HIRLAM Physics Plan and Report 2005 - 2006
0.0.1

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Contents

1 General

1.1 Introductory remarks

In this draft, basic tasks in development of HIRLAM physical parametrizations are scetched. Three categories of tasks are identified and marked in the plan: *Short-term task*: urgent, (small), ready in 2005, *Long-term task*: continuing or starting soon, but ready 2006 and beyond, and *Common task with ALADIN*: to be included to the physics plan common with ALADIN.

The plan is divided into three parts: areas - turbulence and convection, cloud microphysics, radiation, surface and orography; common - interfaces and code structure, tools and diagnostics; practical - suggested workshops etc. The three first areas are related mainly to atmospheric physics while the two latter belong to the surface-related processes. These include climate generation, surface data assimilation and parametrizations in the forecast model, i.e. the elements

of an externalized surface block.

1.2 Aims and basic tasks

1. To contribute to **solution of current prognostic problems** in synoptic and mesoscale HIRLAM, such as the Nordic temperature problem and ever appearing smaller problems.
2. To contribute to **further development of the parametrization schemes for the use in the fine-resolution model**: detailed cloud microphysics interacting with radiation, unified approach to shallow convection and moist turbulence, improved handling of surface-atmospheric interactions.
3. To **clean and reformulate the packages and interfaces of HIRLAM physics in a consistent way** so that they can be used as a basis for further development of the evolving mesomodel in a common IFS-based framework
4. To develop tools, methods and data suitable for **diagnostics and validation of physical parametrization schemes**, such as a common with ALADIN single-column model or Sodankylä data set.

2 Areas

2.1 Turbulence and convection

2.1.1 Moist CBR and shallow convection

◦ **Further develop the moist turbulence scheme** (moist CBR) coupled to relevant cloud physics. The schemes should be assessed in single column mode on the various available cases (e.g. EUROCS and GABLS) and then direct testing in 3D forecast-assimilation mode should follow. Testing should be done at the standard RCR configuration and resolution but also at a higher horizontal and vertical resolution with both KFRK and STRACO.

Priorities: *Short-term task*

Persons: Sander Tijm, Bent Hansen Sass, Javier Calvo, Karl-Ivar Ivarsson

Status in the middle of April: Bent has been working with moist CBR-STRACO combination, studying the problem of moist conservative variables, reformulation of mixing length to avoid extra mixing and the way of consistent implementation of moist CBR inside STRACO. Preliminary results reported in the Tartu workshop.

Status in August: A simplified version of the moist CBR scheme has been tested and also implemented operationally at SMHI in June 2005. (Note that KF-RK are used at SMHI). Sander has got this version for further studies. [1]

[1] From Karl-Ivar: The full version is **very** expensive to run, the time for running the whole forecast model is doubled ! The computation time is approximately the same with the simplified version as with the dry one.

◦ **Clean the code of moist CBR**, with KF-specific code as a function of noption.

◦ Study into the **impact of moist CBR on shallow cumulus**: must moist CBR tendencies be put to zero when there is shallow convection?

◦ Within the present moist turbulence scheme there are options to include a **statistical cloud scheme within the turbulence**, for calculation of incloud buoyancy. Also a preliminary parameterisation of cloud top entrainment has been included. These parameterisations will be further developed and the performance of them evaluated at a variety of vertical resolutions, in connection with the relevant cloud parametrization schemes. The entrainment formulation must be made a function of the vertical resolution. The long-term aim is to develop a **unified turbulence - shallow convection approach** suitable for use in the fine-resolution model.

Priorities: *Common task with ALADIN*

Persons: Wim de Rooy, Sander Tijm, Karl-Ivar Ivarsson

Status in the middle of April: Preliminary 1D results reported by Wim (and also by Colin) at the Tartu workshop.

Status in August: Start of entrainment formulation as a function of vertical resolution.

