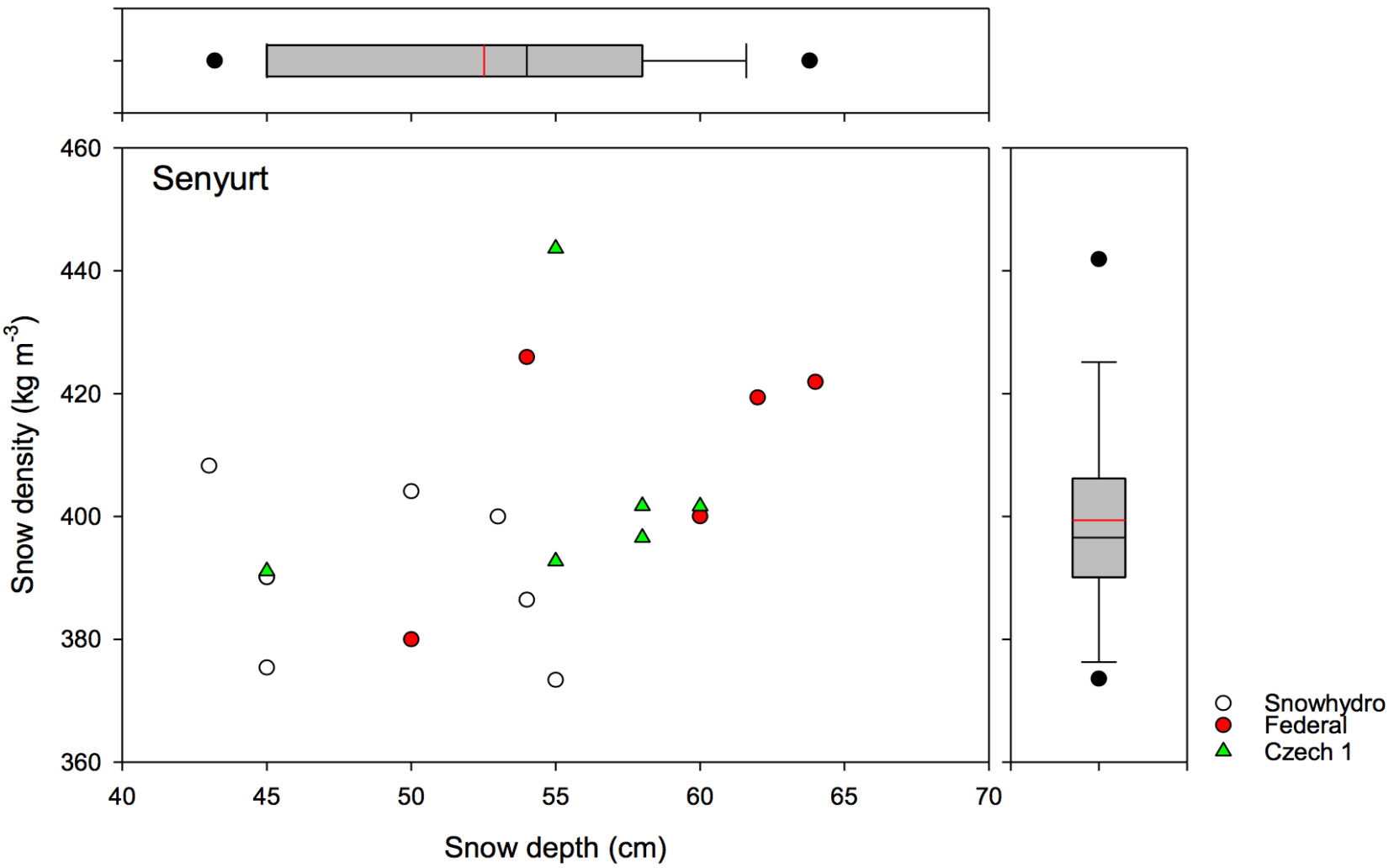
1- Erzurum (Turkey): 1st March 2016

Guzelyayla site



1- Erzurum (Turkey): 1st March 2016

Senyurt site



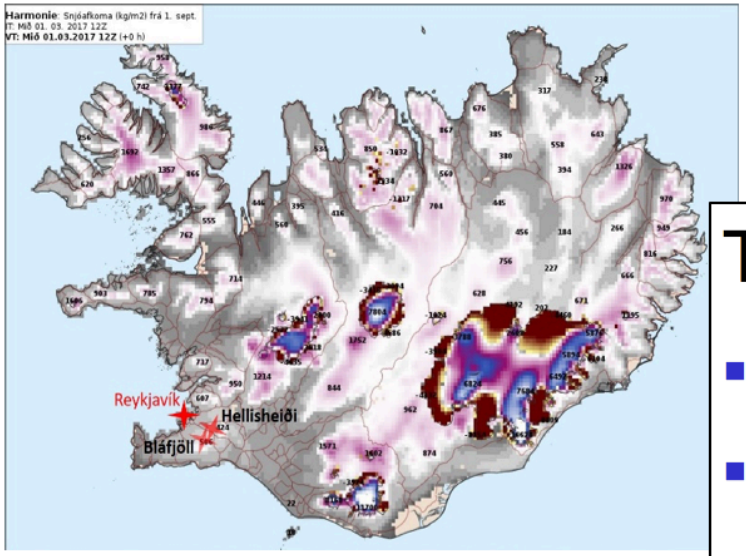
1- Erzurum (Turkey): 1st March 2016

Conclusions of 1st Field campaign

-The experimental design of the field campaign does not allow to properly distinguishing to which extent the differences in snow density and SWE are due to the variability of snow characteristics or to the used device or human errors.

- It is difficult to establish which devices are better or worse, it mainly depends on the snow depth and snow characteristics (hardness, wetness, sticky snow, etc). In this particular case (shallow and soft snow), short and wide tubes were easier to use. Long tubes and those that need to be emptied into a bag were the less useful at that day (i.e. Snowhydro).

2- Reykiavick: Februarv 2017



Organization

Two sites:

- Hellisheiði POWER PLANT
- Bláfjöll SKI AREA

50 cm/125 mm

95 cm/350 mm

2- Reykiavick: February 2017

Organization

- Trench about 20 m long (two at POWER PLANT)
- Snow density profile measured first
- Then, snow depth and water equivalent were measured by different snow samplers
- 5 measurements (close to each other) on the left and right sides of the trench (experts, novices)

