



Norwegian
Meteorological
Institute

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TorMic-Project: Radar-Based Detection and Forecasting Tornadoes and Microbursts

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Content

- Background
- Methodology
- First results from the radar
- The Norwegian Deep Convection Database
- Future work

TorMic-Project

MET Norway has recently renewed its procedures for Extreme Weather warnings



Tornado/Microbursts:

- develop a forecasting methodology suitable for the Norwegian climate
 - model-based (days in advance)
 - radar-based (nowcasting)
 - find thresholds
- develop appropriate warnings for tornadoes / microbursts

Ingredients based forecasting

Source: <http://www.estofex.org/guide>

Most important:

- Latent instability
- sufficient lift to release the instability
- vertical wind shear

FORECASTING SEVERE CONVECTIVE STORMS

THEORY OF CONVECTIVE SYSTEMS

1.1 INGREDIENTS-BASED FORECASTING

1.2 INSTABILITY

1.2.1 CAPE
1.2.2 The Skew-T diagram
1.2.3 Side notes regarding CAPE
1.2.4 The choice of the parcel

1.3 LIFT

1.3.1 Lift on various scales
1.3.2 Assessing the presence of (sub)synoptic scale lift
1.4 VERTICAL WIND SHEAR AND CONVECTIVE MODES

1.4.1 Single-cell storms
1.4.2 Multi-cell storms
1.4.3 Linear convective systems or squall-lines
1.4.4 Supercells
1.4.5 Mesogyns
1.4.6 The structure of supercells

CONVECTIVE WEATHER HAZARDS

2.1 FLASH FLOODS
2.2 STRAIGHT-LINE WINDS
2.3 TORNADOES
2.3.1 Supercell tornadoes
2.3.2 Squalls
2.3.3 Conduces
2.4 LARGE HAIL

