

## **Use of ISBA in HIRLAM**

**Patrick Samuelsson  
SMHI**

**Acknowledgements to HIRLAM colleagues:**

**Björn Bringfelt, Stefan Gollvik, Ernesto Rodríguez, Simo Järvenoja,  
Beatriz Navascués, Juan José Ayoso, Kai Sattler, Han The,  
Nils Gustafsson**

# Tiled surface scheme for HIRLAM based on ISBA for the land tiles



Work on ISBA for HIRLAM was initiated by Björn Bringfelt in the beginning of the 90s.

Björn introduced a tiled scheme with three sub-tiles for land.

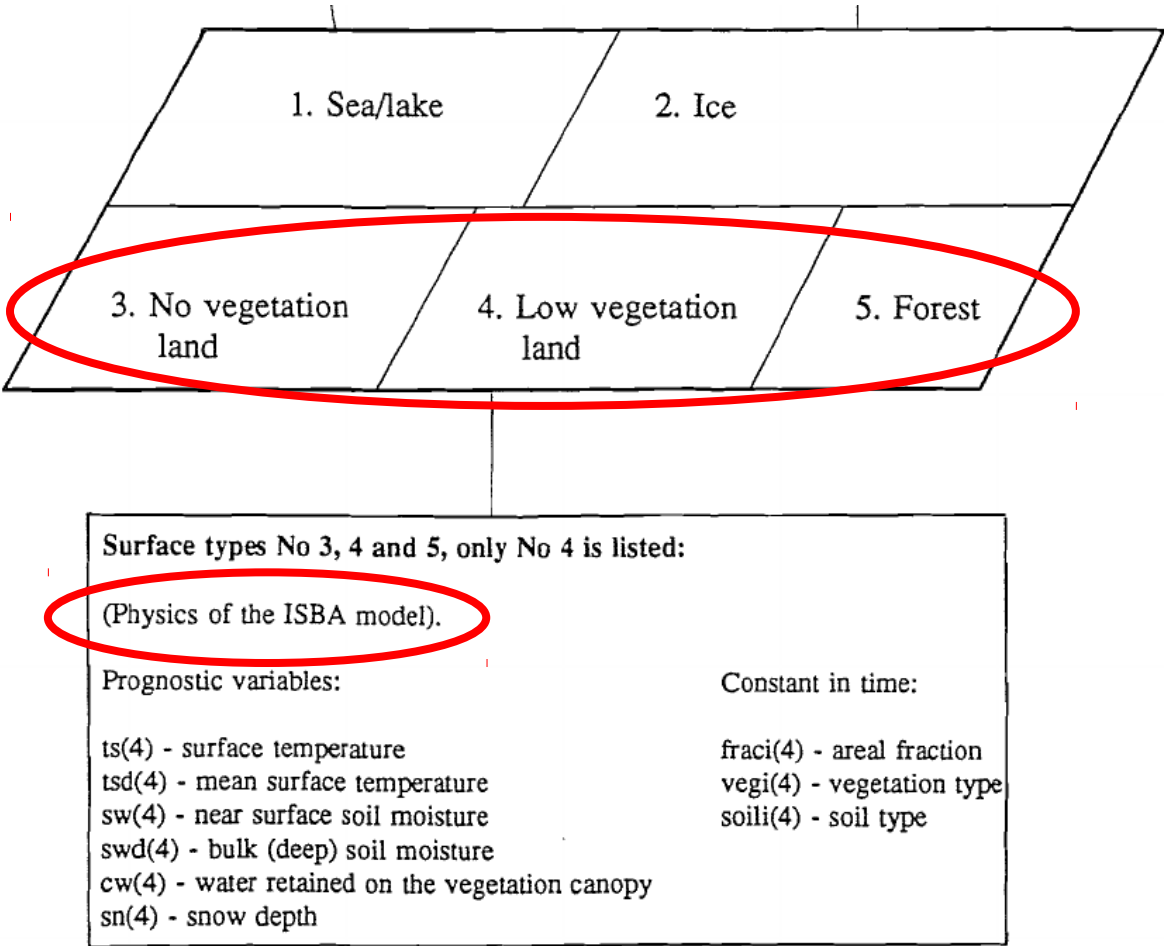


Figure 2.1. The five possible surface types in a grid square of the new surface scheme for HIRLAM, prognostic variables and constant data.

