

Towards an integrated assessment framework to study the effects of forest management and climate on water fluxes in boreal landscapes

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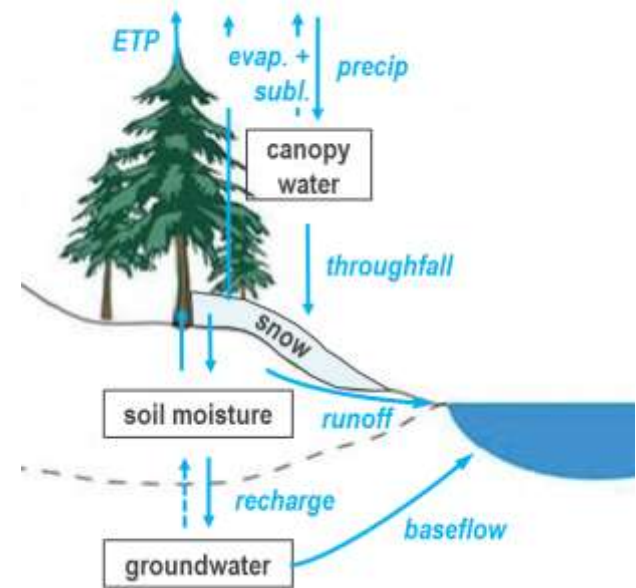


The Norwegian
Water Resources
and Energy
Directorate



Background

- Forests are recognized for their decisive effect on the landscape water balance
- Forest structure determines energy partitioning and dominant flow paths
- Spatial and temporal variability in forest structure often poorly represented in (large scale) hydrological modeling frameworks
- Land use change and changes in forest structure are often neglected in hydrological impact assessments

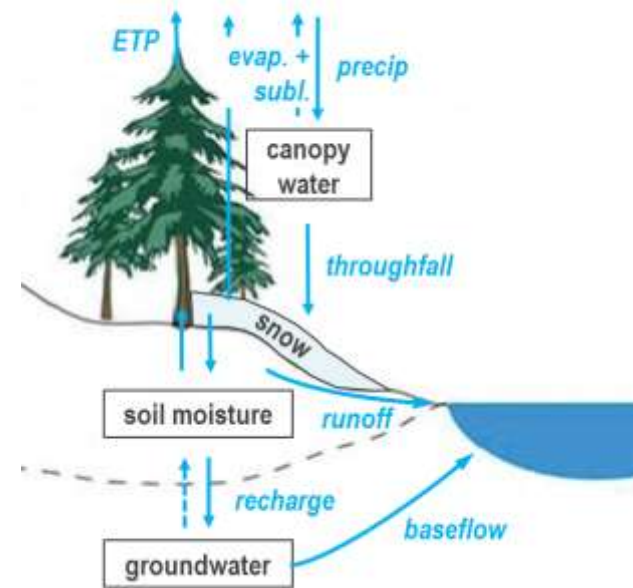


Overarching goal

To (further) develop a hydrological modelling framework to account for effects of forest structure on hydrological processes and landscape water fluxes

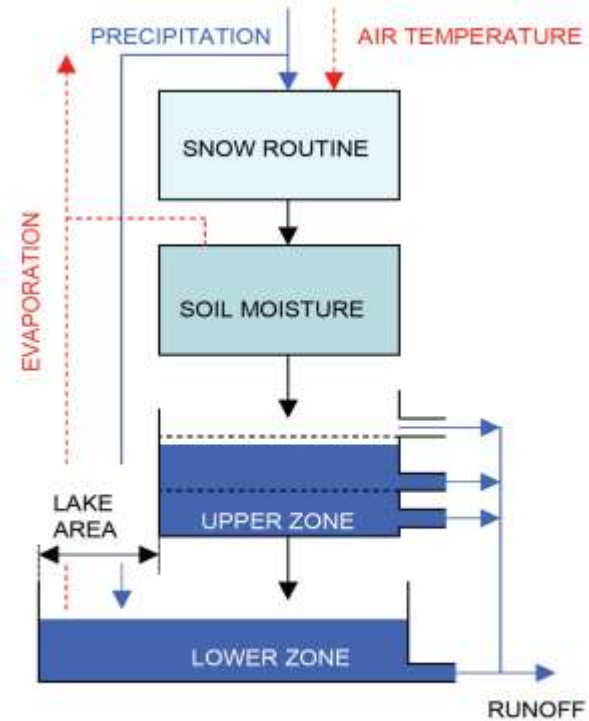
Outline

1. Hydrological model
2. Current land cover scheme
3. Enhanced forest classification scheme
4. Growing season processes
5. Snow pack dynamics