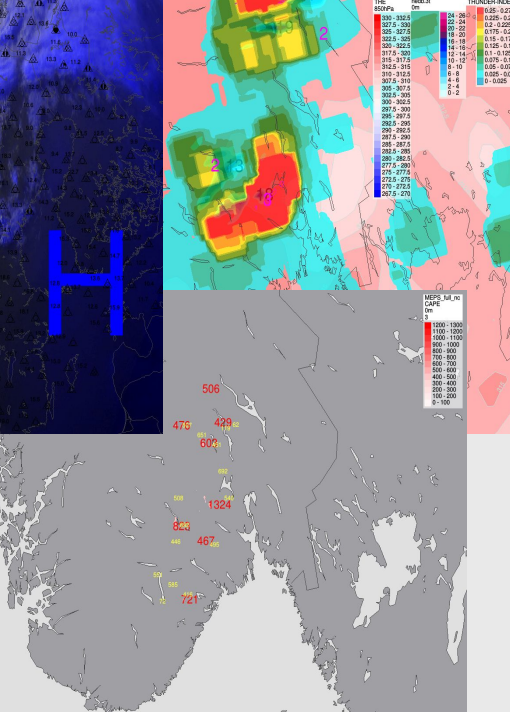
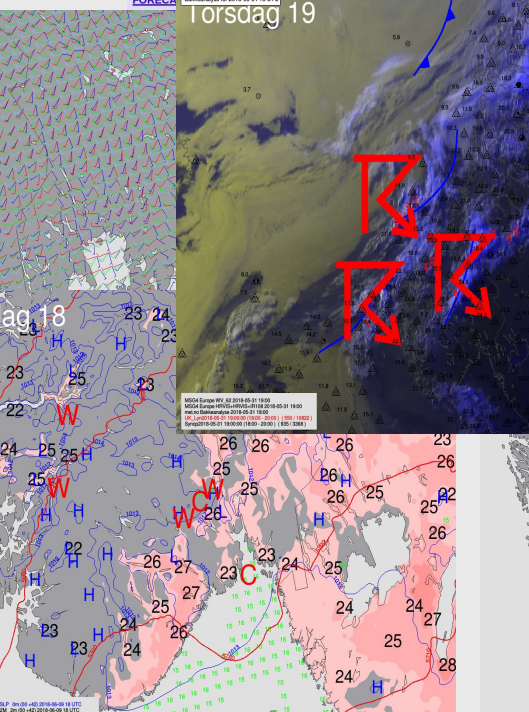
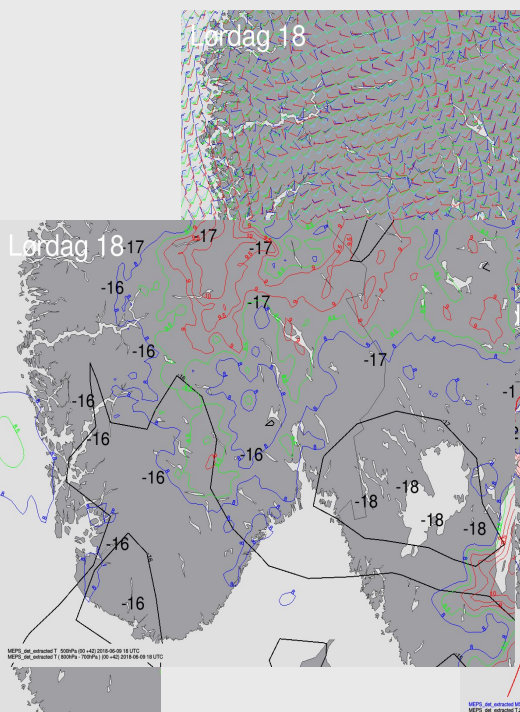
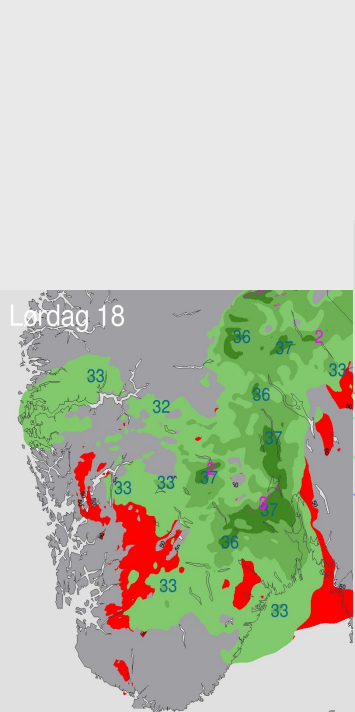
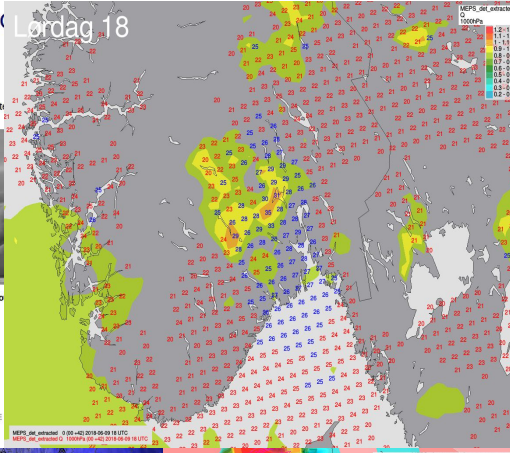
FORECASTING

Forecasting Severe Convective Storms
Pietter Groenemeijer
Ari-Juha Punkka
Jenni Teittinen

Based on a manual written at the Finnish Meteorological Institute



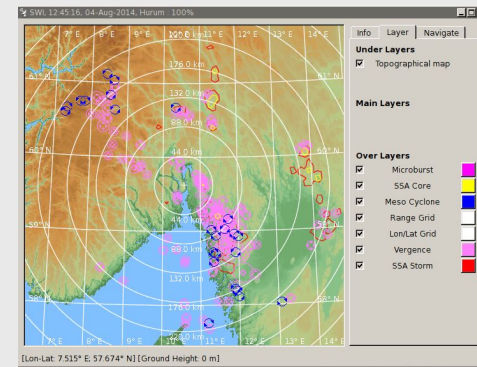
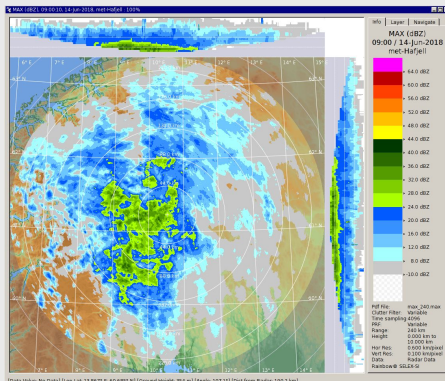
Shelf cloud photographed along the coastline west of van Werst



Nowcasting

How to detect severe convection on the Norwegian Radar Network?

