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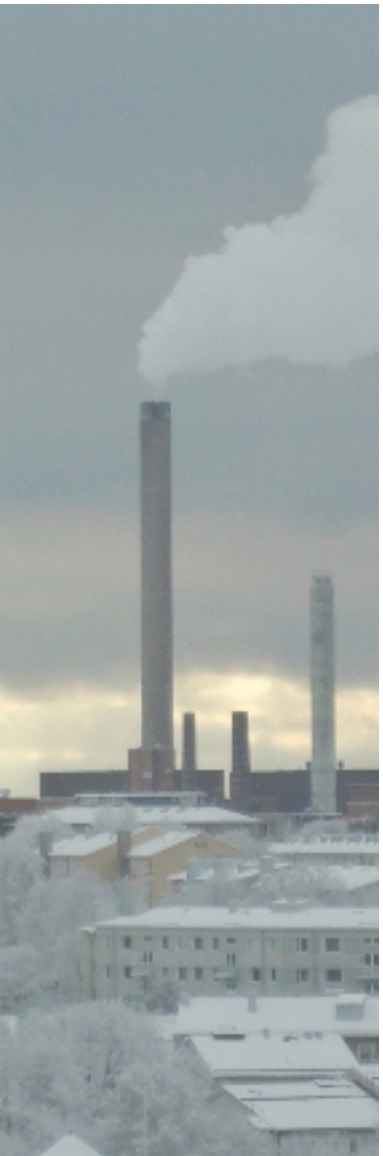

Report for final discussion

The group started with definition of tasks:

Task
Starting points
Sources for discussion
Schedule

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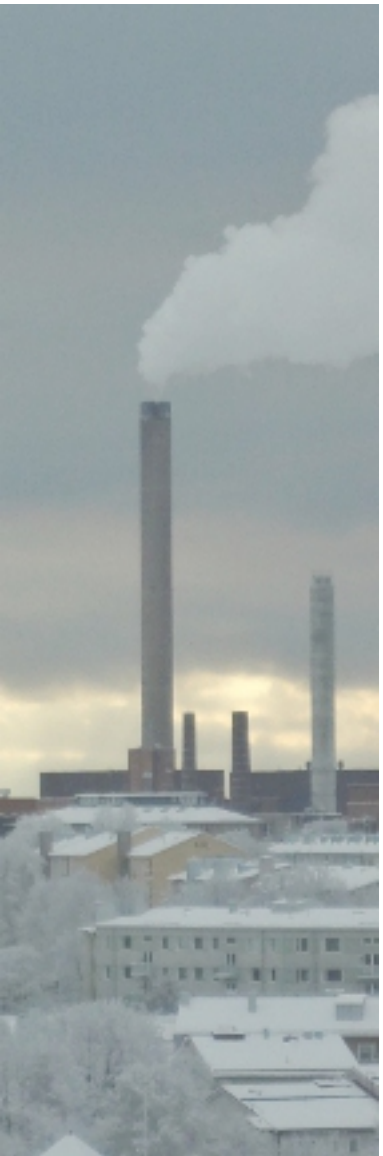

Task

Identify the most important forecasting challenges in the stable boundary layer

Suggest short- and long-term actions to study and solve the problems

Discuss and suggest validation methods for stable boundary layer studies

Agree on common actions/collaboration between models accross different scales

Main conclusions ECMWF/GABLS SBL workshop (Nov 2011)

- ✓ Uncertainty in the formulation of diffusion in stable situations remains high. Meso-scale variability and terrain heterogeneity are important
- ✓ *Use of Turbulent Energy equations to support the turbulence closure.*
- ✓ Large uncertainties on momentum budget in models. Impact of drag over land on the planetary scales. Intercomparison proposed.
- ✓ Biases in the LW downward radiation even in clear sky situations. Verification studies using e.g. BSRN were recommended.
- ✓ SBL is highly interactive with the underlying surface. Consider coupled system. LES should have at least simple surface energy balance.
- ✓ More diagnostic studies on behavior of the boundary layer and its interaction with the surface. More use of super-sites (CEOP, FLUXNET)
- ✓ For land surface : (i) shallow top soil to represent fast time scales, (ii) multi-layer snow scheme, (iii) use many observational sites to derive relevant model parameters, (iv) use DA techniques to "inverse" land surface parameters.
- ✓ *Define a new GABLS case for uniform snow*