Hydrological model

- Conceptual precipitation-runoff model **HBV**, (further) developed by the Norwegian Water Resources and Energy Directorate
- 1 km scale w/ subgrid land cover
- Hydrological response units defined by land cover type
- Rather generic representation of land use/vegetation
- Standard tool for hydrological and climate impact assessment in Norway



Current land cover scheme



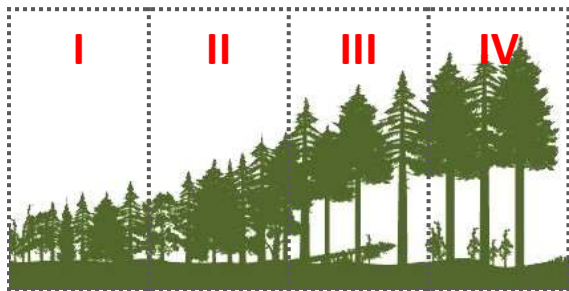
Data-driven, spatially distributed forest characterization that reflects hydrologically relevant differences in land surface parameters:

- Albedo
- Canopy height
- Leaf area index
- Deciduous leaf area (share)

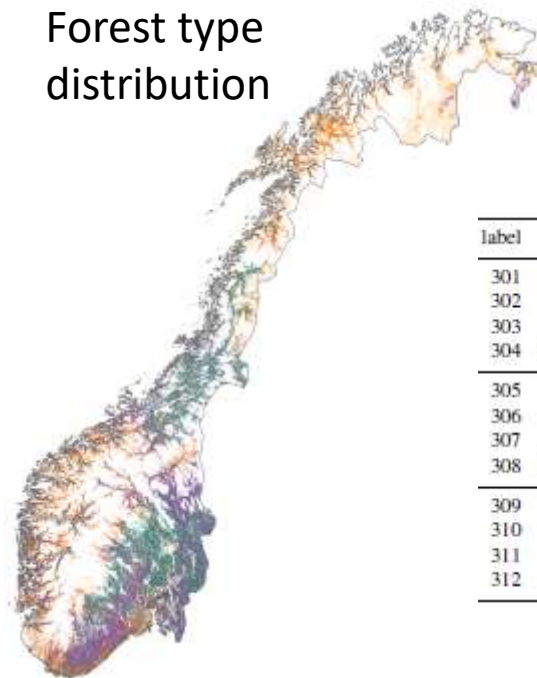
Multi-source remote sensing data

National forest inventory data

Forest classification scheme



Forest type
distribution



Parameter look-up
table

label	V	H	CL	LAI _{max}
301	22 (28.9)	7.5 (3.1)	6.3 (2.8)	1.4 (1.6)
302	92.2 (51.7)	12.3 (2.5)	10.1 (2.2)	4.3 (2.2)
303	201.3 (70.1)	16.8 (3.1)	13.2 (2.6)	6.7 (2.5)
304	373.9 (138.9)	22 (4.5)	15.8 (3.5)	9.1 (3.4)
305	20.8 (23.1)	7.5 (2.8)	4.6 (1.7)	0.9 (1)
306	80 (49.2)	11.6 (2.4)	6.7 (1.4)	2.4 (1.4)
307	129.5 (67.9)	17 (3.9)	9.4 (2)	2.3 (1.2)
308	236.4 (107.1)	17.2 (5)	8.4 (1.6)	4.4 (1.5)
309	7.2 (10.8)	4.9 (1.6)	3.2 (1.1)	0.5 (0.7)
310	36.1 (28.9)	8.4 (2.1)	5.5 (1.3)	1.8 (1.6)
311	97.6 (50.8)	12.2 (3.7)	7.9 (2.5)	3.9 (2.1)
312	227 (111.2)	18.3 (5.5)	10.3 (3.2)	7 (3.2)