How use the radar information most efficient operationally?



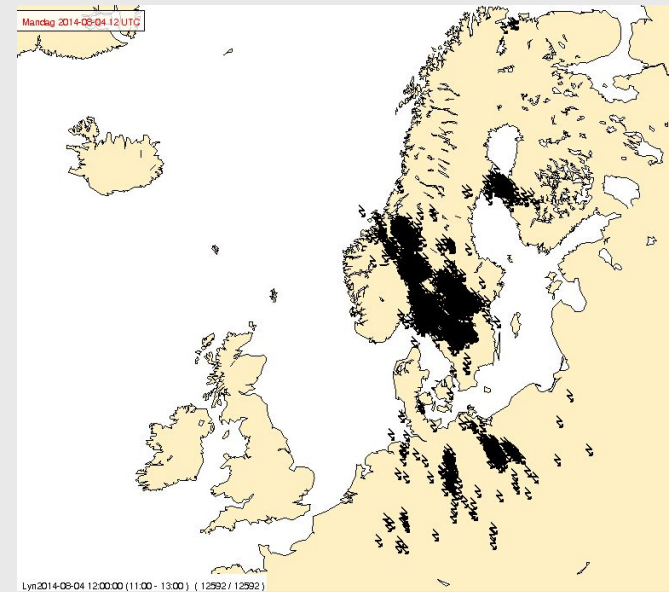
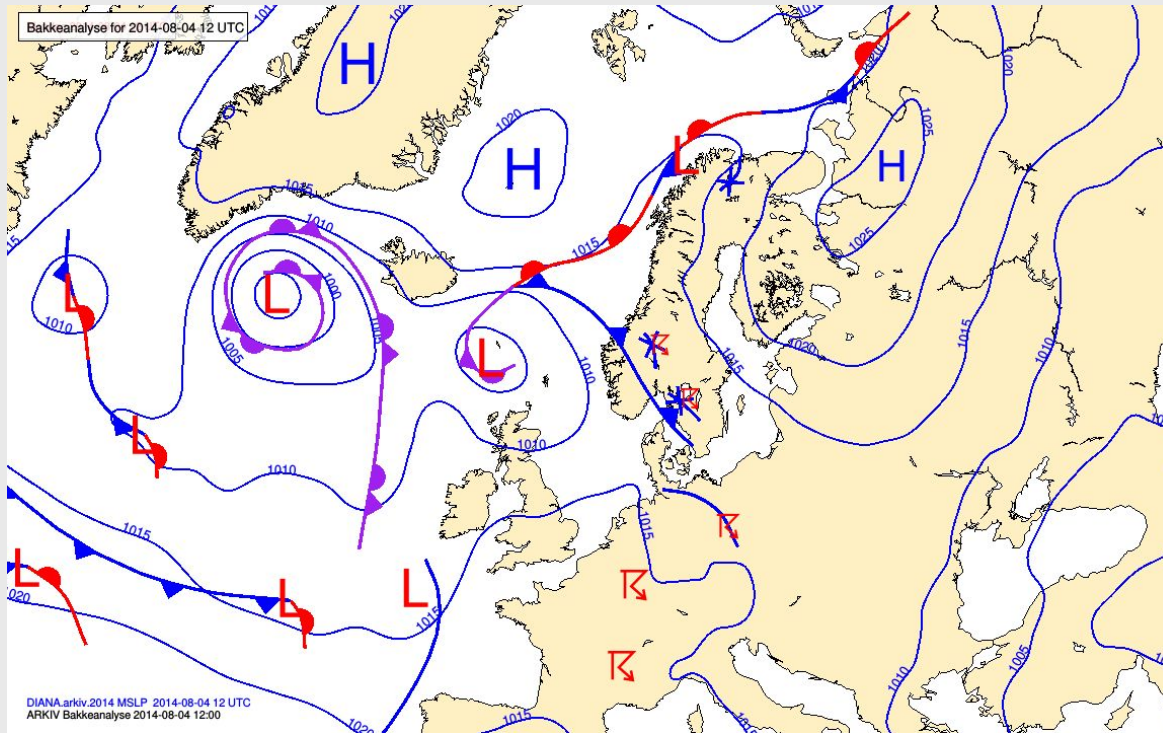
How good are existing detection algorithms (Selex / RainbowDart)?