GGI (State Hydrological Institute)
Estonia, Lithuania

USGS, USA

Metallic, mechanical balance scales

FMI, Finland

Metallic, Mechanical balance scales

SnowHydro, Spain, plexiglass

Electronic strain gauge scales

ETH_SLF, Switzerland
Metallic, Mechanical spring scales

Glass fiber (CHMI), Slovakia
Electronic spring scales

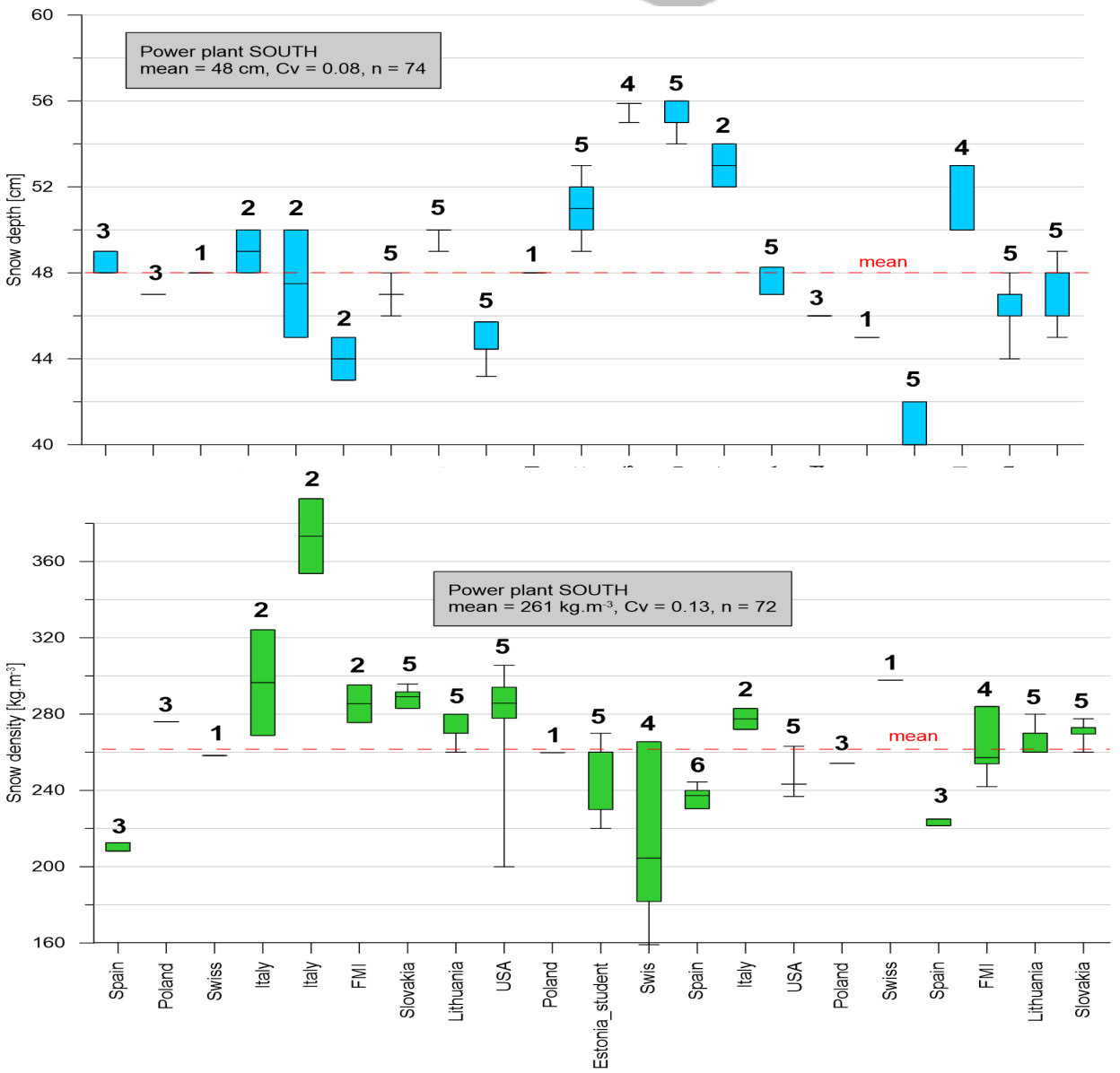
IF PAS, Poland, spring scales

Snow/Ice, Italy

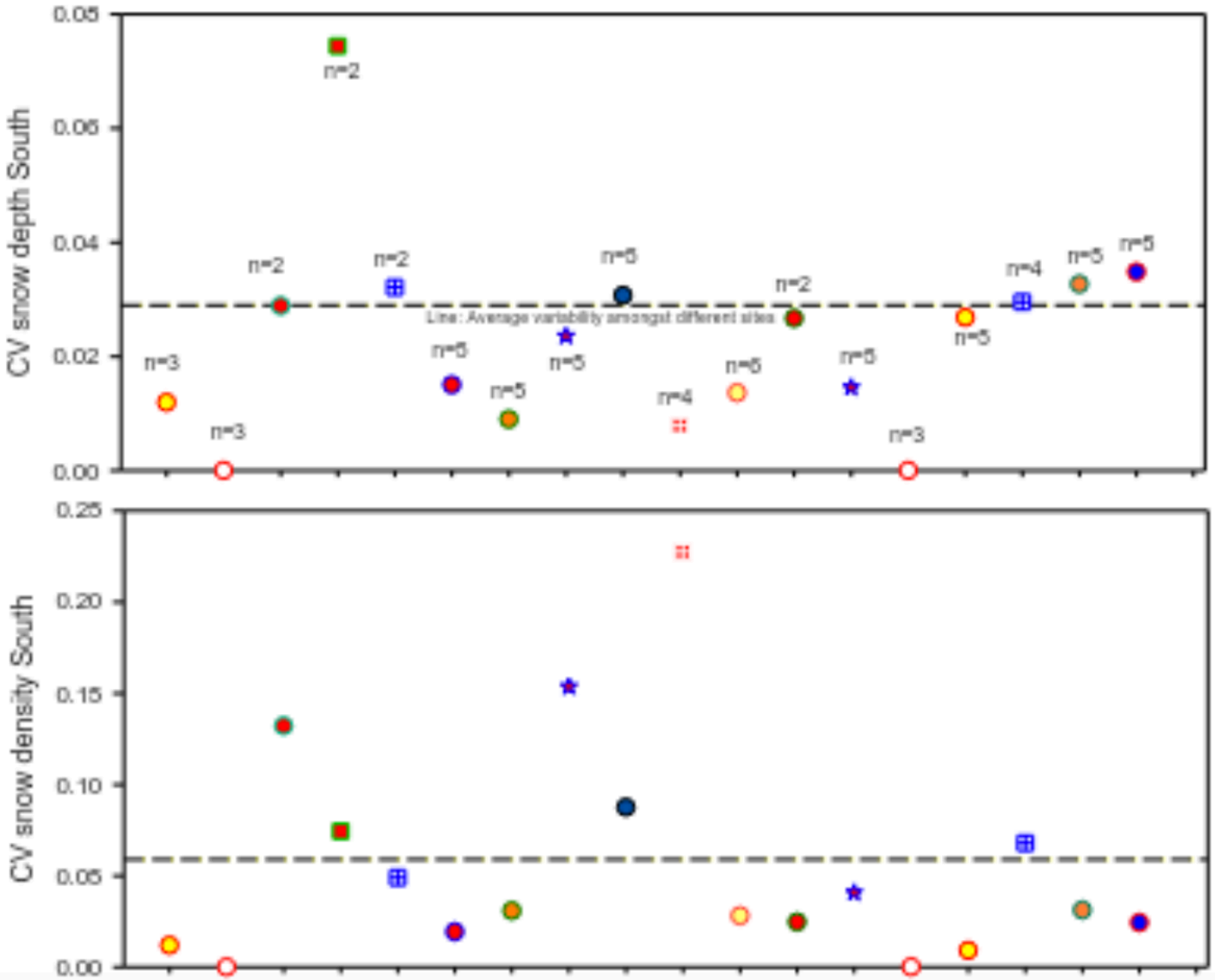
Hard (artificial) snow, Slovakia

Not used in intercomparison measurements

