Use of snow products in Statkraft

CryoLand Dissemination Workshop – Nordic
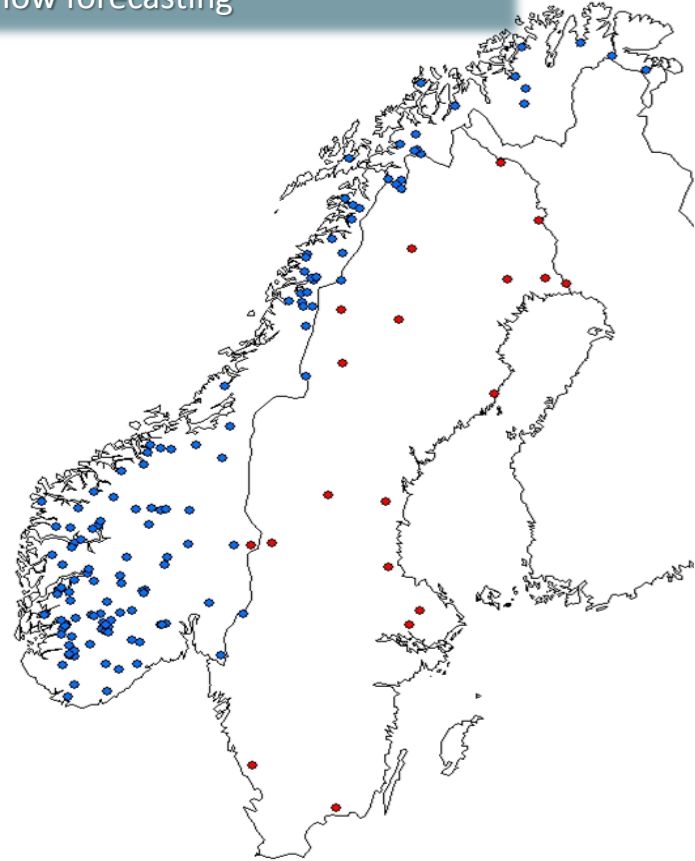
Oslo, 8.October 2014

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In Scandinavia:
- 334 hydro powerplants (2013)
- 13 900 MW
- 35 - 40 TWh / year

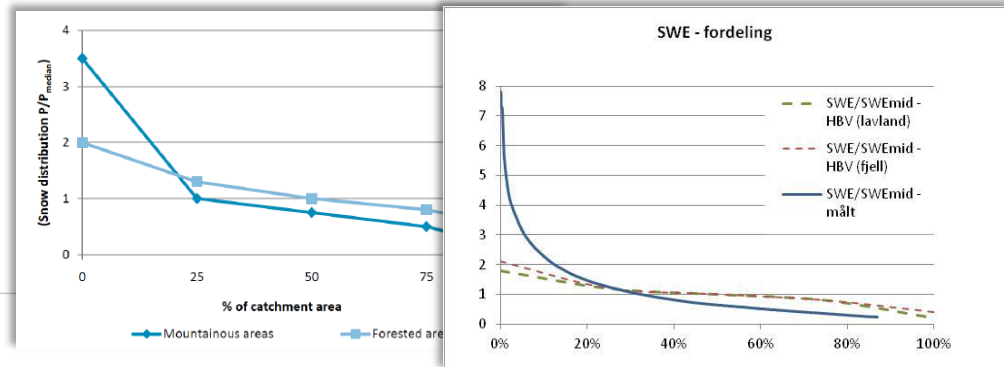About 200 Rainfall-Runoff models for hydrological state and inflow forecasting

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Snow in the HBV-model

▸ HBV model for runoff forecasting (short term and long term)

- Estimates snow accumulation from observed precipitation and temperature

- Estimates snow melt by a temperature degree-day model

- Estimates SCA based on assumed snow distribution curve

NEDBØR
TEMPERATUR
SNØMAGASINET

Snow melt = C · (T-T$_s$)

SWE - fordeling

SWE/SWEmid - HBV (lavland)
SWE/SWEmid - HBV (fjell)
SWE/SWEmid - målt

Snow update procedure today

▸ Sources of information:

- **Field snow surveys mid February and mid April**
  - Estimated SWE
  - No/sparse information on snow distribution/SCA

- **Multitemp_FSC_Scandinavia_Multisensor (KSAT)**
  - Daily FSC product, 250m resolution

- **Multitemp_FSC (GlobeSAR)**
  - Daily FSC product, 250m resolution
  - Pan Europe – Scandinavia – Norway – Selected catchments
  - Post processed (single day – interpolated pixels – age of pixels – time development vs. previous years)