Radar data used in these results

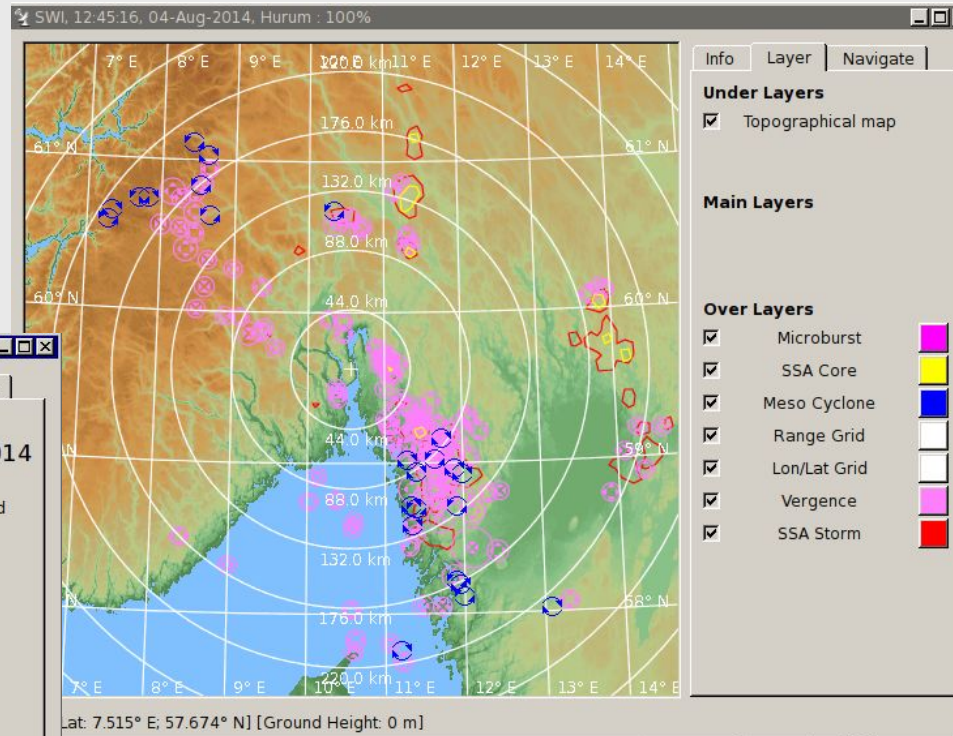
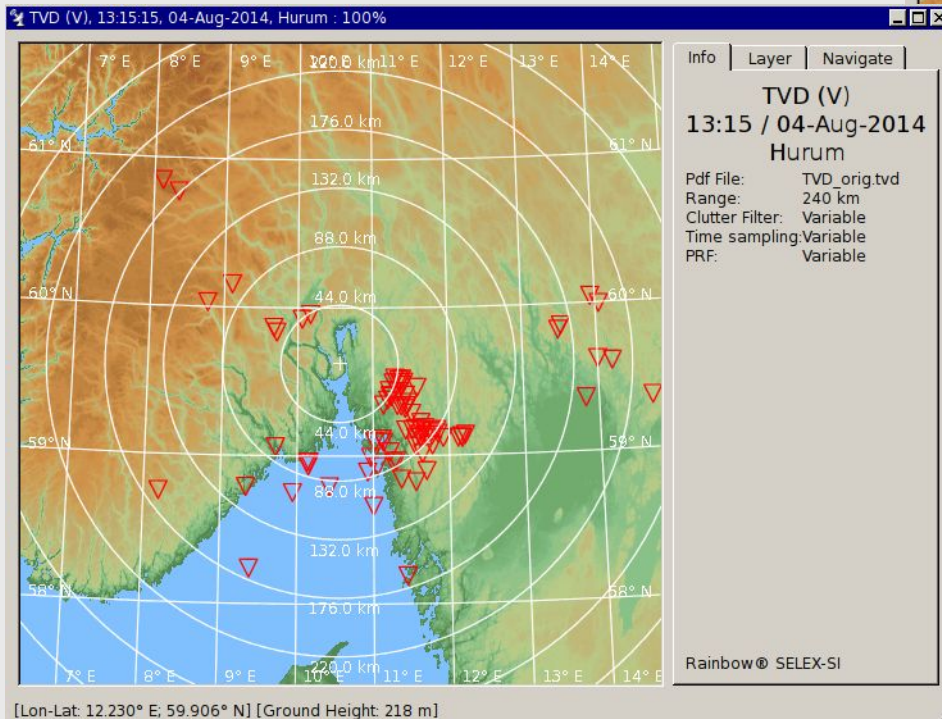
- Hurum weather radar
- Selex Gematronik DP
- Manufacturer specific convective products
- Convective situation 4/8-14