# Tiled surface scheme for HIRLAM based on ISBA for the land tiles

In this report Björn Bringfelt (1996) concludes:

In contrast to the old reference surface scheme of HIRLAM (described in Kållberg 1990), **this new scheme can utilize the information of more complete physiographic data bases on land use and soil type.**

**The ISBA parameter values are used separately for each subsurface type 3 through 5. Thus, the albedo is used in calculating the net radiation flux of the subsurface, needed for the heat flux storage G. Intercepted rainwater and snow depth are treated within subsurface types 3 through 5 and 2 through 5 respectively.**

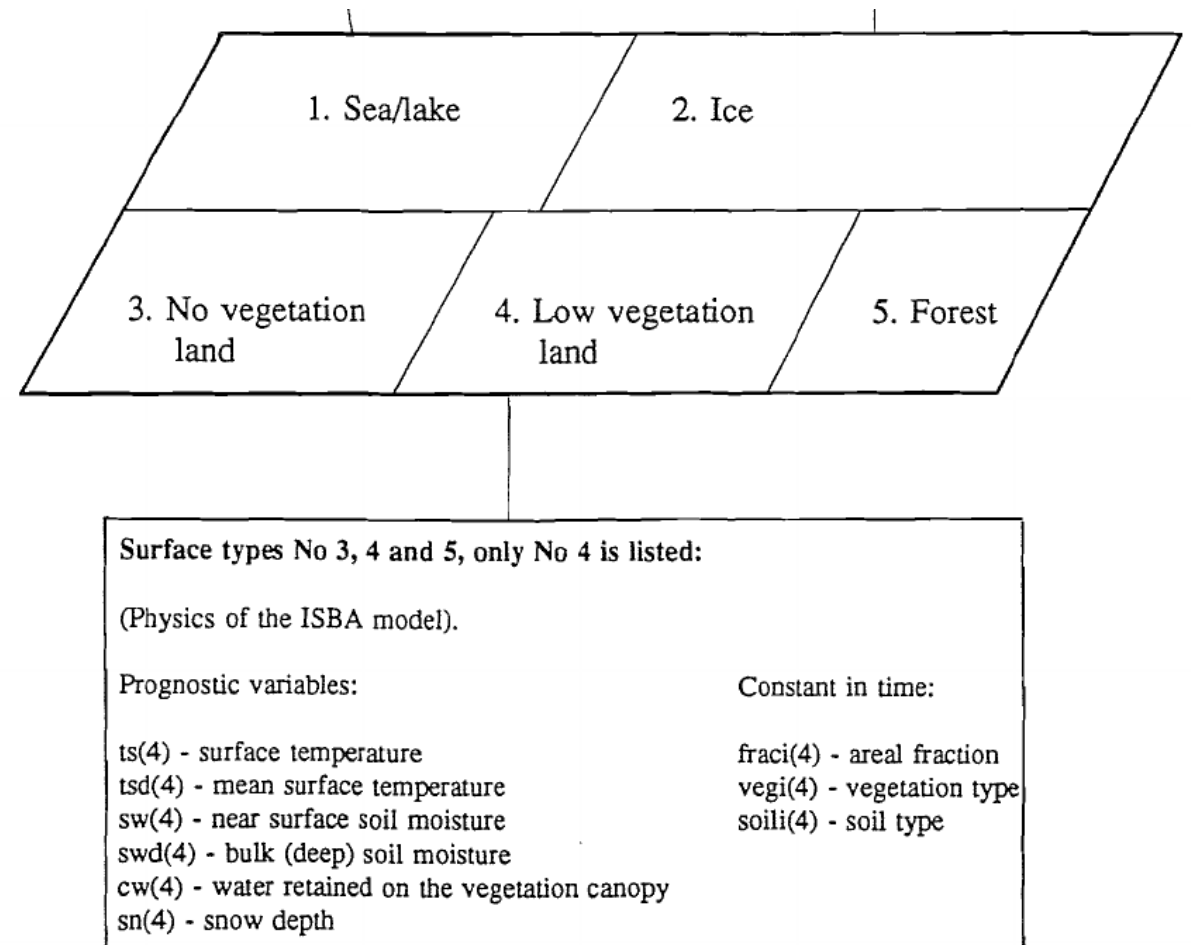



Figure 2.1. The five possible surface types in a grid square of the new surface scheme for HIRLAM, prognostic variables and constant data.

