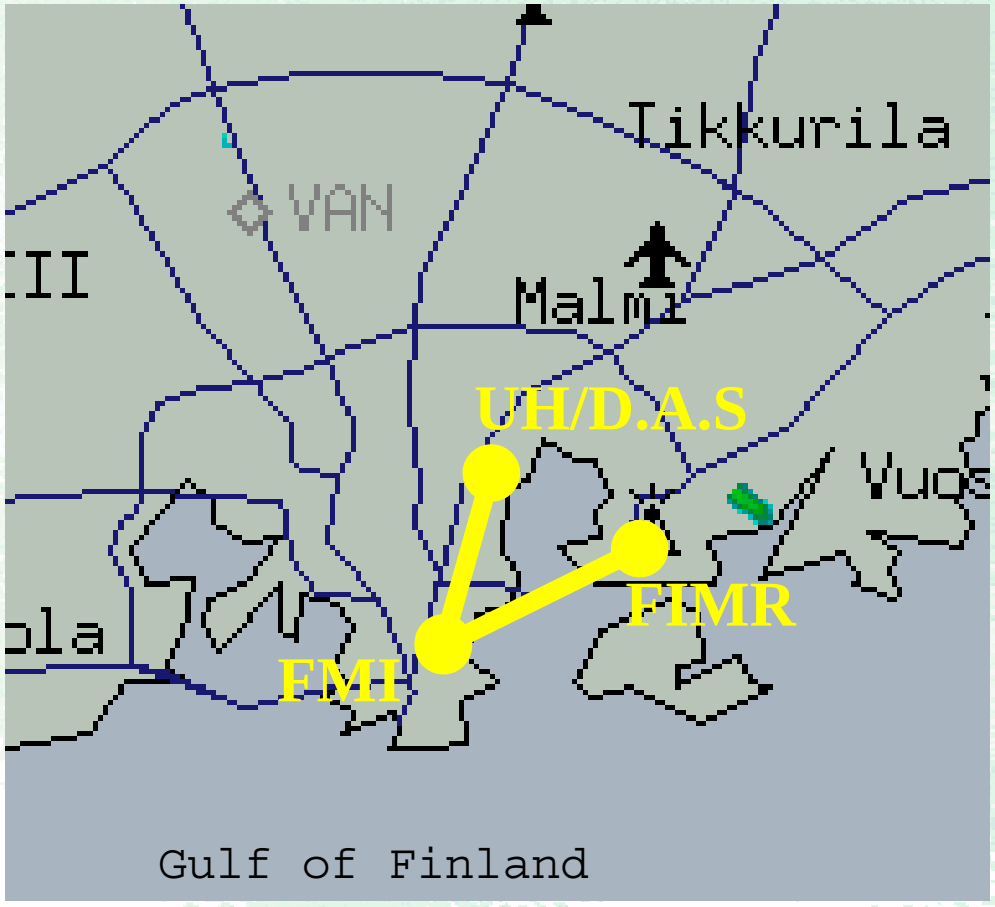
Helsinki meso met-modelling

Carl Fortelius, FMI

- History
- Plans
- Requirements



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History

- **The 2D UH mesoscale model**
  - Research tool
  - Hannu Savijärvi et al.
- **Hirlam**
  - Research tool and operational NWP system
  - The Hirlam consortium
- **MM5**
  - Community research tool
  - PSU/NCAR

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History

- **The 2D UH mesoscale model**
  - Dynamical core: Alpert et al., 1982
  - Parametrizations
    - Monin-Obukhov surface layer
    - Mixing length turbulence closure
    - Cloud physics
    - Advanced solar and thermal radiation
    - Interactive soil scheme

History

- The 2D UH mesoscale model
- **Hirlam: Complete NWP system**
  - Observation handling, analysis, forecast model, post processing

- **Hirlam**
  - Hydrostatic or non-hydrostatic dynamics
  - Parametrizations:
    - Monin Obukhov surface layer
    - Turbulent mixing length based on TKE
    - Deep and shallow convection
    - Cloud physics
    - Solar and terrestrial radiation
    - Interactive soil scheme
  - Analysis of upper air (3D-VAR) and surface characteristics

History

- *Example 1*
  - **Coastal winds and low level jets**
    - Hannu Savijärvi, Sami Niemelä, Priit Tisler
    - QJRMS 2005, 625-637