2.1.2 Stable boundary layer studies

◦ **Stable boundary layer** modifications based on the work of Sergei Zilitinkevich et al. - accounting for free flow stability in calculating the PBL height, handling of capping inversions, derivation of surface fluxes using generalized length scale - will be implemented for testing in a version 6.4 (first the one-dimensional, later three-dimensional model) environment.

Priorities: *Long-term task*

Persons: Veniamin Perov, Timo Vihma, Yevgeni Atlaskin

Status in the middle of April: Discussed, preparation of Sodankylä data ongoing by Yevgeni.

Status in August: Discussed a little at NetFAM Sodankylä summer school, see http: netfam.fmi.fi.

The simplified version contains the moist parameterization with the buoyancy based on total cloud water content and liquid water potential temperature, in same way as in the "full" version but the usual old cloud cover is used. No extra entrainment is done at cloud top, which may by neccesary with full version if the vertical resolution is not fine enough. Instead, the moist buoyancy is not allowed to be more stable than the corresponding dry buoyancy. This may happen at cloud tops when the cloud condensate amount decreases with height. The effect of this very simple change is principally the same as using an extra cloud top mixing parameterization but computationally cheaper. The moist buoyancy is allowed to be negative only when also the dry stability is negative. This is done to reduce interference with the convection scheme and to reduce numerical noise.

The verification shows a fairly reduction of stratiform cloudcover (especially lows clouds) by using this parameterization compared to the dry CBR. The cloud field is also normally closer to observations especially during winter and spring. But it must be noted that the amount of low clouds is very much dependent on other things in the model (surface scheme etc.) Another effect is (as expected) a little less deep and faster filling lows. This is assumed to be a result of the extra vertical mixing.

2.1.3 Towards a three-dimensional turbulence scheme

◦ ...

Priorities: *Common task with ALADIN*

Persons: Veniamin Perov,

Status in August:...

2.1.4 Solving current problems

◦ A modified parameterisation of the **Charnock Number**, whereby this number is a function of the low level wind speed, will be developed and tested.

Priorities: *Short-term task*

Persons: Sander Tijm

Status in the middle of April: 3D experiments show little or no impact. One more 3D study will be performed, but has low priority.

Status in August: No change with respect to April

2.2 Cloud physics

2.2.1 Development of the cloud microphysics

◦ Evaluate the benefits of separate **prognostic treatment of cloud liquid water and cloud ice**. Work will initially be done with KFRK code and at fairly high resolution (∼11km) it is hoped this will feed ideas into the mesoscale work on development of cloud microphysics parametrizations

Priorities: *Short-term task*

Persons: Karl-Ivar Ivarsson

Status in the middle of April: Preliminary results reported in the Tartu workshop by Karl-Ivar.

Status in August: Cloud ice has been put in as an extra scalar in the SMHI old operational HIRLAM version. [2] Next,

[2]From Karl-Ivar: This can not be done in 6.3.5, since cloudwater and TKE are treated differently in the dynamics and is desirable to treat cloud water and cloud ice in the same way. (TKE is implemented as an extra scalar). So cloud ice is a prognostic variable with its own name in the same way as cloud water from now. This means that a lot of code changes in the dynamics are done, but for the moment code changes are not included in EULER and NORMOD. The tests so far seems to fairly improve the forecasts, but some tuning is needed since there is some over-prediction of the 2-d cloudcover in the summer cases tested. In cold winter situations it seems to effectively reduce an over-prediction of the amount of low clouds.

1. The code was imported into the framework of Hirlam 6.3.5
2. A new RK-code is used, basically the same as in the CAM - code, but only the changes in PCOND and the treatment of cloud fraction is included since those changes seem to be the most relevant ones.
3. Started implementing in the code in the 1D version of 6.3.5. (reference 1D version)
4. Done case studies for different seasons and using different horizontal resolutions.