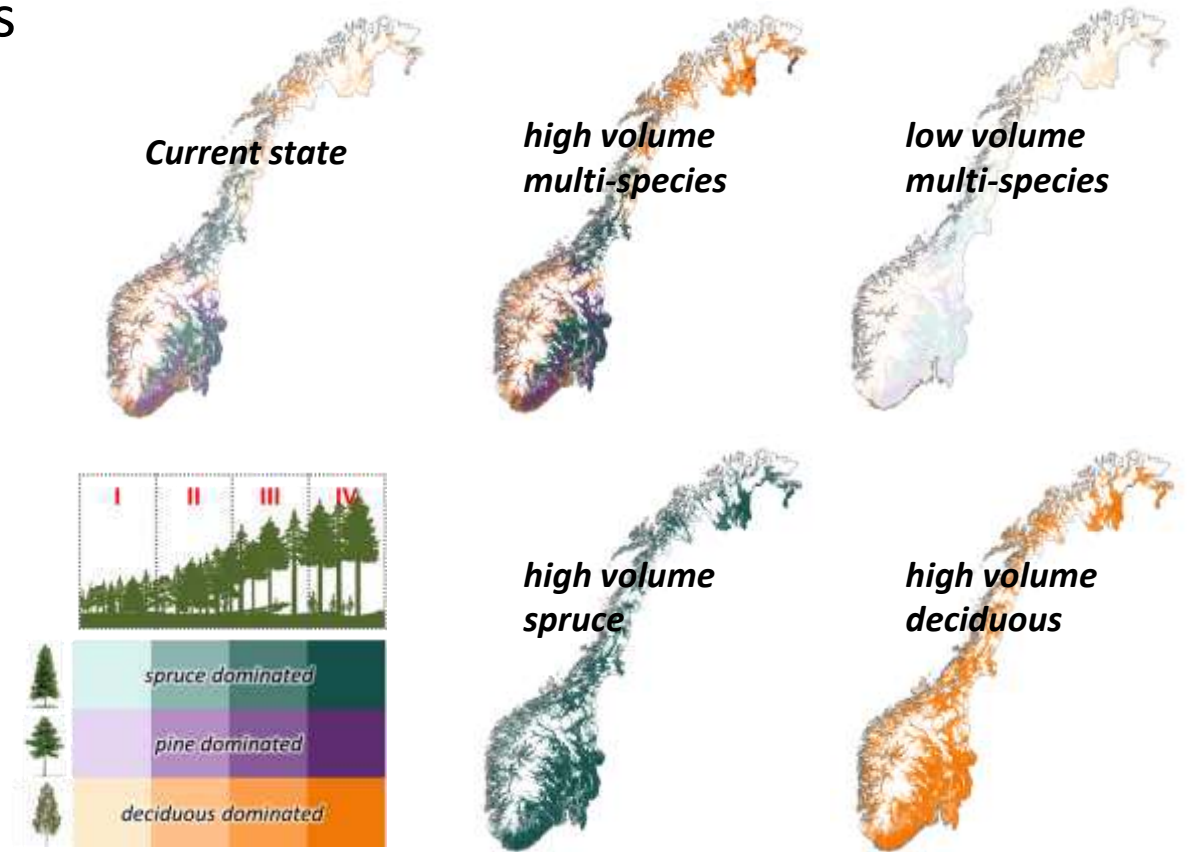
Majasalmi et al. (2018): An enhanced forest classification scheme..., Biogeosciences 15