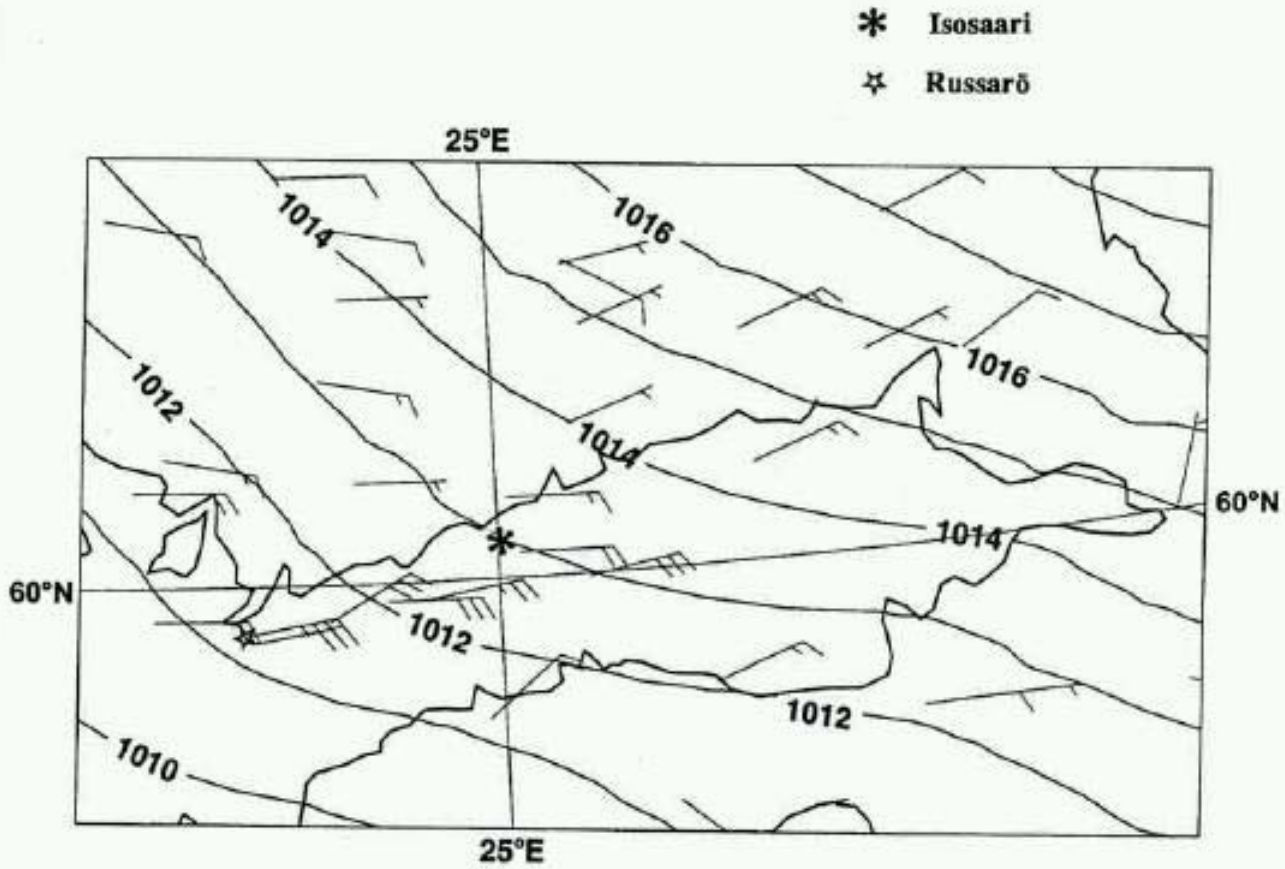