◦ Implement the **Schultz scheme** with simple treatment of in-cloud and precipitating water/ice (four variables) into the framework of 1D, later 3D HIRLAM physics, in connection with KF convection as an alternative of RK microphysics. The relatively simple Schultz scheme within HIRLAM physics will be used for comparison with more detailed approach of MesoNH microphysics in AROME.

◦ Study the possibilities of use the ALADIN **Lopez microphysics** scheme.

Priorities: *Long-term task*

Persons: Andres Luhamaa

Status in the middle of April: Schultz code available and started to be studied by Andres.

Status in August: Implementation of Schultz code to nonhydrostatic HIRLAM v. 6.4.0 has been started by Andres.

◦ **Update the Rasch-Kristiansson scheme** to the current Rasch-Kristjansson-Zang reference in Community Atmospheric Model (CAM).

Priorities: *Short-term task*

Persons: Javier Calvo

Status in the middle of April: Javier will test the CAM modifications.

Status in August: First 1D and 3D experiments reported by Karl-Ivar. [3]

2.2.2 Maintenance of a deep convection parametrization for synoptic scale

◦ **Further development of the KF scheme** will be pursued with an aim to improve both the meteorological and computational performance of the scheme. Suggested developments will be tested in one-dimensional HIRLAM environment. Several updates have been prepared for implementation of the next release of the scheme and may be tested with full three-dimensional system.

[3] From Karl-Ivar: Javier has got my updates and I have done some 1D and 3D test with it, but not any longer runs. 1D runs indicate that with the new code the scheme is more stable with less 2-delta-t jumps in the cloud field etc., especially when using a short timestep. The only side effect noticed is that the amount of cloud condensate is a little lower, which make clouds more transparent to short-wave radiation and thus a slightly higher T2m at daytime in summer (little too high ?).

Priorities: *Short-term task*

Persons: Javier Calvo, Karl-Ivar Ivarsson, Paulius Jalinskas

Status in the middle of April: A review about the performance of KFRK in HIRLAM was presented at the Tartu workshop by Javier. Experiments and analysis of parallel runs to understand the behaviour of KFRK in synoptic scale have been made by Karl-Ivar. Some problems found have been discussed among interested people.

Status in August: Tuning and validation of the scheme in SMHI environment reported by Karl-Ivar. [4]

◦ **ECMWF convection scheme** will be implemented and tested in the one-dimensional HIRLAM environment.

Persons: Wim de Rooy

Priorities: *Long-term task*

Status in the middle of April: Not started yet.

[4]From Karl-Ivar: A small change in the way of computing the precipitation release was shown to reduce numerical noise in the model. The reduction could be seen in both 1D runs and in 3D runs. The largest reduction was found in case of strong winds (strong advection). A typical such example is cirrus in jet streams. After rather tedious testing, this change was included in SMHI operational model, together with a change of the critical relative humidity towards higher values. This change in the precipitation release seems not to be neccesary in the new (CAM) RK- version since it is behaving more stable anyway. (The effect of it is very small in CAM-version)

A third way of computing the precipitation release has also been tested. Here, simple analytic expressions are used to compute the effect of auto-conversion etc. Since every part of the precipitation release is computed separately, it is easy to do separate computations of the precipitation release from cloud water and from cloud ice. The method seems be both numerically stable and to give reliable results. A possible bad side effect of slightly longer computation time has not been noticed.

Duty forecasters have noticed that there is often too little low clouds in case of deep convection. If the critical relative humidity is set to a lower value in case of deep convection this problem seems to be reduced or eliminated.

Experimental (semi-operational) runs with 0.05 deg. resolution (5.5 km) have been going on at SMHI since the beginning of May this year. Here, some experiments have been done to find a way of reducing the double-counting of convection which is a well known problem at this resolution. (Convection is partly resolved by stratiform cloud physics) Case studies with the following different handling of convection have been done:

1. Use current RK-KF scheme
2. Use current Straco scheme
3. Use current RK-KF scheme but the convection is switched of. (= only RK-scheme)
4. Use current RK-KF scheme but the convection is partly switched of in some different ways, so far all based on how deep the convection is. Very deep convection is more suppressed the less deep convection, since it is assumed that deep convection cells also are larger horizontally and thus more likely to be resolved by the stratiform cloud physics.