# Tiled surface scheme for HIRLAM based on ISBA for the land tiles



ELSEVIER

AGRICULTURAL  
AND  
FOREST  
METEOROLOGY

Agricultural and Forest Meteorology 98–99 (1999) 239–256

[www.elsevier.com/locate/agrformet](http://www.elsevier.com/locate/agrformet)

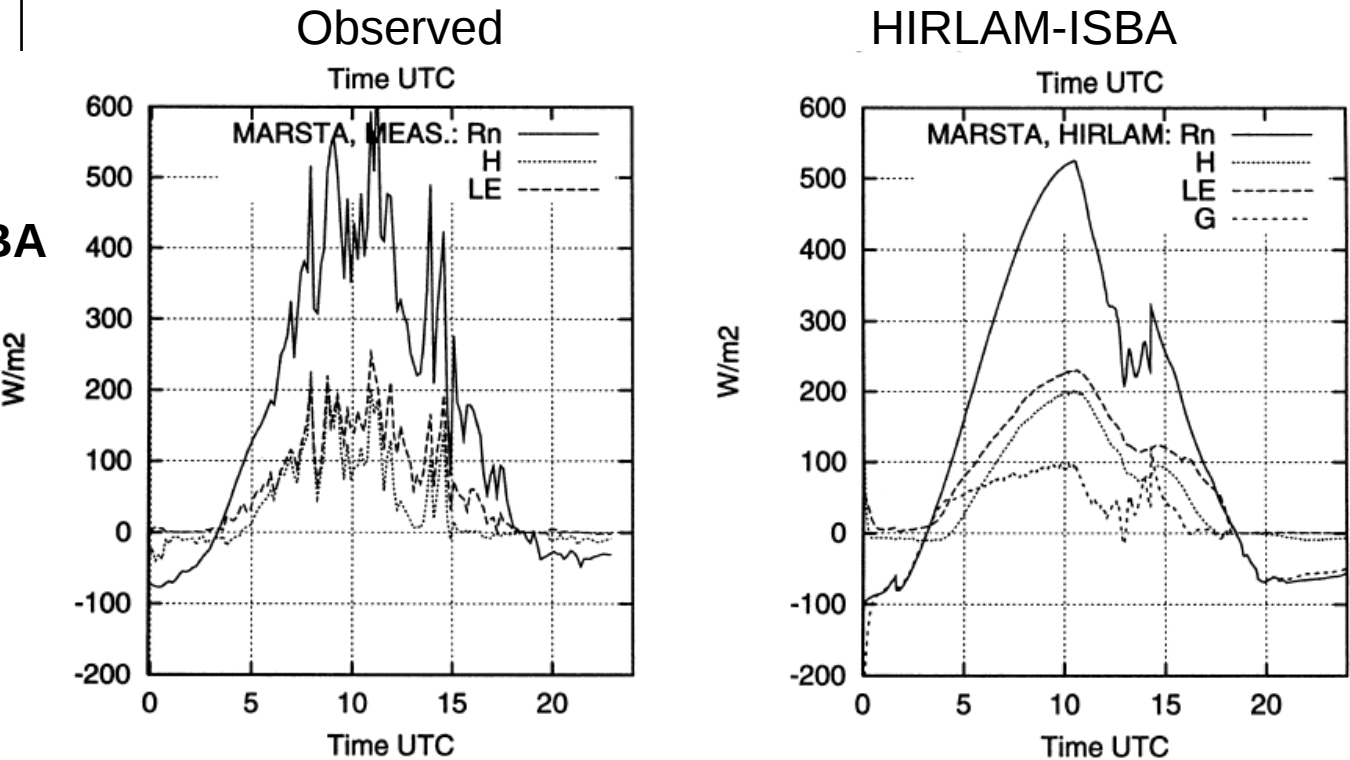
A new land-surface treatment for HIRLAM — comparisons with NOPEX measurements

B. Bringfelt<sup>a,\*</sup>, M. Heikinheimo<sup>b</sup>, N. Gustafsson<sup>a</sup>,  
V. Perov<sup>a</sup>, A. Lindroth<sup>c</sup>

<sup>a</sup>Swedish Meteorological and Hydrological Institute, Norrköping, Sweden  
<sup>b</sup>Finnish Meteorological Institute, Helsinki, Finland  
<sup>c</sup>Department of Physical Geography, Lund University, Lund, Sweden

