Integration of meteo-hydro-cryosphere observation networks: key challenges and triumphs

Jórunn Harðardóttir, WMO RA VI Hydrology Forum, April 2-4, 2019
2009 + 2019

ICELANDIC METEOROLOGICAL OFFICE

HYDROLOGICAL SERVICE

Icelandic Met Office
The new Met Office

Integrated institute

Expanded scope

► Natural hazards
► Climate change
► Hydrological research

Main processes and tasks for the new Icelandic Met Office from January 1, 2009
Integration was the strategy for the new combined institute

Increasing efficiency through economy of scale

Expansion of science

Independent divisions that span all scientific disciplines
Organization of IMO

The key is integration!

Independent divisions that span all scientific disciplines

- Observations
- Processing & Research
- Warning & Forecasting
- Finance & Administration
- Information Technology
Around the clock monitoring of IMO 24/7

Automatic processing

Automatic warnings

Interpretation of data and monitoring

Issued warnings: Officials / Int. Aviation / The Public

Instruments in realtime monitoring

Additional realtime monitoring measurements

Numerical models for forecasts and scenarios

Older data and risk assessment

Collaboration with scientists

Unique Globally

Research Department
Monitoring needs measurements!

Over 500 real-time measurements

Earthquakes and volcanoes
- Seismic stations
- GPS monitoring system
- Strain meters
- Tilt meter
- Infrasound
- InSAR measurements
- Gas measurements
Meteorological monitoring

**Atmosphere**

- Weather stations
- Radars (fixed and mobile)
- Wind and particle lidars
- Remote sensing via satellites
Hydrological monitoring

- 120 water gauges of which 78 have discharge measurements and rating curve
- 42 water temperature
- 23 conductivity
- 2 turbidity
- 1 pH
- 14 air temperature
- 3 web cams
- Sediment transport
- Glacier mass balance
- Snow thickness
The Hydrometric Observation Network

New network analysis

The new Icelandic Met Office has broader scope than the older HydroService

- Water-related risks, hydrological, environmental and climate research more pronounced

Major changes in Icelandic society, travelling, tourism

Changes in the Icelandic frame of law

Over 35% downsizing of governmental funding in 10 years

Long term strategy for network extension has been sent to the ministry – three timescales
Equipment isn’t all!

What more is needed?

Human resources
► 25 trained personnel with diverse background
► Engineers, geophysists, geologist, geographers, meteorologists, technicians...

Specialized vehicles, snowmobiles, all-terrain vehicles, boats, helicopters...

Power generation in the field

Tele-communication network – data streaming

Databases

Glacier measurements in NW-Iceland with help from the Coast Guard

Mobile-radar in operation during Holuhraun eruption in 2014
Observation division (AOT)

Status of integration

Four divisions by subject

► Still certain specialization
► Short weekly meetings with all staff of AOT
► Coordination of field work
► More integration with weather and water than with seismometers and GPS equipment

QC differs by subject

► Only primary QC for Earth, Weather and RS
► Time series of quality controlled data (annual basis) produced for water
► QC for other data performed at Processing and Research Division
Observation division

Status of integration

Coordinator of data streams & raw data quality
- Integration of data stream options
- Development of solutions for QC of raw data

Independent data bases
- WISKI for hydrology but homemade for other
- New upgrade of Vista Data Vision will help displaying different data from different fields

Innovation at home
- Development of homemade solutions for power generation, telecommunication, transport issues etc. – for all observation fields
Integration of observation systems quite good

Hofsjökull example
Hofsjökull

- WMO Global Cryosphere Watch
- Integrated CryoNet Cluster station
Observation systems

More integration achieved in logistics/hardware/software of the networks than in staff mobility
Other integration of hydrology

Processing and Research Division

Much increased knowledge transfer between hydrologists, meteorologists, geophysicists etc.

Mobilization of scientist between subjects

Numerical Weather Prediction data used in hydrological products

Major advances in data analysis, modelling and product development with integrated approach

Climate change research shows how greatly these systems are interconnected in Iceland

Accumulated discharge from the HARMONIE NWP model
Climate change

Affects the whole natural system

- Increased temperatures and precipitation
- Melting glaciers
- Change in total and seasonel discharge patterns
- More floods and droughts
- Increased rockfalls/debris flows due to melting of glaciers and permafrost
- Isostatic uplift due to decreased glacier volumes
- Eustatic sea-level rise
- Possibly more geothermal and magma production due to less glacier volume – more frequent/larger eruptions and glacier outburst floods (jökulhlaups)

Interlinked system!
Holistic approach needed
Big data – remote sensing
Complies with WMO strategy
Overall triumph with very few cons!!
IMO’s Centennial
1920 - 2020