Analysis 4/8-14 12UTC



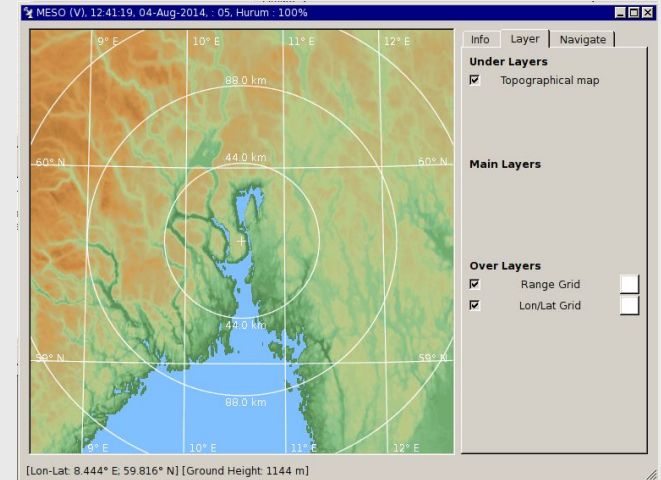
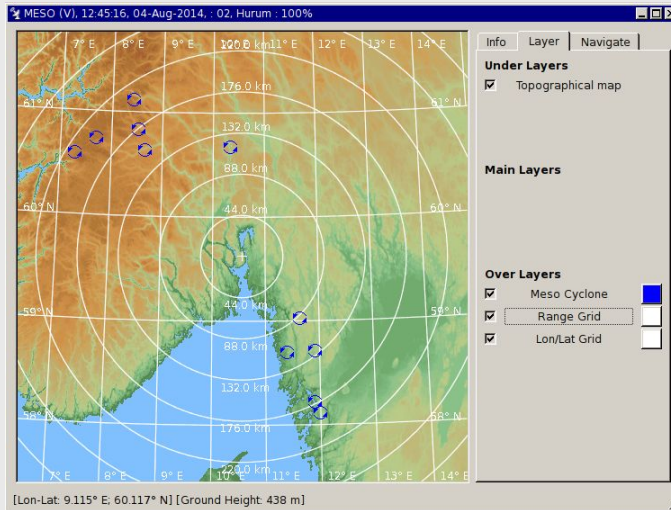
Severe Weather Index and Tornado detection



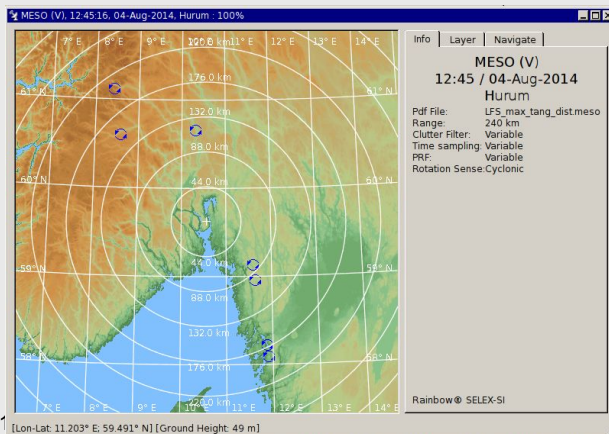
Test of meso cyclone indicator.