Radar images have been compared with one hour precipitation fields. The comparisons indicates that the current RK-KF scheme produces too smooth precipitation fields in case of deep convection (as expected) The Straco scheme and RK- scheme alone seem to have a somewhat more realistic structure of the precipitation field. This means more local and intense precipitation. But in one respect the current RK-KF scheme seems to be more realistic, and that is that the convection is often organized in convective bands. This is more or less absent with the Straco scheme and with RK-scheme only, but is seen also if convection is only partly switched of. When convection is partly switched of, the result is (as expected) somewhat more local and intense precipitation. Some other ways of doing this have been proposed by Colin, but not tested yet.

Status in August:· · ·

2.2.3 Solving current problems

Predicting **fog formation over the sea** especially during spring in weak wind conditions has shown to be problematic for HIRLAM. Possible problems with definition of cloud emissivity seem to require further study (see: Radiation).

Priorities: *Short-term task*

Persons: Bent Hansen Sass, Niels Woetman-Nielsen

Status in the middle of April: One-dimensional fog studies over sea started by Bent, with a combination of moist CBR and STRACO.

Status in August: Fog sensitivity sudies reported by Niels and Bent in NL48.

◦ **Optimization of the KRFK code** will be done in cooperation with a computer system vendor (NEC).

Priorities: *Short-term task*

Persons: Javier Calvo, Per Undén

Status in the middle of April: Benchmark code prepared by Javier, waiting for NEC.

Status in August: NEC got the code in April, no progress there.

2.3 Radiation

2.3.1 Radiation for sloping surfaces

◦ Further testing leading to implementation of a short- and longwave **radiation parametrization for sloping surfaces**.

Priorities: *Long-term task*

Persons: Anastasia Senkova, Laura Rontu

Status in the middle of April: Dissertation by Nastya accepted at RSHU in February. Derivation of still missing orographic parameters based on Hydro1k data and testing ongoing.

Status in August: Finding optimal solutions for calculation of the local horizon, sky view factor etc, cleaning and writing a journal paper ongoing.

◦ Derivation and implementation in the climate files of the needed fine-scale orography variables.

Priorities: *Long-term task*

Persons: Anastasia Senkova, Kai Sattler, Laura Rontu

Status in the middle of April: Not started yet.

Status in August: Preparations started.

2.3.2 Long-wave radiation and cloud-radiation interactions

◦ Improvement of **long-wave radiation parametrizations in clear and cloudy sky conditions** will be studied based on the work by Hannu Savijärvi (Radiative and turbulent heat fluxes in the clear-air boundary layer, accepted to QJRMS).

Priorities: *Long-term task*

Persons: Anastasia Senkova, Laura Rontu, Ulrika Willén

Status in August: To be started.

2.3.3 Solving current problems

◦ A correction to the calculation of the **position of Sun** was suggested by Enric Terradellas and Javier. Ready for implementation after a security test.

Priorities: *Short-term task*

Persons: Enric Terradellas

Status in August: Security tests done by Laura, prepared for implementation in 6.4.1.

◦ A possible small problem in **transmission of SW radiation through heterogeneous clouds** has been pointed out by Bent. A 1D test is suggested to be done at RSHU to see the significance of this.

◦ **Fog problem** (see Cloud microphysics). More 1D tests are needed to understand the role of cloud emissivity and suggest possible improvements.

Priorities: *Short-term task*

Persons: Anastasia Senkova, Laura Rontu

Status in August: Some preparations started, a student from Vilnius University involved.

