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Improving regional slush flow early warning by establishing thresholds



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Which conditions leads to triggering of slush flows at a regional scale?

What are slush flows?

A snow/water mixture with water as the driving force. Unlike snow avalanches, they are triggered in low slope areas usually between 5° and 30°, typically during heavy rainfall, and/or intense thaw. Exposed snow types are depth hoar, fresh snow on frozen ground and coarse-grained snow (Hestnes, 1998).

Today's challenge



Warning levels for Slush flows in Norway:

- Level 4: Many large slush flows are expected.
- Level 3: Some large and smaller slush flows are expected
- Level 2: Slush flows are possible
- Level 1: Generally safe conditions



Slush flow in northern Norway, May 2010. Photo: Louise Fontain



Initiation area of a slush flow. Photo: A. Taurisano

70 registered slush flow events

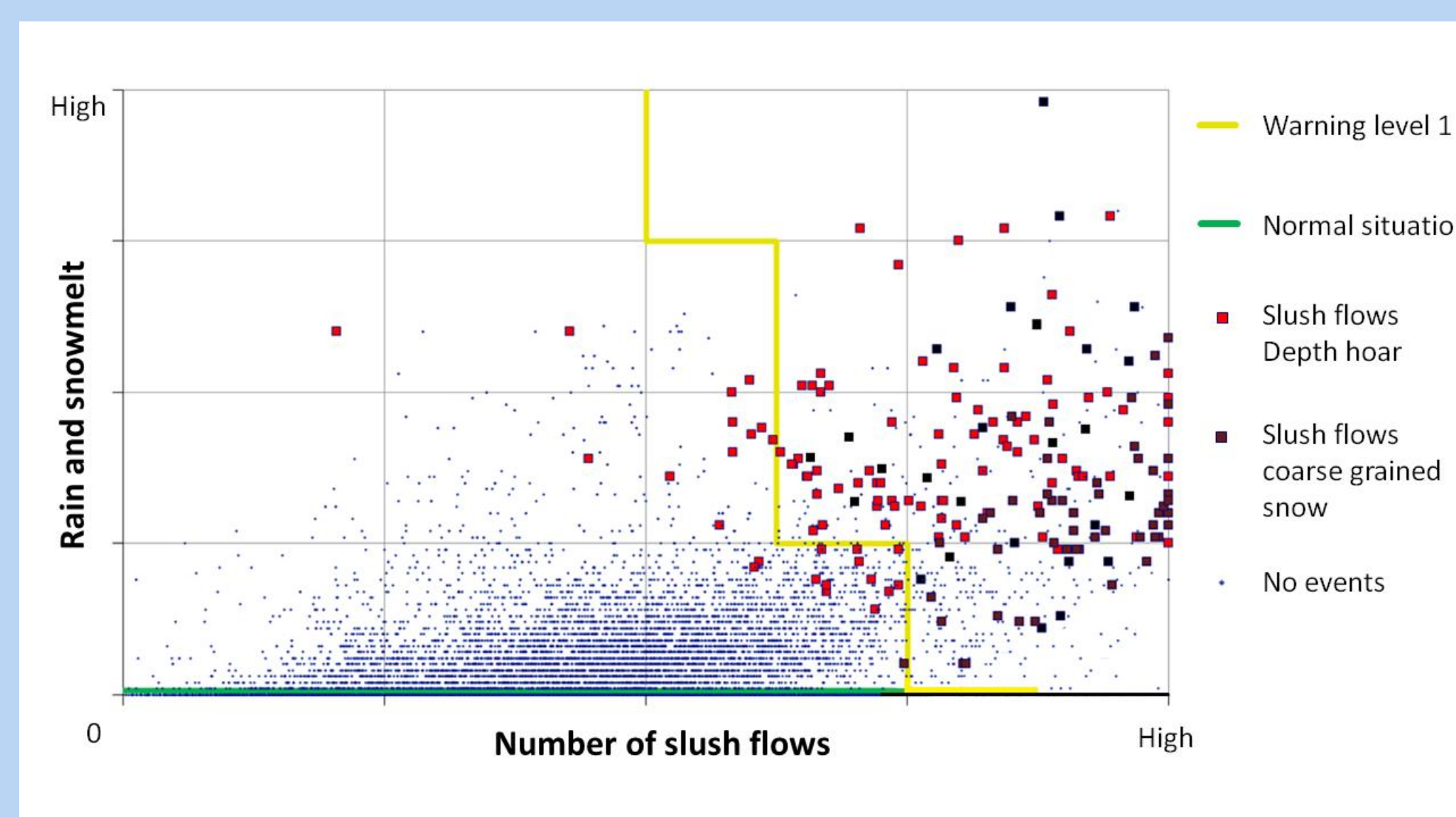


Slush flows constitutes a significant hazard in Norway. A destructive slush flow in Rana region, January 1981. Photo: Steinar Bakkehøi, NGI