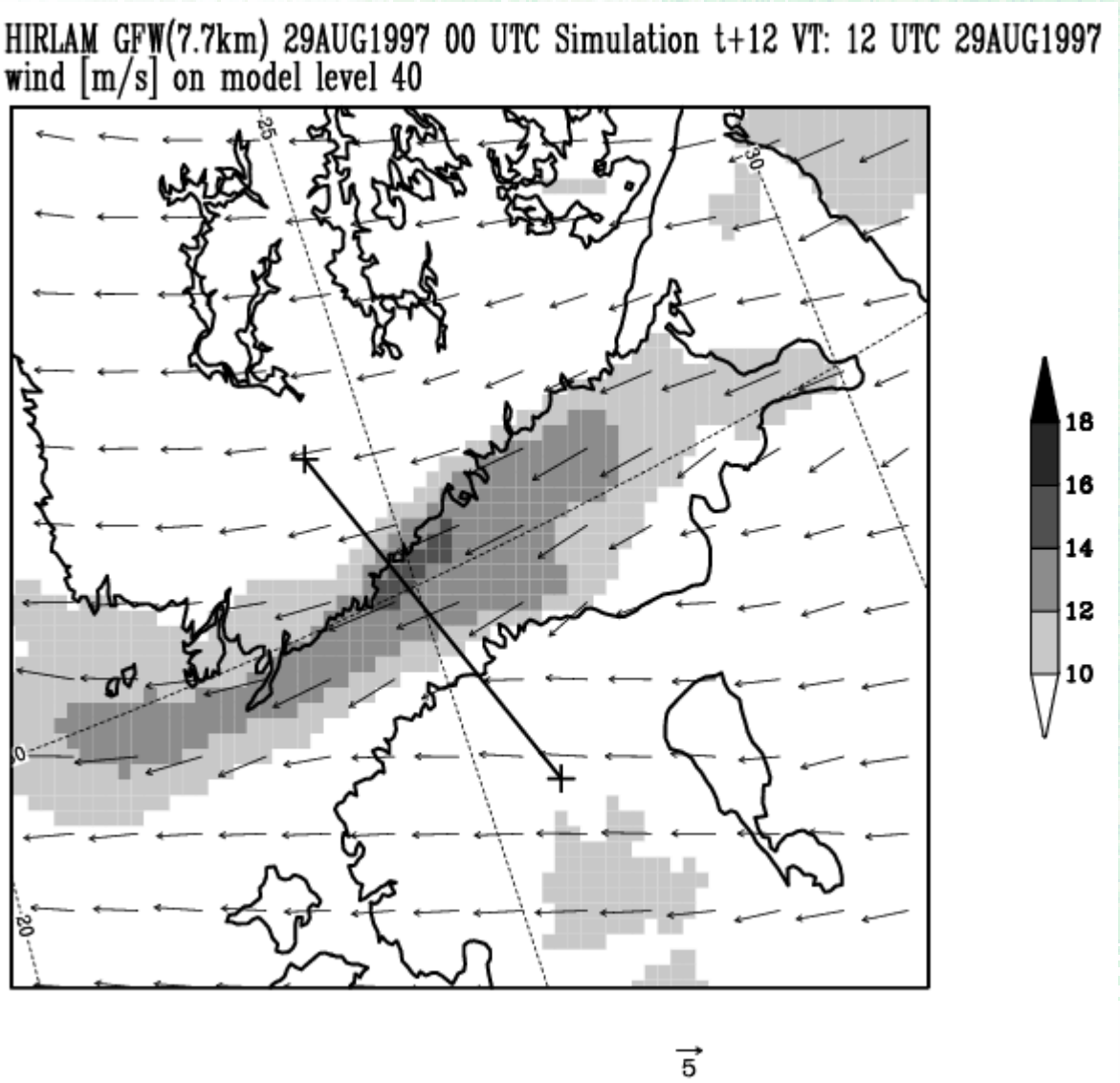