2.4 Surface and orography

2.4.1 Surface data assimilation

Surface data assimilation is discussed in the **data assimilation plan**.

2.4.2 New snow and forest scheme

◦ Further **development and evaluation of the new snow/forest scheme** will be made to improve the meteorological performance of the scheme. Initially this will be done without assimilation of new surface variables. Following this assessment and development, assimilation of the new variables needed by the surface scheme will be addressed. An explicit representation of soil water freezing and melting will also be tested. After testing will follow the implementation of the scheme.

Priorities: *Short-term task*

Persons: Stefan Gollvik, Timo Vihma

Status in the middle of April: Code implemented to v. 6.3.5, corrections made, surface analysis included by Ernesto and Stefan. Expected to be ready for three-dimensional testing in the beginning of May. Systematic one-dimensional tests for winter and spring cases made and reported in HNL by Sander.

Status in August: Three-dimensional parallel 6.3.5 experiments without new snow analysis have been run and comparison with Sodankylä data started for Jan2005 and Mar2005. Implementation of the scheme to 6.4.1 to be done at SMHI. Further developments of the scheme reported by Stefan. [5]

2.4.3 Reneval of the surface description (ECOCLIMAP)

◦ Continued introduction and evaluation of the **ECOCLIMAP surface description** data set. This will involve studying the soil moisture increments during the surface analysis step as a means of assessing the impact of the new climate variables on the full forecast-assimilation cycle of the model.

Priorities: *Long-term task*

Persons: Han The

Status in the middle of April: Han and a person to be found (since Teresa left INM) are recoding (on top of version 6.3.5) the transfer of of the new vegetation + soil climatic fields around the whole code down to the surface routines. The ECOCLIMAP fields are still produced externally to HIRLAM using the ECOCLIMAP software.

Status in August: Recoding and cleaning reported by Han [6]

[5] From Stefan: The situation is that I have just recoded the ice part, now also containing snow, in the same way as the other snow tiles. So now I have 8 tiles, 1-5 as before and 6,7 and 8 for snow tiles open land, forest and sea ice respectively. I have also done a substantial cleaning, where the solution of the heat conduction (CALCTEND) is used consistantly. Now I have also included a refined coding of the heat conduction, taking into account not only soil moisture, but also soil ice (Viterbo -type so far). ... There are some limits for what could be done within the surface scheme. It is very sensitive to the radiation, so maybe (???) someting could be tuned also there, without leaving the "physical space".

[6] From Han: The work is based on version 6.3.7. Purpose is to combine the parameter fields into a single three-dimensional array instead of separate 2D fields. Similarly this method is applied to the prognostic surface fields. E.g. the soil moisture/temperature layers which are defined as separate layers and treated as such instead of a three-dimensional field. ...

This part of the job (i.e. recombining the climate fields) is well under way. In addition I am cleaning up the

◦ Implementation of the ECOLIMAP dataset (including interpolation to a **rotated grid and ECOLIMAP aggregation algorithms**) within the HIRLAM climate generation software.

Priorities: *Long-term task*

Persons: Han The

Status in the middle of April: Work to aggregate fields on the rotated HIRLAM grid within the climate generation step is still to be done.

Status in August:· · ·

2.4.4 Small- and mesoscale orography parametrizations

◦ **Document and evaluate the MSO/SSO parameterisation** in the context of the present reference code and implement this as an option in the reference code. Documentation of the MSO/SSO parameterisation schemes. Implementation in the reference code will be aimed for in mid 2005.

Priorities: *Short-term task*

Persons: Laura Rontu

Status in the middle of April: Report about comparisons written by Laura based on experiments with rotated stress but without Charnock or moist CBR.

Status in August: Final tests waiting for the orography fields.

◦ Continued introduction of new climate variables needed for the correct performance of MSO/SSO parameterisation at a wide range of model resolutions.

Priorities: *Short-term task*

Persons: Kai Sattler, Laura Rontu

Status in the middle of April: ongoing work by Kai.