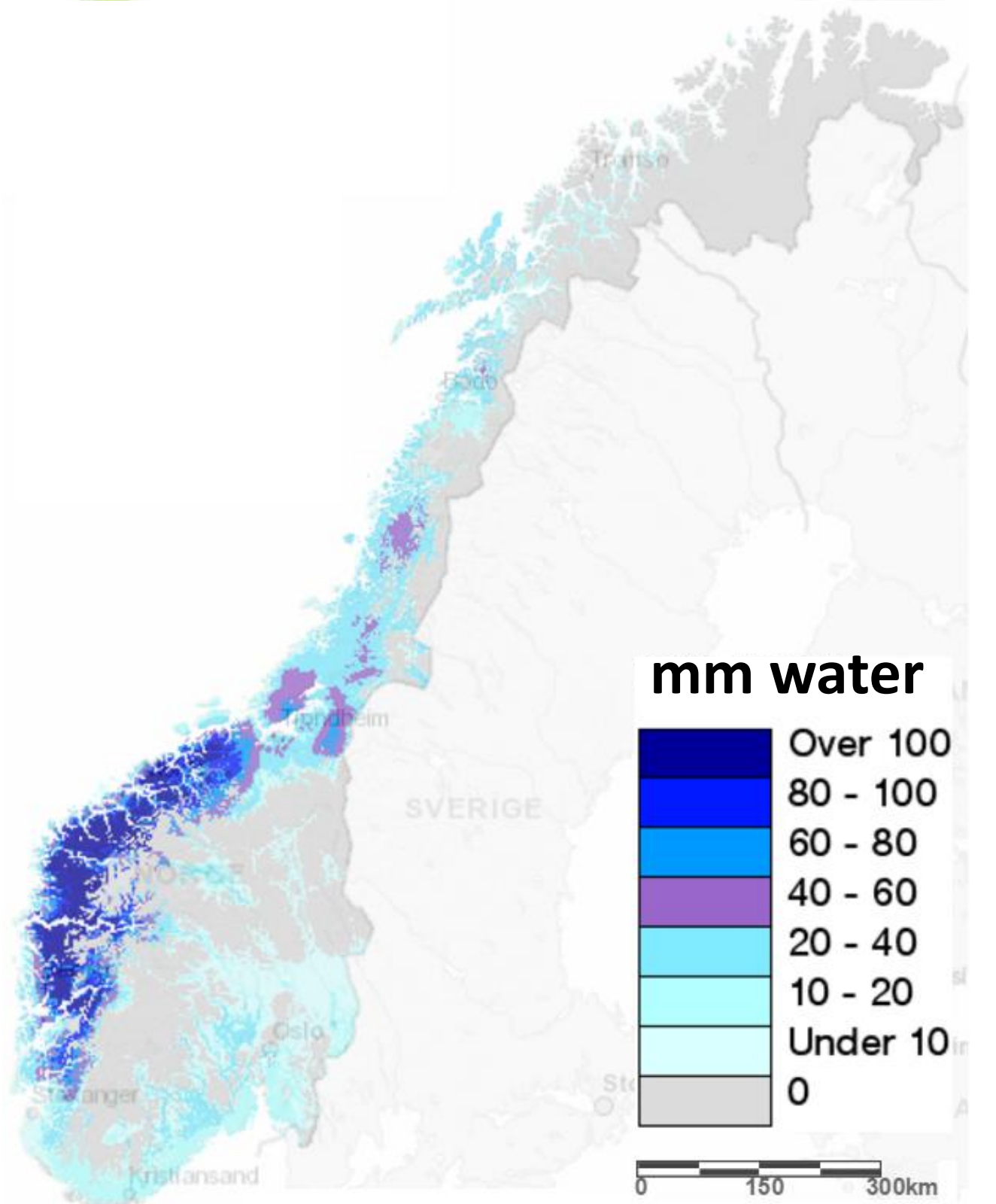
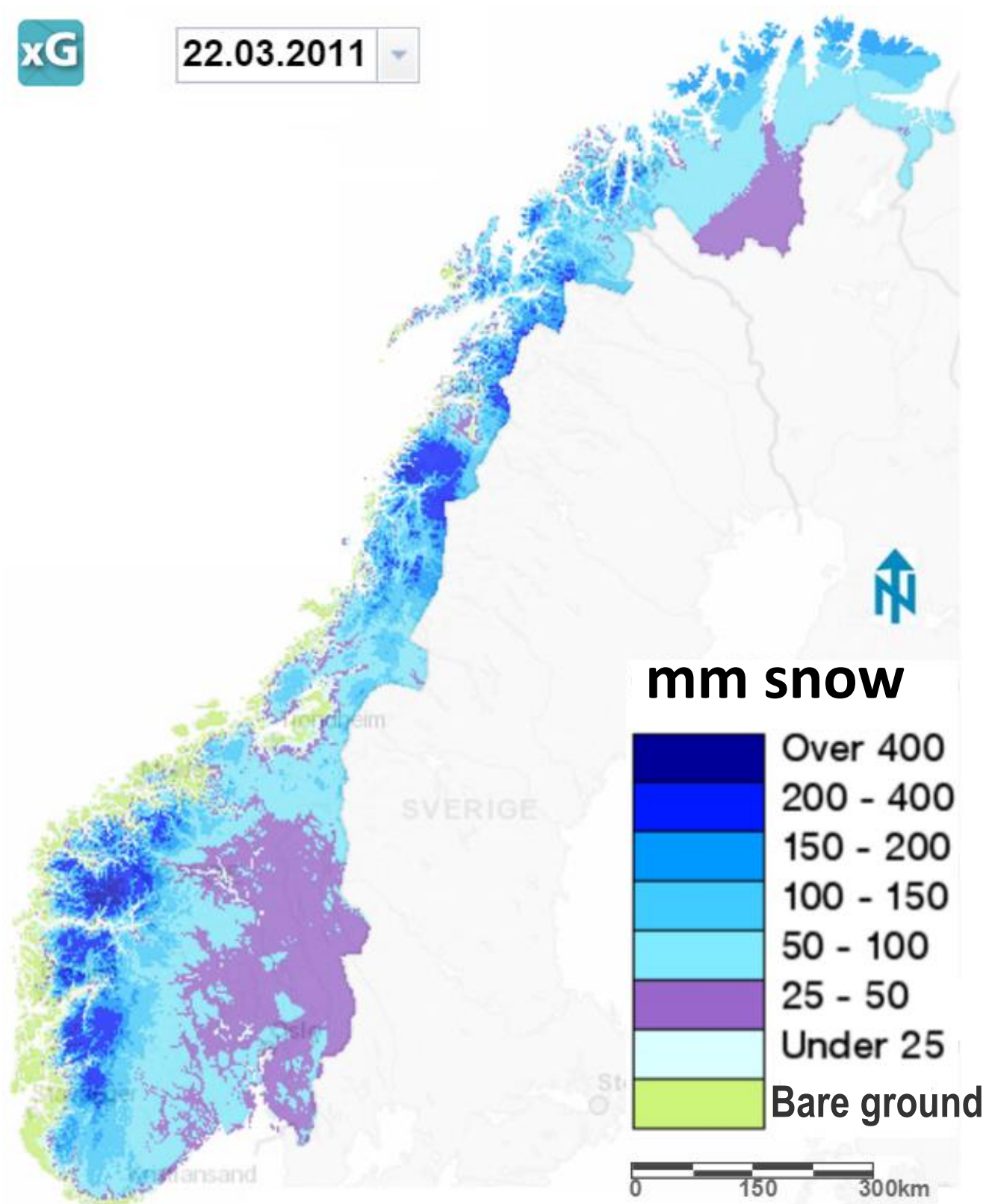
Analysis:

- Classification Tree
- Multivariate

Threshold values



Hydrometeorological data



Daily observations and simulations for meteorological and hydrological conditions are assembled as thematic maps and time-series at www.xgeo.no

Reference

Hestnes, E. 1998. Slushflow hazard-where, why and when? 25 years of experience with slushflow consulting and research. *Annals of Glaciology*, 26, 370-376.

Snow properties



RegObs.no

Crocus Snow model

+	0	169.3
+	0	163.5
+	0	174.5
+	0	174.9
+	0	180.4
+	0	186.2
+	0	173.8
+	0	184.6
+	0	203.7
+	0	202.5
+	0	214.0
+	0	240.7
+	0	249.2
+	0	246.0
+	0	222.6
+	0	232.9
+	0	248.0
+	0	303.2
+	0	304.8
+	0	304.3
+	0	303.2
+	0	260.6
+	0	300.5
+	0	268.7
+	0	268.6
+	0	290.3
+	0	315.3
+	0	308.3
+	0	288.2
+	0	317.6
+	0	358.9
+	0	337.9

Crocus simulation example. From GEO4430, MSc. Course at UiO by T. Schuler.

Web Tools



Xgeo.no



RegObs.no



Varsom.no