Sensitivity analysis

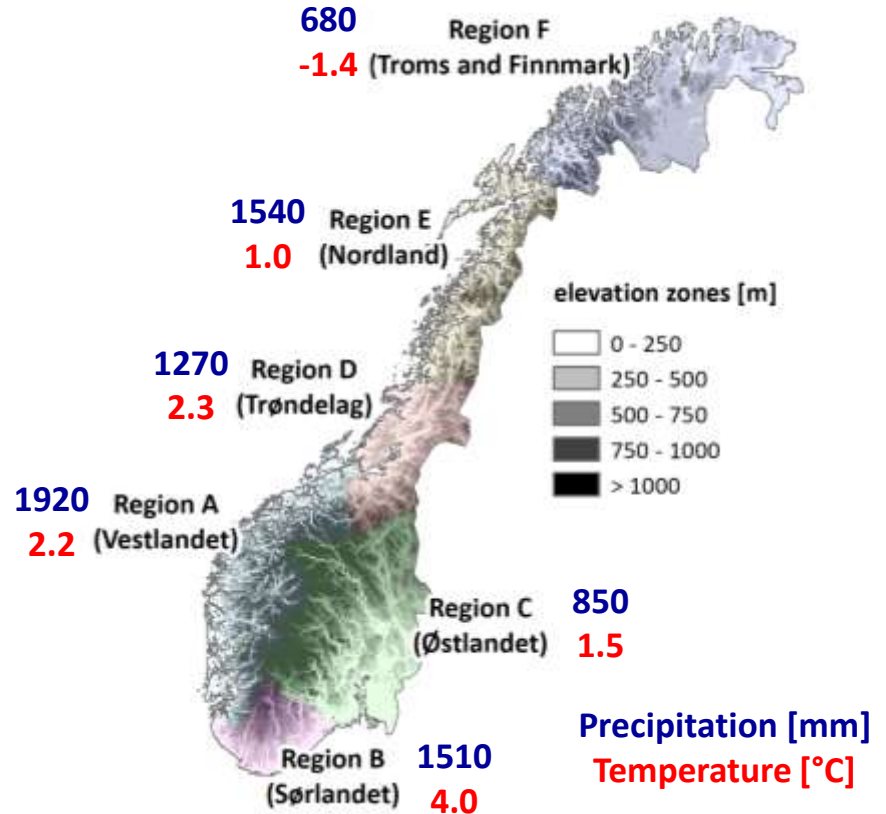
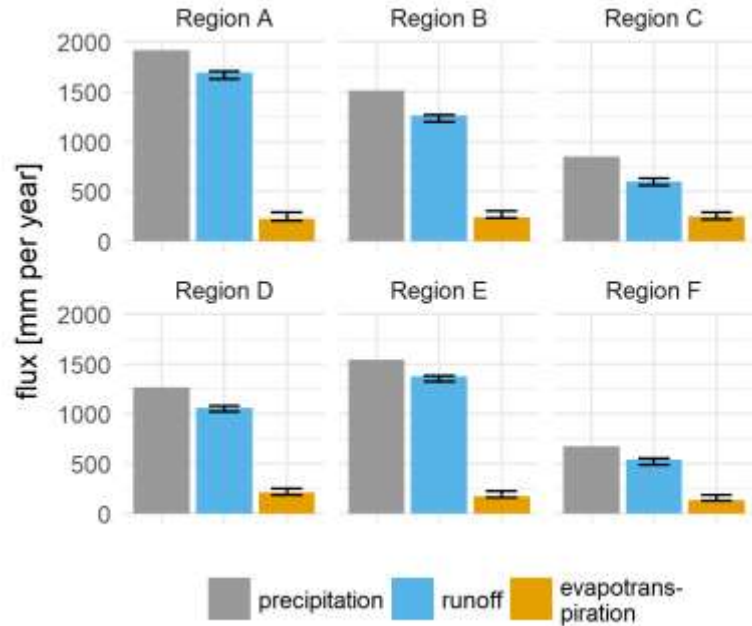
Transient hydrological simulation (1993-2012) under contrasting forest structure scenarios

Effects on:

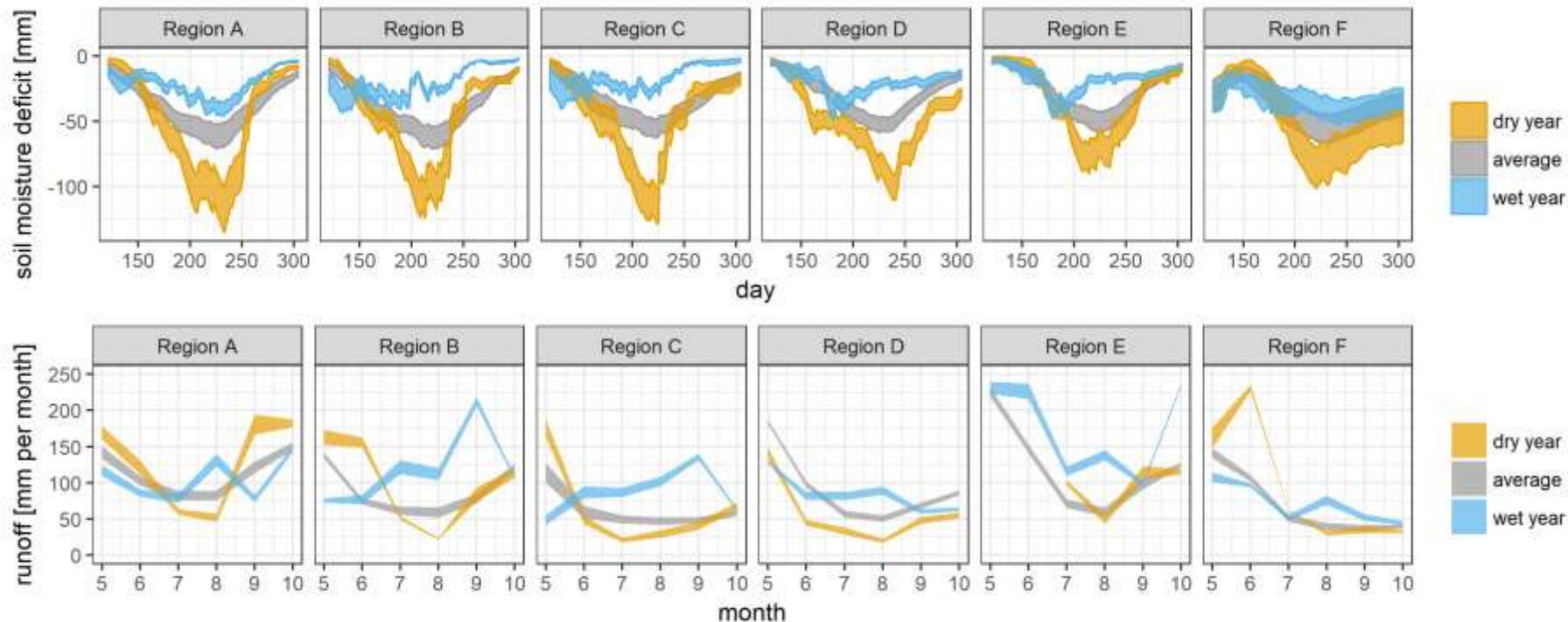
- Evapotranspiration
- Runoff
- Soil moisture deficit