Status in August: Coding nearly done, but the performance of the band-pass filter is still an issue. Near future work is to include testing and a pre-implementation on the ECMWF computers.

2.4.5 Solving current problems

◦ An extensive **evaluation of the quality of the HIRLAM near-surface temperatures and surface fluxes** will be made for a wide variety of meteorological conditions. Main interest is in the Nordic temperature problems during winter and spring. Observations from masts as

source code. For example, the include files TXT_DAT.inc, SOIL_TEXT.inc, VEG_DAT.inc have been combined into a single include file, CLIM.inc, and unwanted value checking has been removed or has been included into GETGRB (e.g. the statement: JSOL=MAX(1,MIN(JSOL,11)), as well as spaghetti-like structures in ISBAH4.f.

well as soundings and SYNOP observations at Cabauw and Sodankylä will be used for direct comparison. Episodes of poor model performance will be studied in detail in order to understand the parametrization problems of and suggest improvements to turbulence, cloud and radiation schemes.

Priorities: *Short-term task*

Persons: Timo Vihma, Yevgeni Atlaskin, Laura Rontu, Stefan Gollvik, Cisco de Bruijn

Status in the middle of April: Some comparisons for Jan-Feb 2005 made by Eric. Preparation a new Sodankylä-HIRLAM comparison data set and related tools ongoing by Yevgeni, Laura and Markku. Cisco is working with the Cabauw data.

Status in August: Preliminary results of Sodankylä comparisons reported and discussed during the NetFAM Summer School (some material available at http://netfam.fmi.fi)

◦ A suggestion to **correct the use of monthly values of the vegetation index and leaf area index** that suddenly change from 30 september to 1 october for the cropland tile has been suggested, tested and reported in NL48 by Sander.

Priorities: *Short-term task*

Persons: Sander Tijm

Status in August: Code prepared and tested, prepared for implementation into 6.4.1.

◦ **Hot summer problem:** unrealistic increase of dew point temperature observed by KNMI forecasters in hot and dry conditions. The role of stomatal resistance in diagnostics of two-metre humidity and other factors needs to be studied in order to suggest correction.

Priorities: *Short-term task*

Persons: Sander Tijm,

Status in August: Study started, hopefully completed before end of summer.

◦ **Greenland ice problem**. Unrealistic behaviour of surface temperature over Greenland continental and sea ice was detected by DMI forecasters. Temporary corrections have been suggested at DMI, but a constistent solution needs to be found and tested.

Priorities: *Short-term task*

Persons: Bent Hansen Sass, Niels Woetman-Nielsen

Status in August: Study started

◦ **Soil freezing problem:** Melting speed of soil ice needs tuning to allow sufficient thawing during springtime. [7]

[7] Ernesto writes: In our view the main problem would be related with the tuning constant which is responsible for the speed of soil ice melting. After a quick meeting, Beatriz and myself propose 3 ways to control the increase of melting speed of soil ice, which seems to be the origin of the problem.

1) Further tune the melting parameter.

2) Impose some limitation to the amount of frozen soil water instead of the whole reservoir (e.g., 10-20 cm).

Priorities: *Short-term task*

Persons: somebody from INM

Status in September: Solutions have been suggested and a person is sought at INM.

◦ **Problem of weak and strong winds**. Analysis of wind verification data seems to show that near-surface weak winds are overestimated and strong winds underestimated by HIRLAM over land areas. New SSO/MSO parametrization may possibly improve this behaviour, but more studies are needed, related to interactions between parametrized turbulence and orography-related parametrizations.

Priorities: *Long-term task*

Persons: Laura Rontu

Status in August: Not started yet.

3 Common

3.1 Interfaces and code structure

3.1.1 Basic thermodynamic equations and IFS structures

◦ Work with the **basic equations and rules of physics-dynamics coupling** has been started within ALADIN and in the HIRLAM mesogroup. ...