2- Reykiavick: February 2017, SOUTH



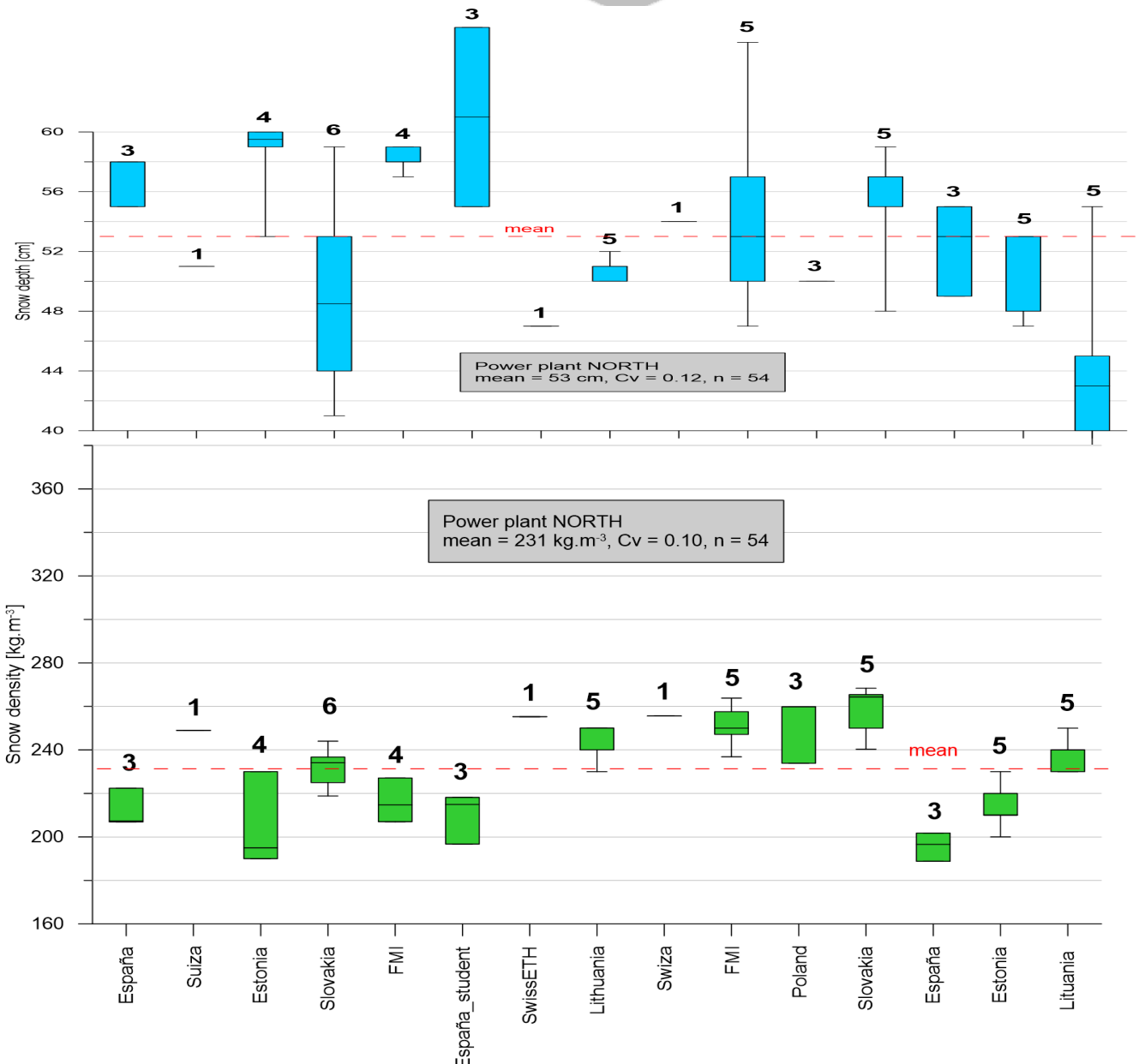
2- Reykiavick: February 2017. SOUTH



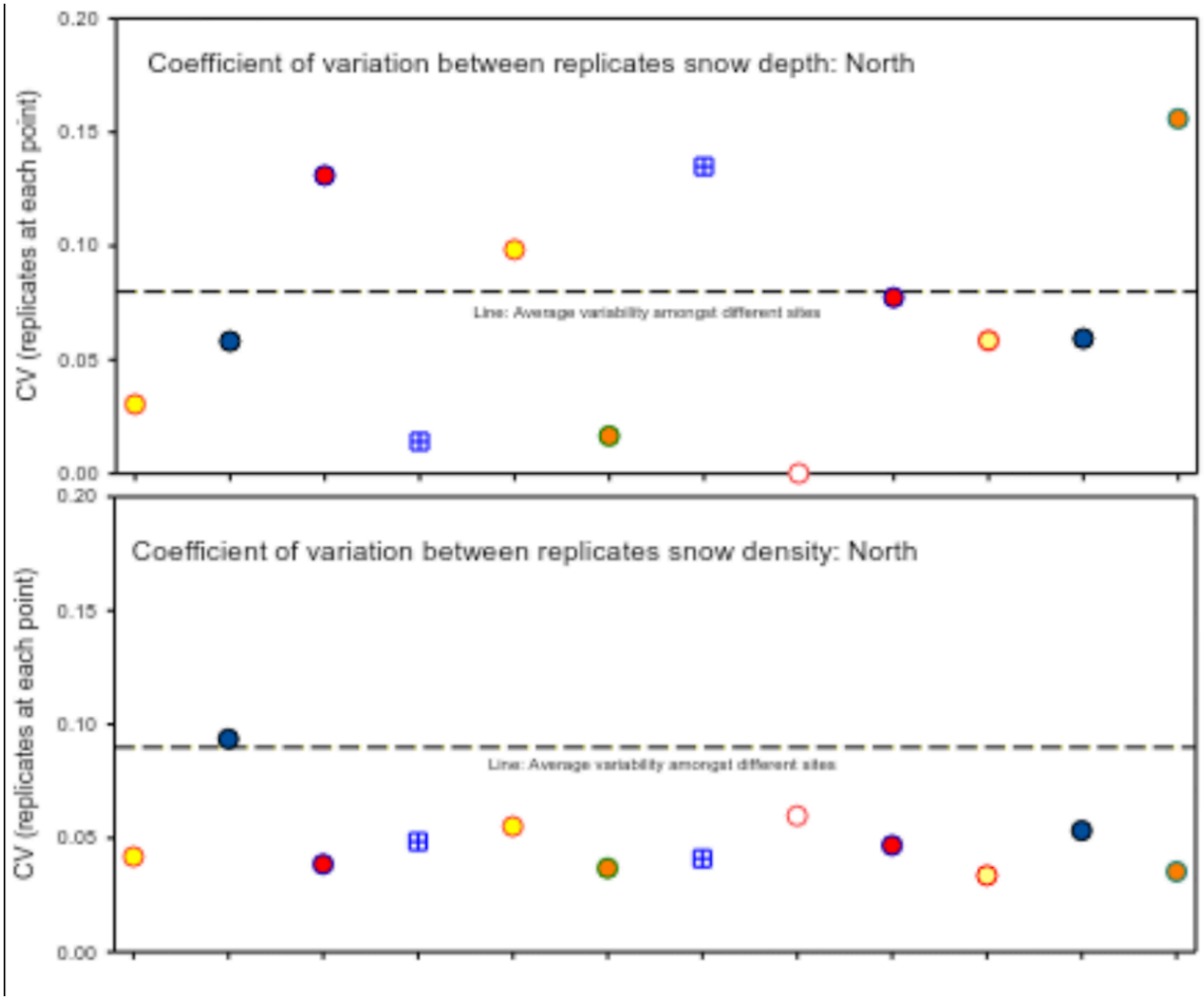
2- Reykiavick: February 2017, SOUTH

	SOUTH									
	Slovakia	Lithuania	USA	Estonia_st	Swis	Spain	USA	FMI	Lithuania	Slovakia
Cv depth	0.02	0.01	0.02	0.03	0.01	0.01	0.01	0.03	0.03	0.03
Cv density	0.02	0.03	0.15	0.09	0.23	0.02	0.04	0.07	0.03	0.02
Cv SWE	0.03	0.03	0.16	0.11	0.22	0.01	0.05	0.07	0.02	0.06

2- Reykiavick: February 2017



2- Reykiavick: February 2017, NORTH



2- Reykiavick: February 2017, NORTH

	Estonia	Slovakia	FMI	Lithuania	FMI	Slovakia	Estonia	Lituania
Cv depth	0.06	0.13	0.01	0.02	0.13	0.08	0.06	0.16
Cv density	0.09	0.04	0.05	0.04	0.04	0.05	0.05	0.04
Cv SWE	0.03	0.15	0.06	0.04	0.14	0.10	0.05	0.16

2- Reykiavick: February 2017, NORTH

Snow depth and density exhibited a noticeable variability (8-15%) in short distances.

Variability in SWE lies around 10% in some cases is more influenced by variability in snow depth, and other by variability in density. The former should be reduced, and the later should increase as snowpack is thicker.

Snow depth and density variability over a trench shows a spatial consistency, what means that natural variability tends to be more influential than variability induced by observer/device

In general the variability between replicates in a point is smaller than the overall variability for the trench, but often we found the opposite situation. It means that error induced by observer/device can exceed the natural variability of snowpack characteristics