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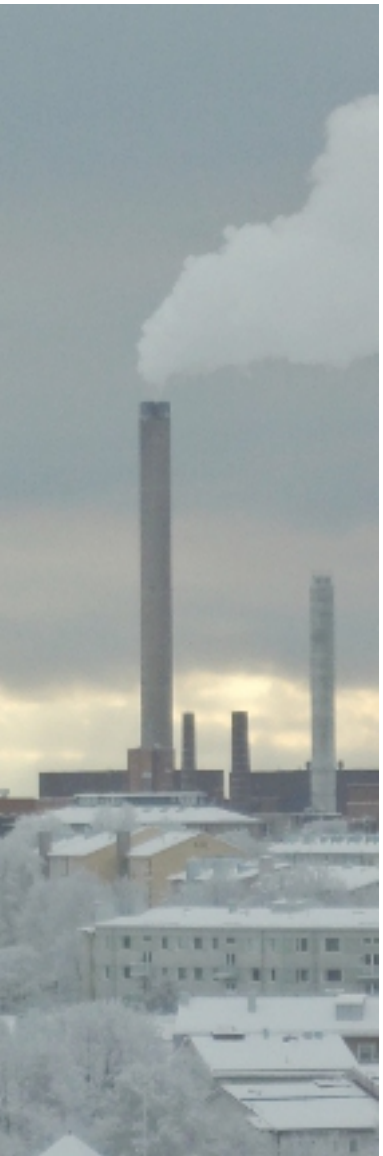

We do not need to list and solve all problems but concentrate on some?

Consistent treatment of momentum fluxes of different scales and origin

Forecast of (dissolution of) fog and visibility over different surfaces

Consistent treatement of cloud microphysics-radiation interactions

Proper handling of heterogeneity of the surface + under and above it

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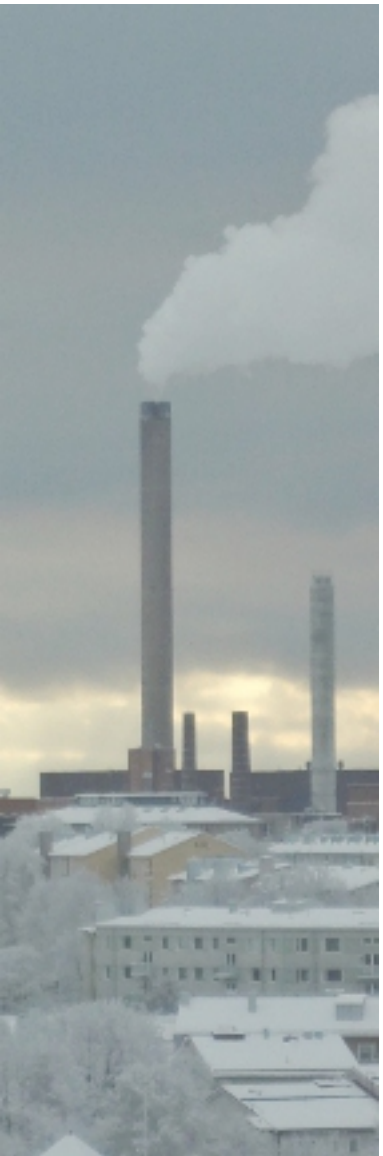

Consistent treatment of momentum fluxes of different scales and origin

- General: tune only schemes you have the lest knowledge, then improve the knowledge there
- ECMWF: improve drag over orography?
- HIRLAM: some experience in scale-dependent treatment of orographic momentum fluxes
- UKMO+DWD: ideas on treatment of the subgrid-scale (thermal) circulations, drainage flow
- AROME, UM, DWD kilometer-scale models: resolving generation of mesoscale mountain waves and blocking
- parametrized everywhere: turbulent drag over rough surface and hills, wave-turbulence-interactions

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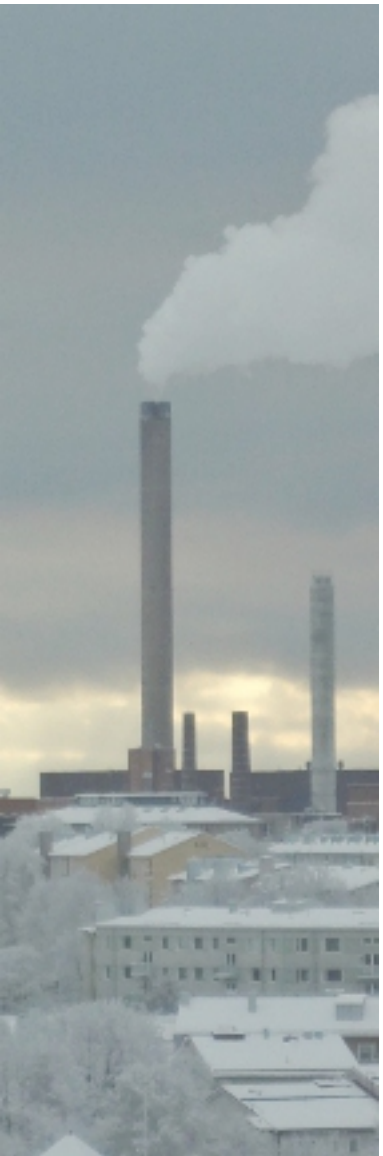