Priorities: *Common task with ALADIN*

Persons: Bent Hansen Sass, Sami Niemelä,

Status in August: Documents have been collected at http://hirlam.fmi.fi/cleanphys .

3.1.2 Low level physics cleaning and recoding

◦ A cleaning of the physics parameterisation codes will be started in 2005 in order to prepare a basis for further (mesoscale) code development and introduction. Conversion of all physics code to Fortran90 is planned. People responsible for each routine will lead responsible for cleaning and standardising that portion of code, following agreed guidelines when building interfaces between the physics routines and between the physics and dynamics.

Priorities: *Short-term task*

Persons: The whole physics team

This would make quicker the thawing in spring time.

3) Force some additional correction during the assimilation step (e.g. when analized T2m exceeds some threshold value over the freezing point at noon, ice should be converted to water).

Status in the middle of April: General discussions during Tartu workshop and ASM about the physics-dynamics coupling. Work by the mesogroup to recode elements of physics. Recoding of climate arrays in PHYS by Han, in the process of ECOCLIMAP implementation. Planned working week in September.

Status in August: Preparations for the September cleaning week ongoing. Documents have been collected at http://hirlam.fmi.fi/cleanphys

3.1.3 Towards an externalized surface code

For further development of the surface description (physiography), surface data assimilation and parametrizations related to the soil and atmospheric surface layer, the approach of an **externalized surface code** has been adopted. For building of such code within the AROME environment two approaches are possible: (1) externalization of the HIRLAM surface code, followed by the convergence with existing SURFEX code, or (2) participation of the HIRLAM surface specialists in the development of the existing SURFEX code. Decicion of the optimal strategy will be made and a detailed plan for the choosen approach prepared till the end of 2005, with discussions during the Physics cleaning week in September.

Priorities: *Common task with ALADIN*

Persons: Stefan Gollvik,

Status in August: Planning started by a common with ALADIN drafting group (Dominique, Ernesto, Stefan).

3.2 Tools and diagnostics

3.2.1 Single column model

◦ A **reference 1D-version** of HIRLAM will be kept up to date with numerous options, to be used for evaluation and development of physical parameterisations. A **unified AROME SCM** allowing to compare and develop MesoNH, HIRLAM and ARPEGE parametrization schemes will be created in cooperation with the ALADIN people.

Priorities: *Common task with ALADIN*

Persons: Javier Calvo,

Status in the middle of April: The first version of HIRLAM SCM made and reported by Javier at the Tartu workshop and ASM05.

Status in August: More case studies and diagnostics implemented. Some bugs corrected. Added LES results for comparison. Some documentation included. Updates sent to users in July. HSCM has been used extensively by Sander and others in solving current problems and testing the new snow-forest surface scheme. Feedback from KNMI users has been useful.

3.2.2 GABLS for boundary layer

◦ **Participation in GABLS II.** GABLS (I) has learned us a lot about the stable boundary layer. The participation in GABLS II should learn us more about the deficiencies in CBR (dry and/or moist) as a function of the stability. GABLS II looks at the daily cycle of a dry PBL.

Priorities: *Short-term task*

Persons: Cisco de Bruijn, Sander Tijm

Status in the middle of April: not started, results ready before middle of August.

Status in August: Intercomparison results should be completed, can be studied and CBR can be adjusted. 1D and 3D studies to performed after the intercomparison is complete.

3.2.3 Sodankylä

◦ **Sodankylä mast, SYNOP, sounding and surface data** will be made available for model comparisons. FMI staff will provide archived data and take care of updating the mast verification page of RCR. For details see the verification chapter of the HIRLAM plan.

Priorities: *Short-term task*

Persons: Markku Kangaset al.

Status in August:· · ·

4 Practical

4.1 Workshops 2005

◦ A convection-condensation mini workshop will be arranged 24-26 January in Tartu. This will assess the present state of the art in high resolution modelling of moist processes. Recommendations of directions to pursue as HIRLAM develops physics for the 2-4km scale will be made.