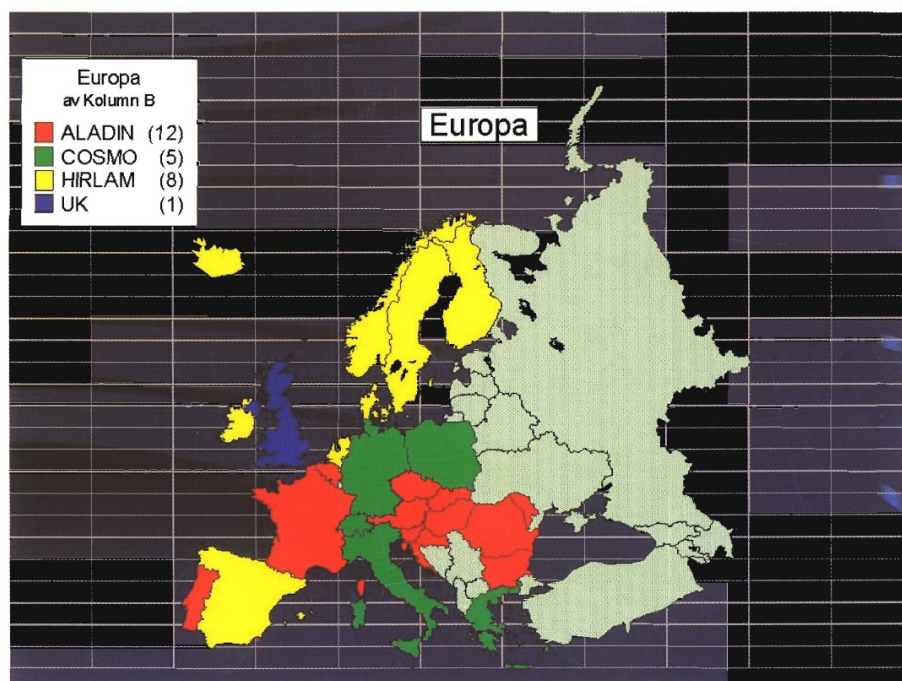
In this paper by Björn Bringfelt et al. HIRLAM-ISBA was validated against surface flux data collected during the Swedish NOPEX project.

The figures show observed and simulated daily cycles of Net radiation (Rn), sensible (H) and latent (LE) heat flux over a grassland area for June 13, 1994.





HIRLAM-5 Final Report



Per Undén, Heikki Järvinen, Ernesto Rodríguez, Gerard Cats

The work by Björn Bringfelt was carried on by Ernesto Rodríguez, Simo Järvenoja, Beatriz Navascués and Juan José Ayoso into a HIRLAM release in 2002:

The old heterogeneous surface analysis has been completely replaced with a new, rewritten, code and script structure. In particular it includes the **additional soil analysis needed for ISBA. It was very extensively tested together with ISBA surface parameterisation and introduced in the Reference system in June 2002.**

The ISBA scheme relies heavily on its assimilation part and one important finding was that **one needs to separate the surface temperatures for water and land fractions within the grid area, which particularly during spring are very different.**

# Analysis of surface variables and parameterization of surface processes in HIRLAM. Part I: Approach and verification by parallel runs

E. Rodríguez<sup>1</sup>, B. Navascués<sup>1</sup>, J.J. Ayuso<sup>1</sup> and S. Järvenoja<sup>2</sup>

<sup>1</sup> Spanish Meteorological Institute (INM), P.O. Box 275, 28070 Madrid, Spain

<sup>2</sup> Finnish Meteorological Institute (FMI), P.O. Box 503, 00101 Helsinki, Finland

(Manuscript received 23 September 2002, in final form 17 January 2003.)

Ernesto Rodríguez, Beatriz Navascués, Juan José Ayoso and Simo Järvenoja show that HH+06 forecasts of T2m in June 1997 verify better against observations if the **dominating land tile** is used instead of the **grid-averaged value**.

Therefore, the land-averaged T2m and Rh2m were used as first guess in the surface analysis.