Consistent treatment of momentum fluxes of different scales and origin

Suggestion:

Ensure consistent in scales derivation of the mean elevation and parameters needed for the parametrisations of subgrid-scale orogaphic momentum fluxes, based on high-resolution digital elevation data (SRTM and others).

Coordinate work already ongoing in HIRLAM, ALADIN, UKMO, COSMO . A working week on the finest scale modelling planned in HIRLAM, might start with the orography update and continue to provide fine-resolution estimates of orographic drag for comparison with global models?

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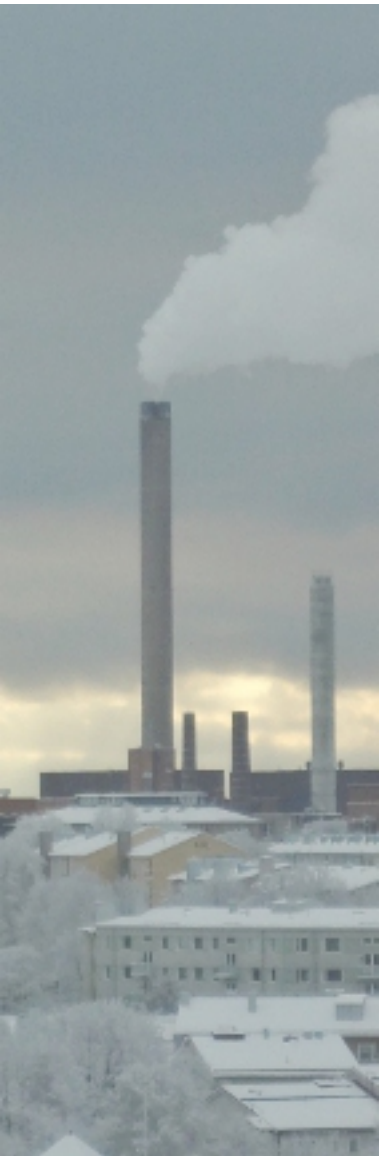
Forecast of (dissolution of) fog and visibility over different surfaces



- Problems detected in AROME
- UKMO experience related to cloud condensation nuclei (aerosol)
- Needs of aviation forecast of visibility and low level clouds (ceiling)
- Predicted – diagnosed – postprocessed

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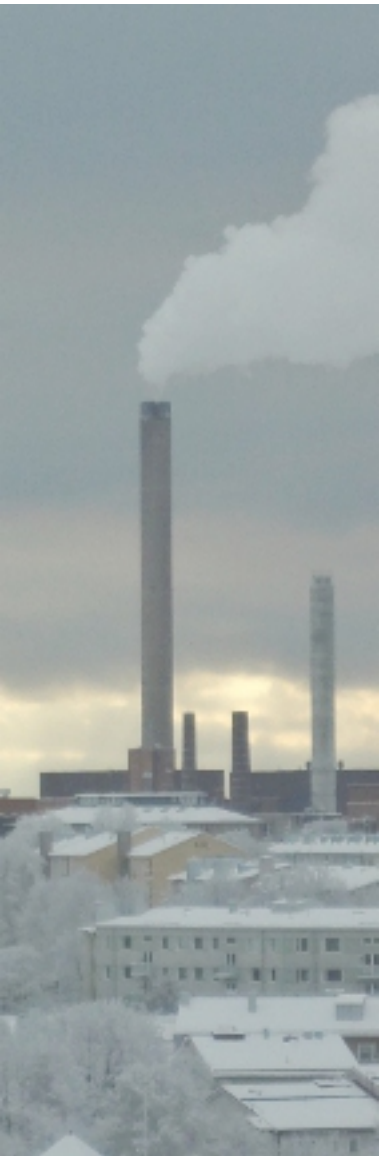

Forecast of (dissolution of) fog and visibility over different surfaces

Suggestion:

Arrange a model intercomparison of forecast visibility and cloud base (=diagnostic, post-processed), starting from an inventory of existing schemes and validation methods