2.

1.



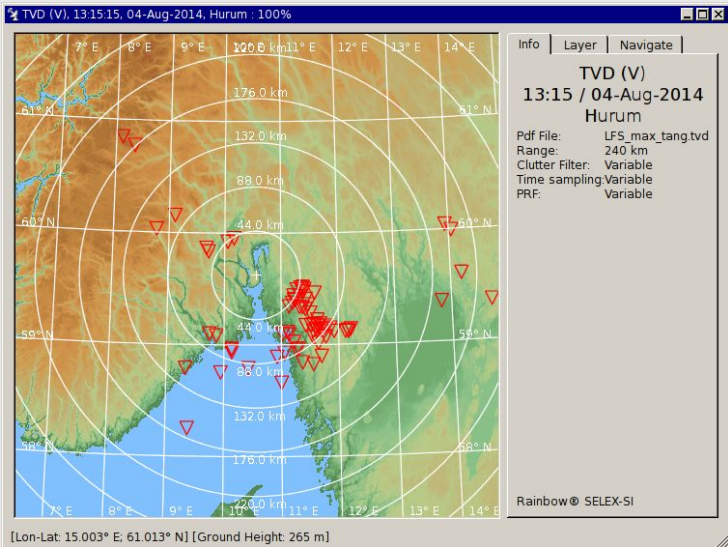
3.



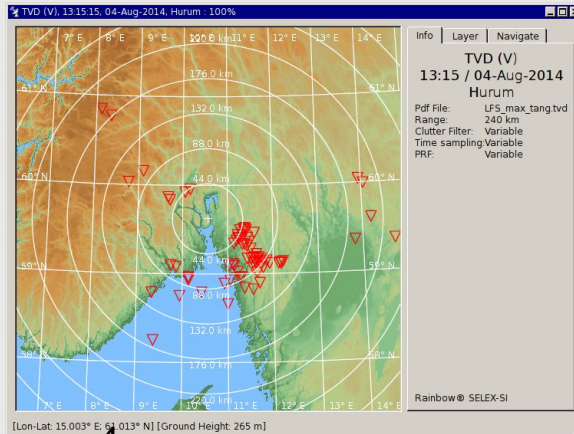
1. wind from reflectivity scan
 2. Wind from wind scan
 3. adjusted max tangential separation of vortices
- Norwegian Meteorological Institute