Figure 7. Observed surface winds on 29 August 1997, 1200 UTC, and HIRLAM surface pressure +12 h forecast (hPa) from 29 August 1997 0000 UTC with 7.7 km horizontal grid length. Stations Isosaari and Russarö (Fig. 11) are marked.


HIRLAM GFW(7.7km) 29AUG1997 00 UTC Simulation t+12 VT: 12 UTC 29AUG1997
wind [m/s] on model level 40
25
30
20
18
16
14
12
10
5

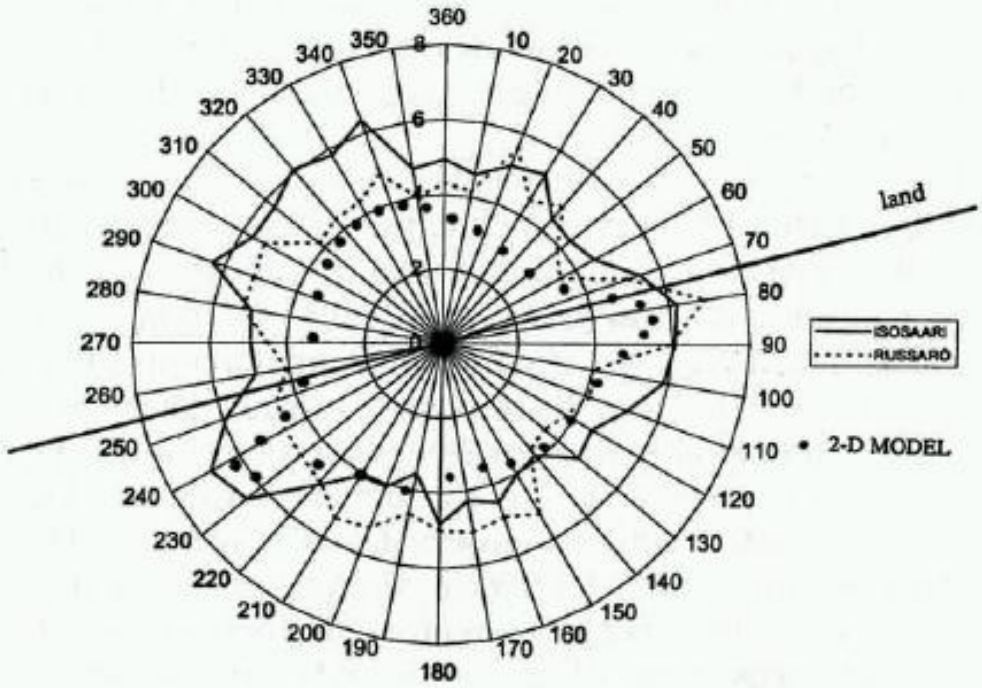
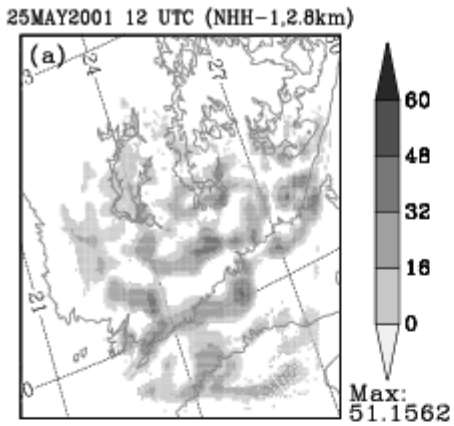
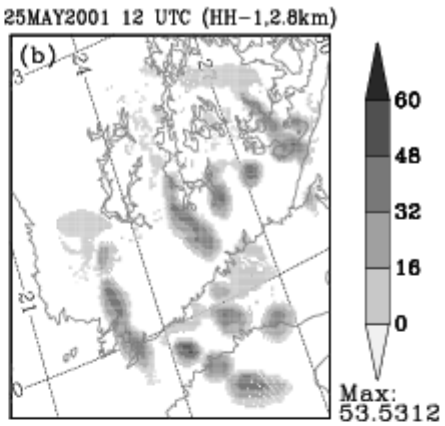


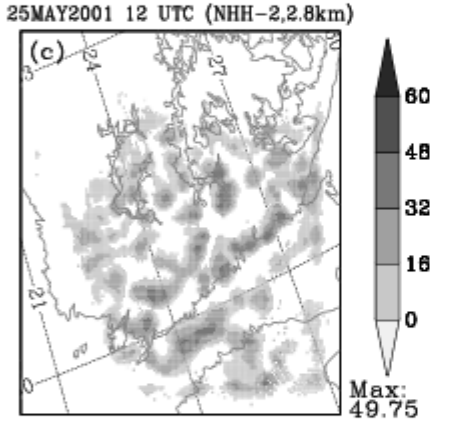
Figure 11. The wind rose of the observed mean surface wind speeds (m s^{-1}) for May–June 1999–2003 from the islands Isosaari (solid line) and Russarö (dashed line). Also shown is the wind rose of the overcast channel 2D simulations (10 m wind vectors 3 km out at sea) for moderate $\mathbf{V}_g$ (10 m s^{-1}) from 32 directions (dots; maximum value of wind from 238° corresponds to 8.5 m s^{-1}).