Status in the middle of April: Presentations and extended abstracts are available at http://hirlam.fmi.fi/CCWS collection of extended abstracts for a printed report finished.

Status in the middle of August: Printed report published.

◦ A working meeting on the Nordic Temperature Problems will be arranged 31 January in Helsinki, in order to review the ongoing studies and coordinate the future work.

Status in the middle of April: Material available at http://hirlam.fmi.fi/NorTemPro. A separate plan-report on Nordic Temperature Problem available.

◦ A summer school on “Complex and vegetation-covered PBL”, arranged in the framework of

Sergei Zilitinkevich's Marie-Curie project and NetFAM 4-14 June in Sodankylä is closely related to HIRLAM physics developments.

Status in the middle of August: Summer School material available at http://netfam.fmi.fi .

HIRLAM physics cleaning week, De Bilt, 26-30 September 2005

Mesoscale workshop, Oslo, 12-14 December 2005

AROME training course, Poiana Brasov, 21-25 November 2005

4.2 Publications

De Bruijn, C. and E. van Meijgaard, 2005. Verification of HIRLAM with ECMWF physics compared with HIRLAM reference versions, HIRLAM Technical Report 63.

Nielsen, N.W and B.H. Sass, 2005. The effect of surface stress rotation on the Ekman pumping. HIRLAM Newsletter, 47, p. 1-8.

Rontu, L., 200n. A study on parametrization of orography-related momentum fluxes in a synoptic-scale NWP model. Accepted to Tellus.

Senkova A., 2005. Dissertation about the parametrizations of sloping surface radiation (in Russian). Accepted at RSHU 17.2.2005.

Tijm S., 2005. The Nordic temperature problems. HIRLAM Newsletter, 47, p. 11-23.

Tijm S., 2005. Problems with the HIRLAM dew point temperature. HIRLAM Newsletter, 48, p. xx-yy.

Zilitinkevich S. S. and Esau I. N., 2005. Resistance and heat transfer laws for stable and neutral planetary boundary layers: old theory advanced and re-evaluated. Submitted to Quart. J. Roy. Met. Soc.

Several extended abstracts related to clouds and convection have been submitted to the Tartu Workshop report published in the beginning of May.

4.3 Visits

Sander Tijm (KNMI), Jan-March 2005, SMHI. Testing of the updated surface scheme and other 1D HIRLAM studies. Working together with Stefan Gollvik. Several preliminary results sent around for discussion, a Newsletter report published.

Yevgeny Atlaskin (RSHU), 31.1. - 11.2.2005 FMI. Collecting the second Sodankyl data set with mast, sounding, synop data and RCR (MBE/RCR 6.36) data for comparison, tools for handling. A description of the data set is under preparation. Working together with Timo Vihma and Laura Rontu, in contact with Sergei Zilitinkevich.

Laura Rontu (FMI), 16-18.2.2005 RSHU. Attending the PhD defence of Anastasya Senkova related to the radiation at sloping surfaces. Discussions about further plans with RSHU HIRLAM people.

Anders Luhamaa (UT) and Paulius Jalinskas (UV/LHMS), 21-23.2.2005 FMI. Plans for future work in microphysics and convection were made and included as a suggestion to HIRLAM physics work plan. A seminar at FMI held based on the Tartu workshop presentations. Working together with Sami Niemelä, Carl Fortelius, Laura Rontu.

Anastasya Senkova (RSHU), 11-22.4.2005 FMI. Working with the sloping surface radiation - calculation of the missing orographic parameters based on the Hydro1k DEM, testing, documentation. Working together with Laura Rontu.

Yevgeny Atlaskin and Hamza Kabelwa (RSHU), 14-16.6.2005 FMI ARC, Sodankyla. Continuation of work with Sodankyla data etc.