Tornado detection

1

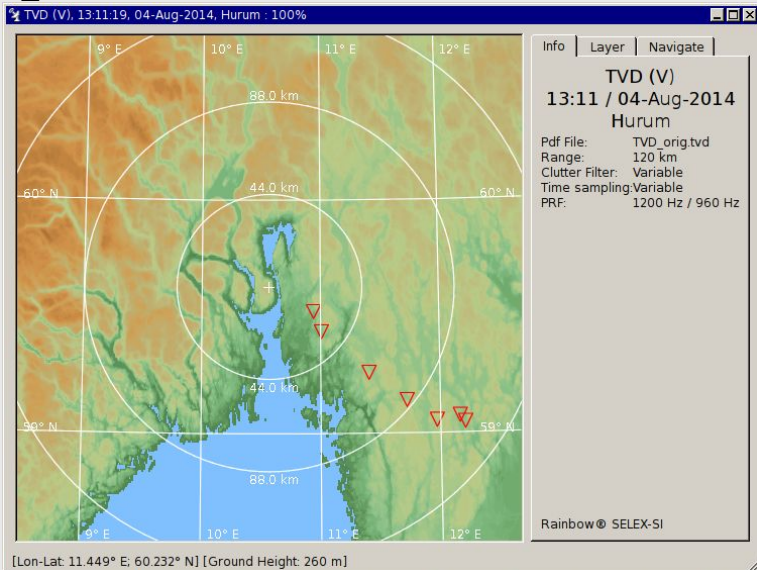


3

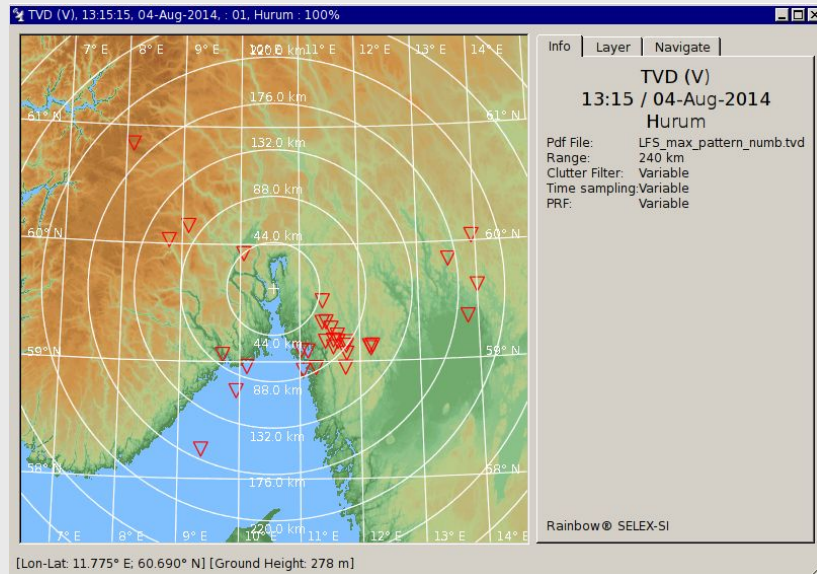


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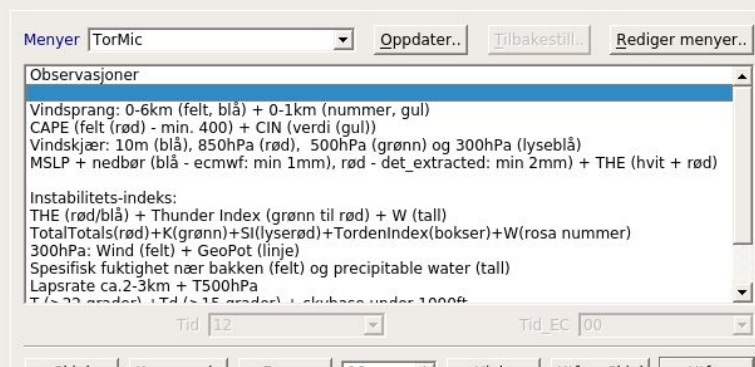


1. Original
2. Windscan
3. increased pattern number
4. increased tangential distance



Norwegian Deep Convection Database

- MET does not have a easy available collection of events
- starts summer 2018
- purpose:
 - get possible cases
 - secure data
 - help to tune parameters (model-based and radar-based)
 - statistics
 - research



Norwegian Meteorological Institute

Criteria

At least one of the following criteria should occurred or is expected to occur during the day:

- precipitation:
 - >10 mm / 1 hour or
 - >20 mm / 3 hours
- thunder activity at SIGMET level
- hail > 1 cm

Registrering av kraftig konveksjon

Instruksen for registreringen er her:
https://docs.google.com/document/d/1KW_Q-1T5-210r52dneoaABJMT70VGwyyWNLk_JtmCPE/edit?usp=sharing

Navnet, brukernavnet og bildet som er tilknyttet Google-kontoen din, blir registrert når du laster opp filer og sender inn dette skjemaet. Er du ikke [sevimm@met.no?](#) [Brii konto](#)

*Må fylles ut

Kortversjon av kriteriene for registrering av kraftig konveksjon

Registrer situasjoner med kraftig konveksjon når MINST EN av følgende kriterier er oppfylt eller ventes å bli oppfylt i løpet av dagen:

- styrtegn: > 10 mm/1 time, > 20 mm/3 timer
- tordenaktivitet på Sigmet-nivå
- hagl-størmåsen >1 cm

Hendelse

Dato av hendelsen *

DD MM ÅÅÅÅ
.. . 2018

Klokkeslett av hendelsesstart (UTC) *

Tid
:

Geografisk område av interesse *

Svaret ditt

Veldig kort beskrivelse av situasjon *

Afterwards?

Case studies

- evaluate parameters
- evaluate thresholds

Refine methodology

Give MET recommendations:

- Use predefined detection algorithms or develop its own?
- concerning issuing tornado / microburst warning
- participate in ESSL???

And continue the work in 2019....



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Takk!

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