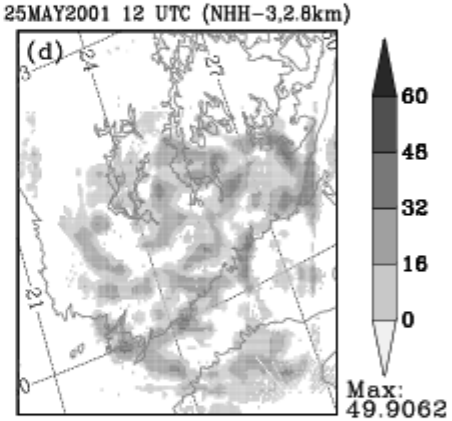
History

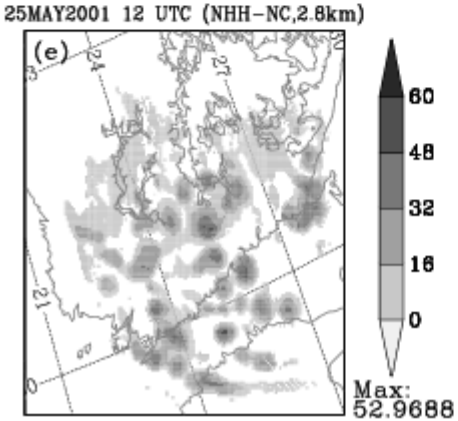
- *Example 2*
  - Applicability of a large scale convection and condensation parameterization to meso-gamma scale....
    - Sami Niemelä, Carl Fortelius
    - MWR, 2005 (in press)
    - “Use of observations in model development”

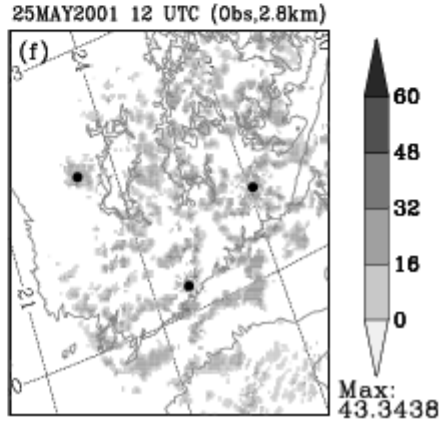












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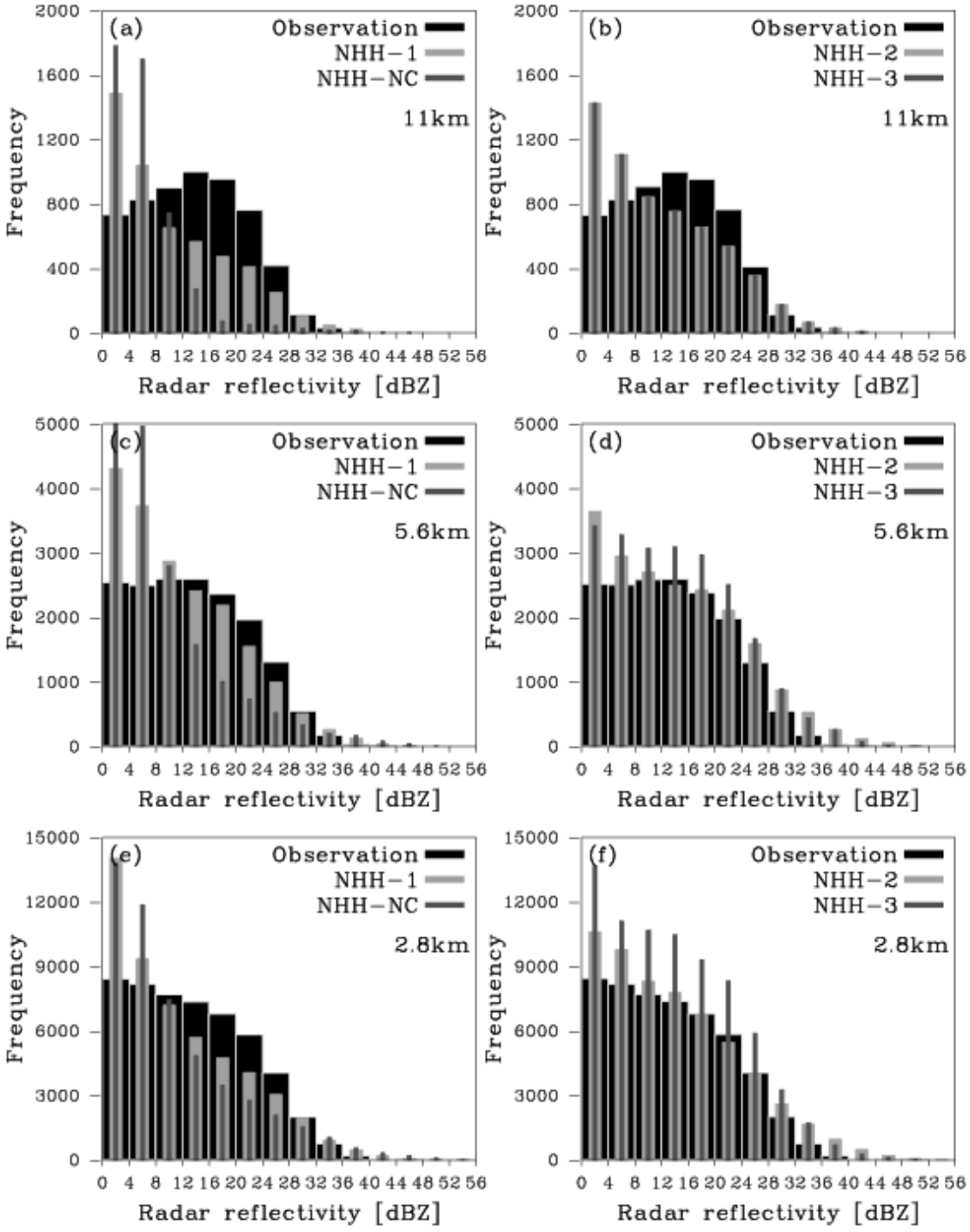