GABLS-5 on fog?
ESA project?
SRNWP atmospheric physics group?
Already available: report of COST action 722 on fog

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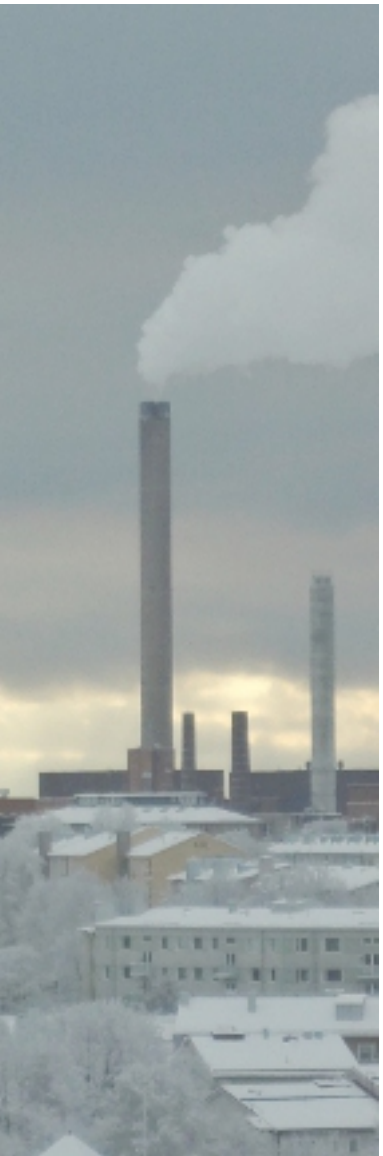
Consistent treatement of cloud microphysics-radiation interactions

> T_{2m}



- Consistent input from cloud microphysics, aerosol to the radiation parametrisations i.e. need to clean cloud input modifications from inside the radiation schemes
- ECMWF experience: advanced clear-sky radiation parametrisations with simplified cloud treatment tailored to global model
- e.g. HARMONIE radiation comparison – to understand the role of cloud-radiation-interactions, advanced clear-sky treatment, surface-radiation interactions in mesoscale
- HIRLAM, UM, COSMO – experience of orographic radiation effects

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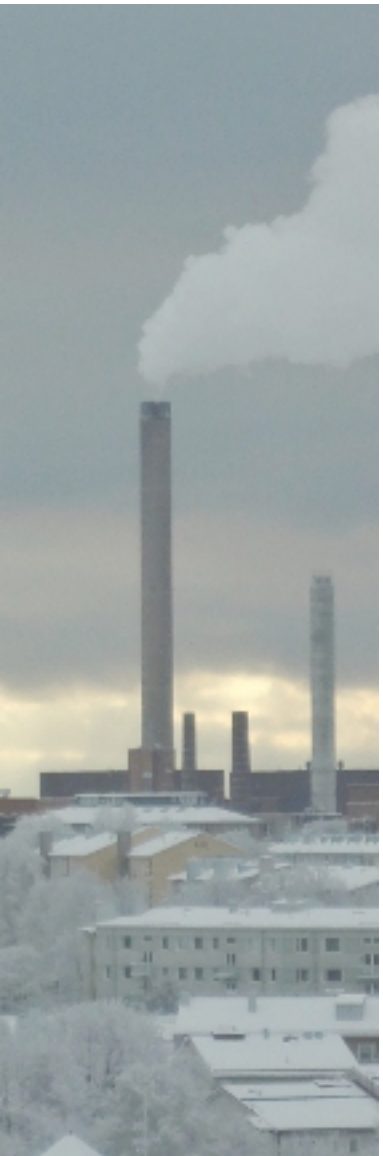
Consistent treatement of cloud microphysics-radiation interactions

$> T_{2m}$



Suggestion:

Ensure consistency between the assumptions concerning cloud particle size distribution in microphysics and radiation parametrizations