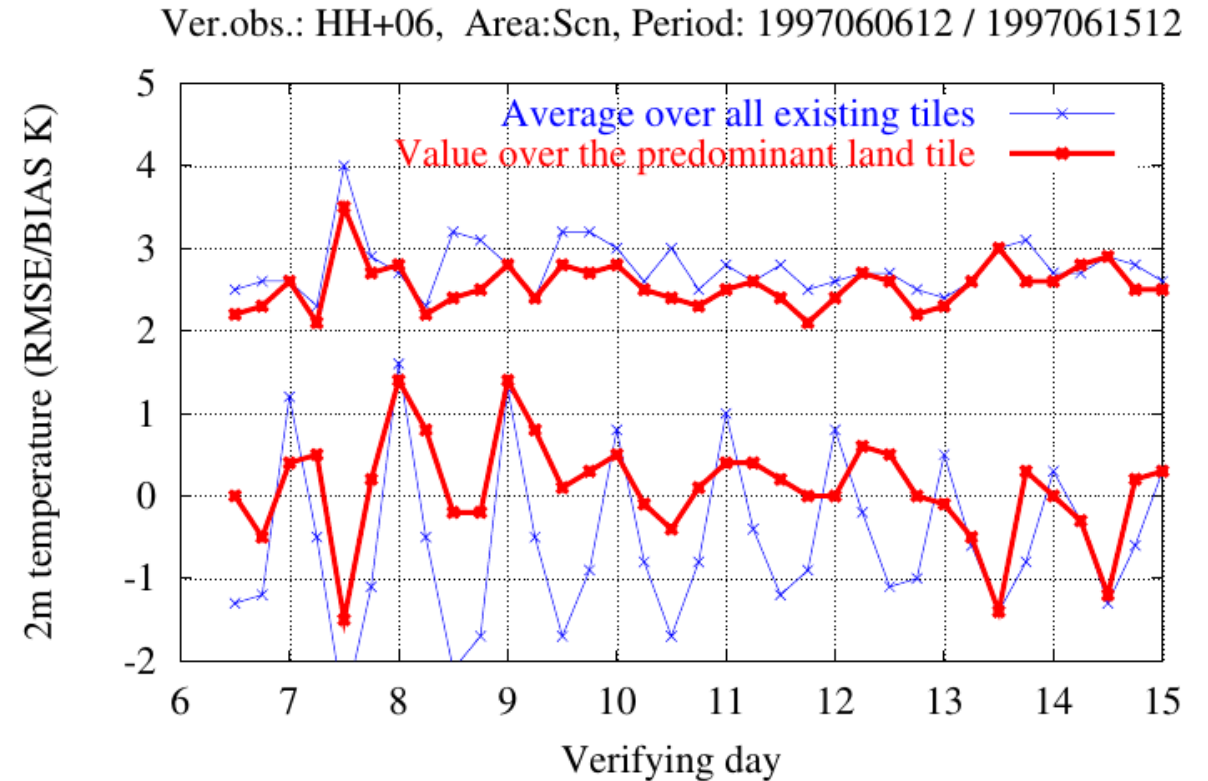
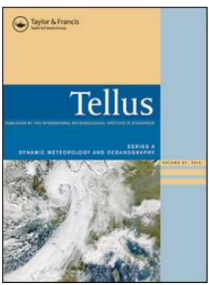


Figure 1: 2-metre temperature bias and rms error of H+6 forecasts using two different verification strategies: i) comparing observations against the most predominant land fraction and ii) comparing observations against the areal average over all existing fractions. Verification period: 6-15 June 1997. Verification area: Scandinavia



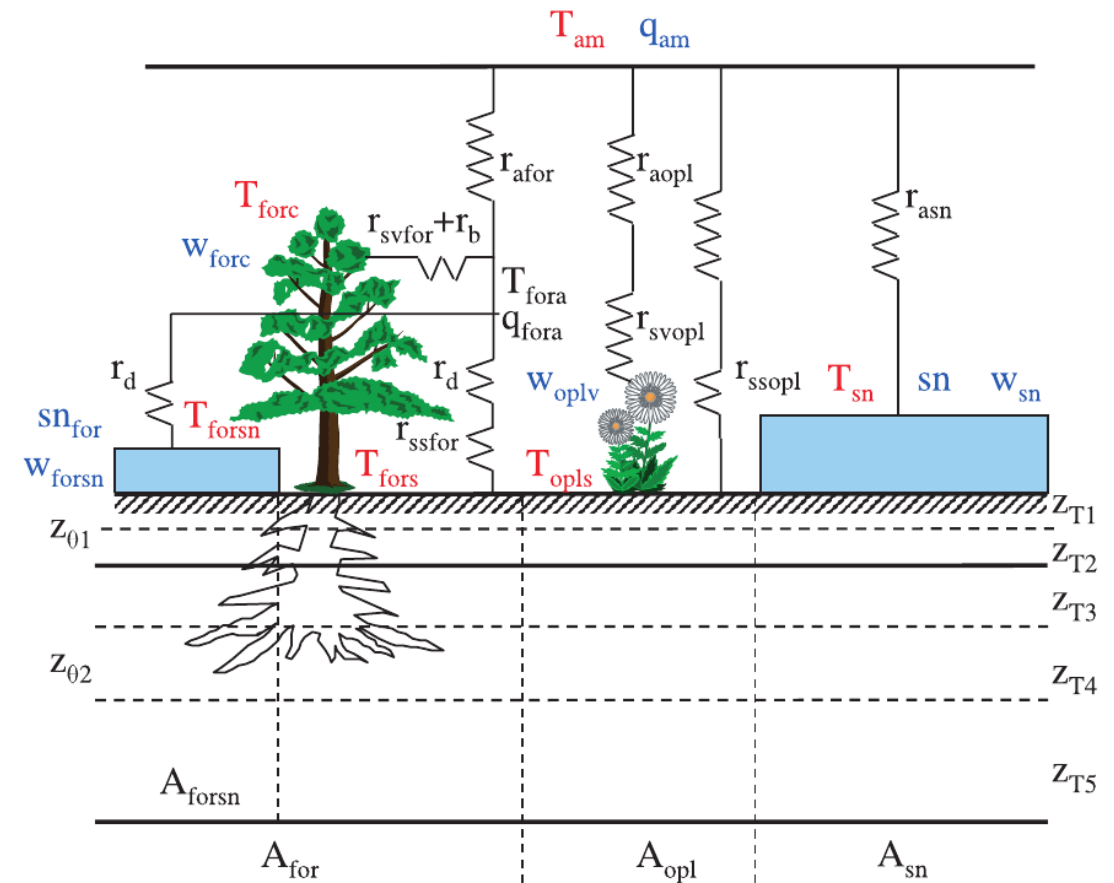
## The Rossby Centre Regional Climate model RCA3: model description and performance