(a)
Observation
NHH−1
NHH−NC
11km
(b)
Observation
NHH−2
NHH−3
11km
(c)
Observation
NHH−1
NHH−NC
5.6km
(d)
Observation
NHH−2
NHH−3
5.6km
(e)
Observation
NHH−1
NHH−NC
2.8km
(f)
Observation
NHH−2
NHH−3
2.8km
Frequency
Radar reflectivity [dBZ]

Plans

- **Meso (gamma)-scale NWP: Why?**
  - To predict and warn about severe weather
  - To serve the needs of air quality prediction
  - To serve the needs of aviation
  - To serve ...
- **Meso (gamma)-scale research modelling**
  - Heterogenous surfaces, complex terrain
  - Local wind climatology

Plans

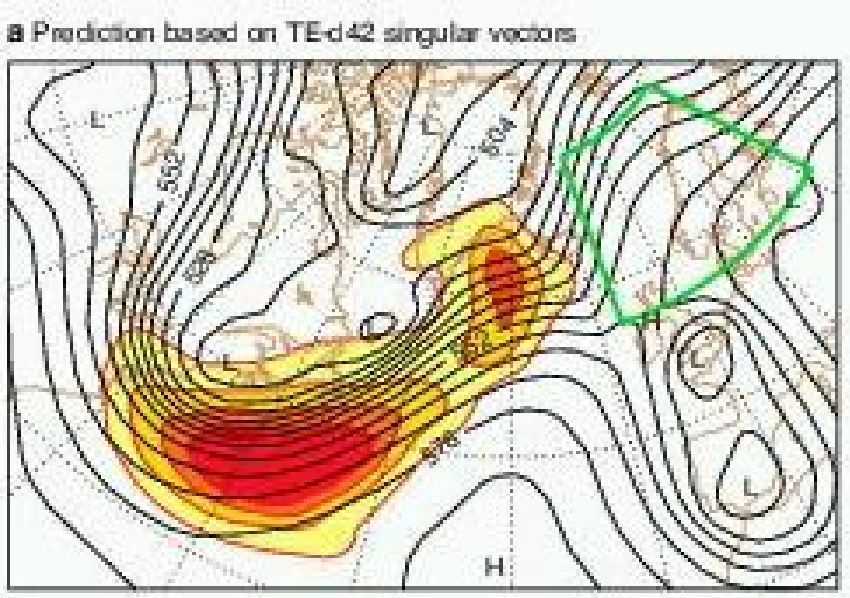
- **Meso (gamma)-scale NWP: How?**
  - AROME
    - Complete, state of the art meso-scale NWP system
    - Beeing developed in cooperation between Meteo France, the ALADIN and the HIRLAM consortia
  - Local analysis and prediction system (LAPS)
    - Analysis and now casting utility (NOAA FSL)
    - Feasibility study under way at FMI

Requirements

- **Simulations** (“boundary val. prob.”)
  - **Lower boundary**: Type of sfc, orography, land use, soil type, soil moisture, sea and lake temperature, ...
  - **Lateral boundary condition**
  - **Verification data**: ABL structure, hydrometeors, low level winds, surface fluxes of heat, moisture and momentum,

Requirements

- **Predictions** (“initial and bd. value prob”.)
  - **Initial state**: 3D structure of the free atmosphere
    - Predictability, Lead time, Domain



“Sensitive areas” for D+2, 2 Dec 2003