- for stable boundary layer: mostly fog and low level water and ice cloud

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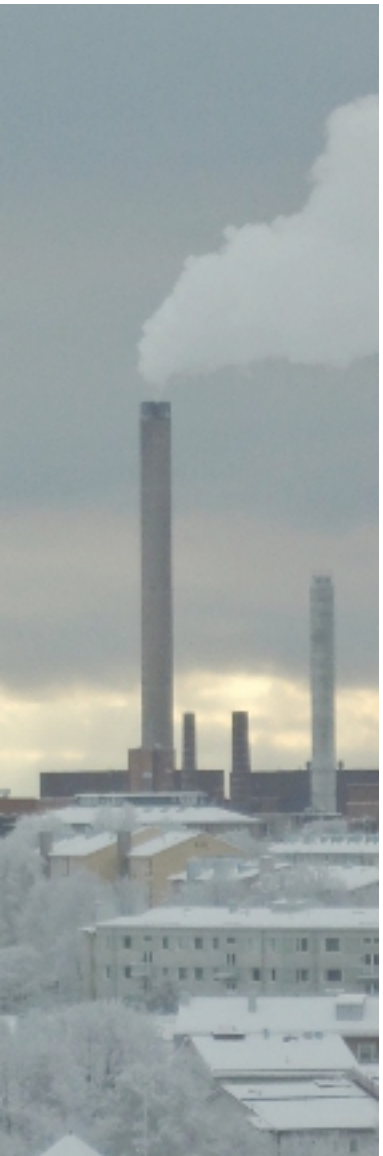
> T_{2m}

Proper handling of heterogeneity of the surface + under and above it



- ECMWF, UKMO: strength of coupling atmosphere-surface
- Consistent handling os surface temperature heterogeneity including profiles under the surface (thermal inertia)
- It is important to know the constant (like land use) and transient (like snow cover) surface properties: physiography, surface analysis connected to prognostic parametrisations (mainly snow and ice)

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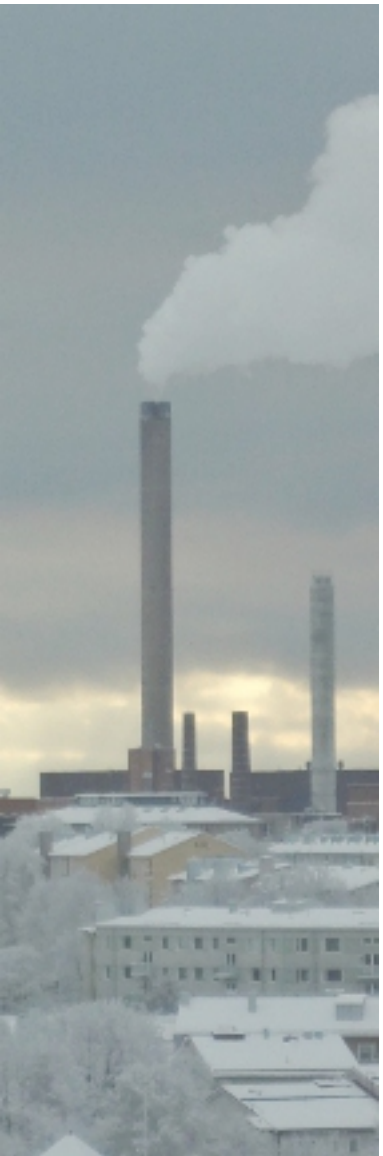

Proper handling of heterogeneity of the surface + under and above it

Suggestion

Compare surface temperature and under-surface profiles of different surfaces, using advanced process models like CROCUS, HIGHTSI, …

existing projects:
CASES99 (GLASS), ALMIP?

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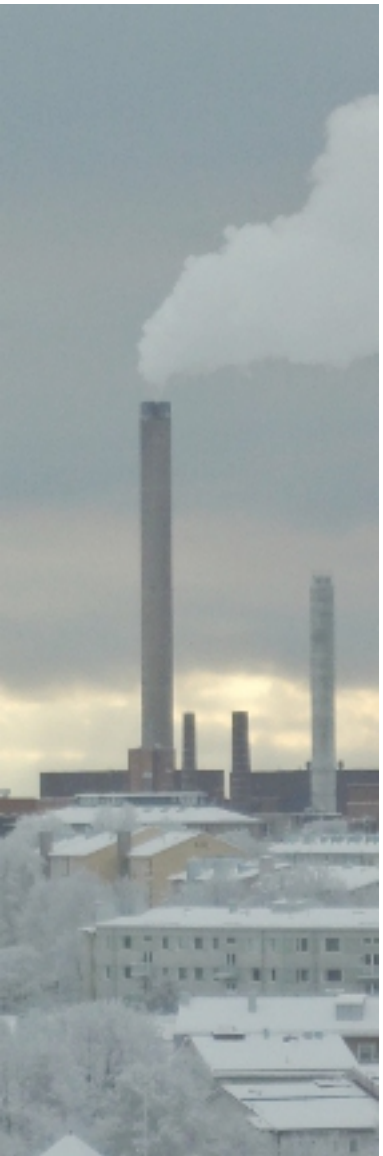

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