Patrick Samuelsson, Colin G. Jones, Ulrika Willén, Anders Ullerstig, Stefan Gollvik, Ulf Hansson, Erik Jansson, Christer Kjellström, Grigory Nikulin & Klaus Wyser

... but problems in this HIRLAM-ISBA land-surface scheme were early identified. The reason was believed to be due to a bad representation of snow in forested landscapes.

Therefore, in 1999, Patrick Samuelsson and Stefan Gollvik started to develop the explicit canopy scheme in combination with a one-layer snow scheme on top of a 5-layer diffusion soil scheme.

First for the Rossby Centre regional climate model (RCA) and later this entered HIRLAMv7.



# ALADIN-HIRLAM cooperation



...where HIRLAM applies the HARMONIE-AROME model configuration, including SURFEX.

Forecasters are happy with many aspects of HARMONIE-AROME, but...

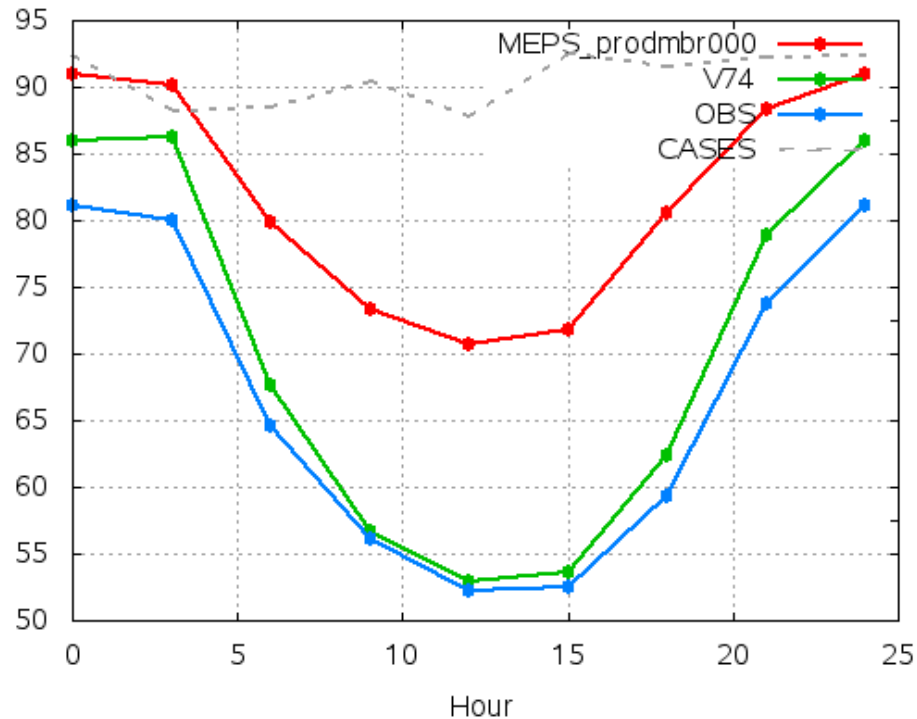