▸ Update of snow in HBV-model

- Manual update of **snow storage**

- **snow covered area/snow distribution** is corrected in extraordinary cases

- Daily FSC product is **used as support** – not operationally used
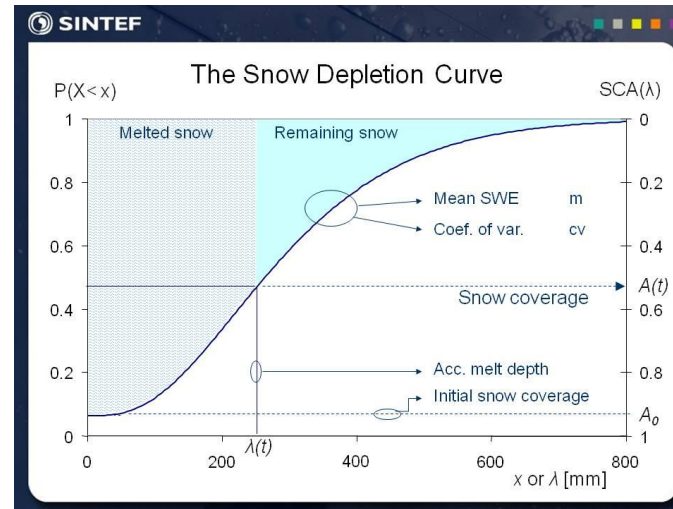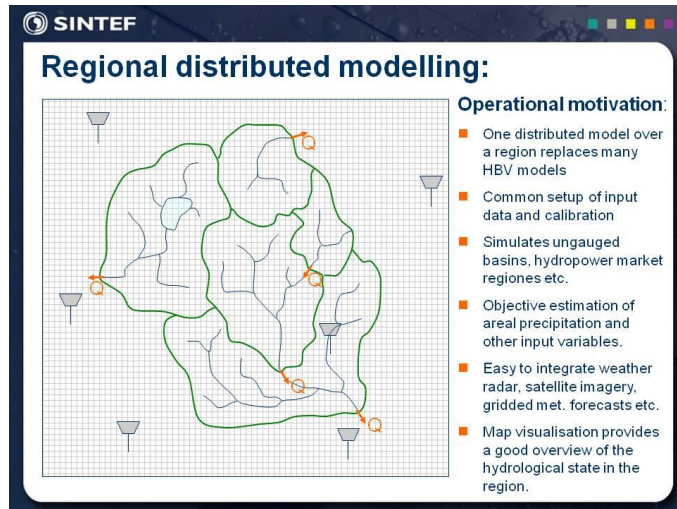
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Challenges with HBV-model

- HBV is a semi-distributed model
  - Snow routine is distributed in elevation zones
  - All other routines are lumped

- Simplified process descriptions in HBV
  - Simple empirical equations
  - Not necessarily physically correct
  - Model needs calibration

- HBV is calibrated against runoff, not against SCA or SWE
  - SWE in HBV is not equivalent with true SWE
  - SCA in HBV is not equivalent with true SCA

- HBV-model is too primitive to utilize the information in SCA maps

- HBV model does not facilitate use of SCA maps in operational forecasting

- SCA maps are being used
  - In evaluation of runoff forecasts
  - In analysis

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Future prospects …………

ENKI:
- distributed hydrological model
- new snow update algorithm
- test implementation in Statkraft recently finished

- SCA will be a more useful information

Statkraft going international

Other products of interest

Product type	Spatial resolution	Temporal Coverage	Coverage	Latency time	Implementation. Priority	EO sensors
Snow extent, Pan-European	500 (1000) m	Daily, full year	35N – 72 N 11W – 45E	<1 day	1	MODIS, Sentinel S3
Snow extent, regional	250 m – 500 m	Daily, full year	Alps, Nordic, Baltic Sea area	<1 day	1	MODIS Sentinel S1, S3
Snow extent, local	25 – 50 m	monthly, full year	Alpine valleys, small AOIs (on request)	<1 day	1	Sentinel 2, (Landsat)
Snow Water Equivalent (Low res) Pan-European	10 – 25 km	Daily, dry snow season	35N – 72 N 11W – 45E	<1 day	1	SSMI/S, AMSR2
Melting snow area	100 m	Daily, Spring/Summer/Fall/Winter	Regional, local	<1 day	2	ASAR (archived), Sentinel S1
Statistical snow Information	HRU / basin	Daily	Local	<1 day	2	--
Snow Surface Wetness	1000 m	Daily	Regional	<1 day	3	MODIS, Sentinel S3
Spectral Surface Albedo	250 m - 1000 m	Daily	Local, regional	<1 day	3	MODIS, Sentinel S3
Snow Surface Temperature	1000 m	Daily	Regional, local	<1 day	3	MODIS, Sentinel S3

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Still waiting ....

▸ SWE product

- dry and wet snow

- daily

- spatial resolution 1x1 km^2 or better

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THANK YOU

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