Results: Long-term mean fluxes

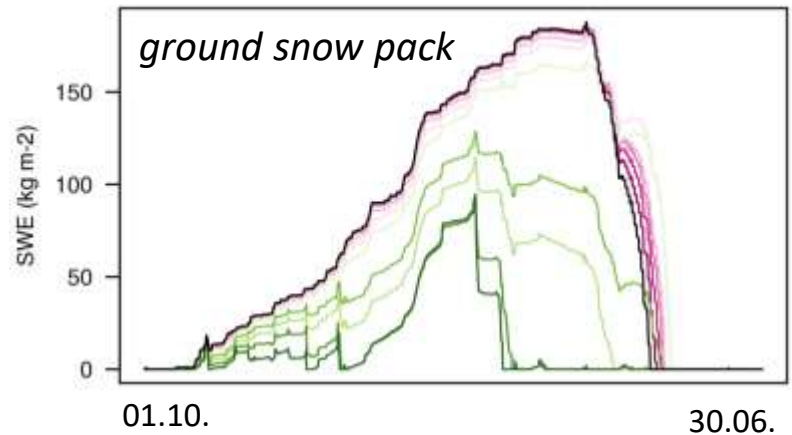
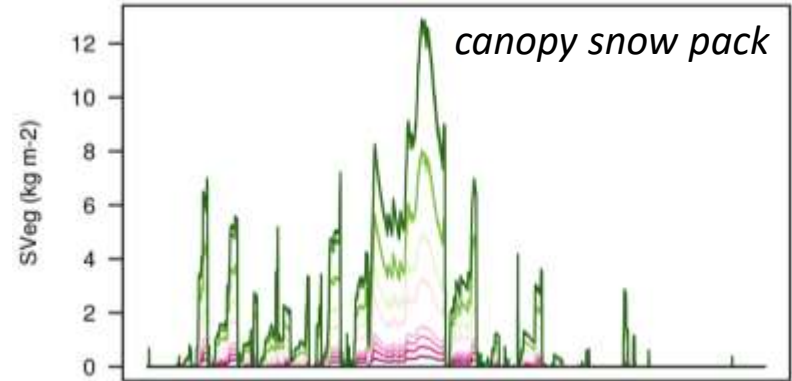
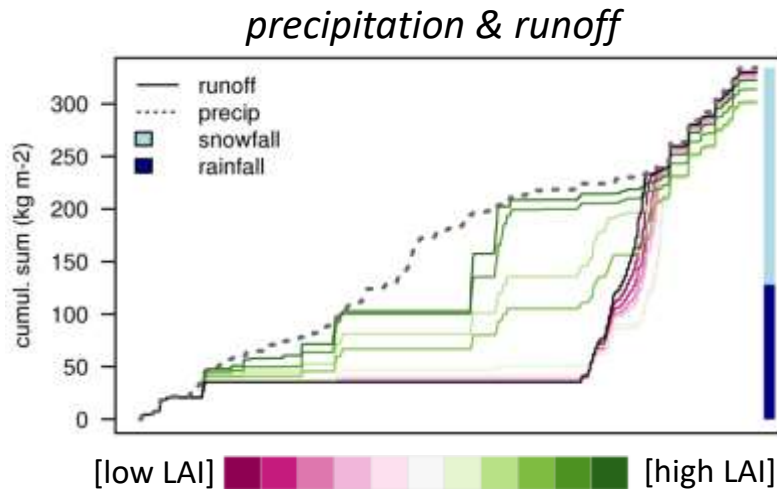


Results: Growing season



Results: Snow pack dynamics

- Site-based sensitivity analysis of snow dynamics under different forest structures (LAI & canopy height)



Thank you for your
attention