# Finnish forecasters do still highly appreciate HIRLAM near-surface performance

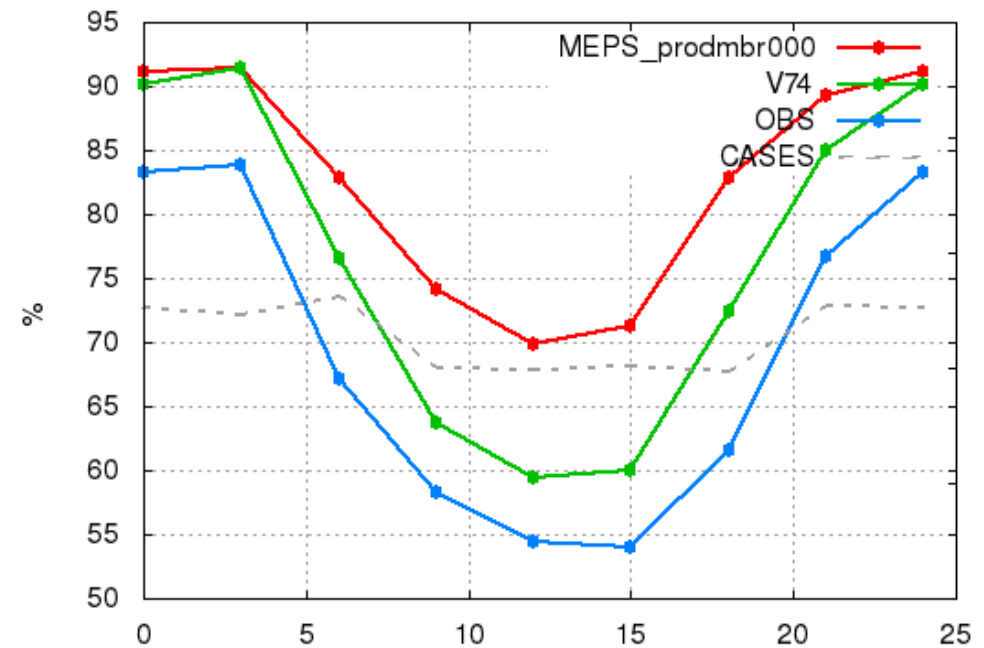
Diurnal cycle of spring-time Rh2m over Finland for

- **observations**
- **operational HARMONIE-AROME with SURFEX (Force-restore, D95 snow)**
- **operational HIRLAMv7.4 (explicit canopy, 1 layer snow, diffusion soil)**

May 2017



May 2018



... so, time for an explicit canopy representation to enter ISBA in SURFEX...

# Explicit canopy for ISBA in SURFEX - MEB

Geosci. Model Dev., 10, 843–872, 2017  
www.geosci-model-dev.net/10/843/2017/  
doi:10.5194/gmd-10-843-2017  
© Author(s) 2017. CC Attribution 3.0 License.



Geoscientific  
Model Development  
Open Access  
EGU

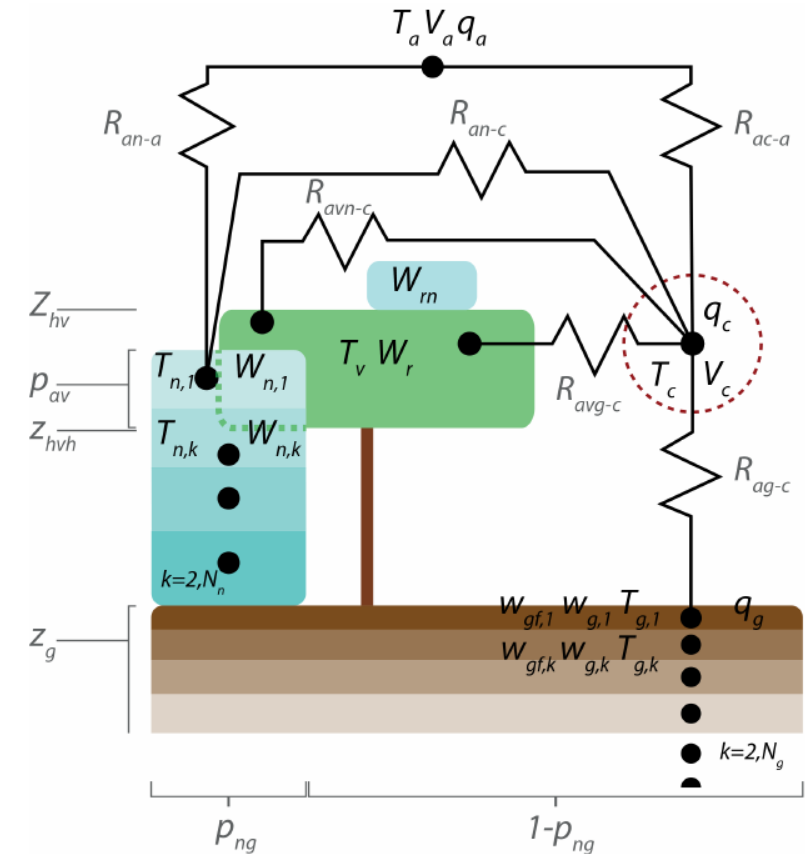
## The interactions between soil–biosphere–atmosphere land surface model with a multi-energy balance (ISBA-MEB) option in SURFEXv8 – Part 1: Model description

Aaron Boone<sup>1</sup>, Patrick Samuelsson<sup>2</sup>, Stefan Gollvik<sup>2</sup>, Adrien Napoly<sup>1</sup>, Lionel Jarlan<sup>3</sup>, Eric Brun<sup>1</sup>, and Bertrand Decharme<sup>1</sup>

<sup>1</sup>CNRM UMR 3589, Météo-France/CNRS, Toulouse, France

<sup>2</sup>Rosby Centre, SMHI, 601 76 Norrköping, Sweden

<sup>3</sup>CESBIO – UMR 5126 UPS, CNRS, CNES, IRD, Toulouse, France



Initiative for MEB in SURFEX was taken at a meeting at CNRM, October 7-9, 2008.

Participants were:

**Joël Noilhan**, Aaron Boone, Bertrand Decharme, Jean-Christophe Calvet, Christine Delire, Patrick Le Moigne, Patrick Samuelsson, Stefan Gollvik, Tido Semmler, Sébastien Lafont, Eric Martin, Jean-Louis Roujean, Gilles Boulet, Lionel Jarlan, Vincent Rivalland.

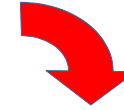


## A Simple Parameterization of Land Surface Processes for Meteorological Models

J. NOILHAN AND S. PLANTON

*Centre National de Recherches Météorologiques, Toulouse, France*

(Manuscript received 19 April 1988, in final form 1 September 1988)



AGRICULTURAL  
AND  
FOREST  
METEOROLOGY

Agricultural and Forest Meteorology 98–99 (1999) 239–256

[www.elsevier.com/locate/agrformet](http://www.elsevier.com/locate/agrformet)

## A new land-surface treatment for HIRLAM — comparisons with NOPEX measurements

B. Bringfelt<sup>a,\*</sup>, M. Heikinheimo<sup>b</sup>, N. Gustafsson<sup>a</sup>,  
V. Perov<sup>a</sup>, A. Lindroth<sup>c</sup>

<sup>a</sup>Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

<sup>b</sup>Finnish Meteorological Institute, Helsinki, Finland

<sup>c</sup>Department of Physical Geography, Lund University, Lund, Sweden

Geosci. Model Dev., 10, 843–872, 2017  
[www.geosci-model-dev.net/10/843/2017/](http://www.geosci-model-dev.net/10/843/2017/)  
doi:10.5194/gmd-10-843-2017  
© Author(s) 2017. CC Attribution 3.0 License.



Geoscientific  
Model Development  
Open Access  
EGU

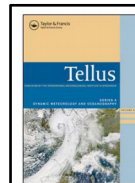
## The interactions between soil–biosphere–atmosphere land surface model with a multi-energy balance (ISBA-MEB) option in SURFEXv8 – Part 1: Model description

Aaron Boone<sup>1</sup>, Patrick Samuelsson<sup>2</sup>, Stefan Gollvik<sup>2</sup>, Adrien Napoly<sup>1</sup>, Lionel Jarlan<sup>3</sup>, Eric Brun<sup>1</sup>, and Bertrand Decharme<sup>1</sup>

<sup>1</sup>CNRM UMR 3589, Météo-France/CNRS, Toulouse, France

<sup>2</sup>Rosby Centre, SMHI, 601 76 Norrköping, Sweden

<sup>3</sup>CESBIO – UMR 5126 UPS, CNRS, CNES, IRD, Toulouse, France



Tellus A: Dynamic Meteorology and Oceanography



ISSN: (Print) 1600-0870 (Online) Journal homepage: <https://www.tandfonline.com/loi/zela20>

## The Rosby Centre Regional Climate model RCA3: model description and performance

Patrick Samuelsson, Colin G. Jones, Ulrika Willén, Anders Ullerstig, Stefan Gollvik, Ulf Hansson, Erik Jansson, Christer Kjellström, Grigory Nikulin & Klaus Wyser





## Pleasure of science...



Aaron Boone enjoying Lake Svängbågen, Sweden, January 2011

Bird watching with Stefan Gollvik at his summer house 2015.



Aaron Boone, Adrien Napoly, Patrick Samuelsson et al. hiking in the Pyrenees October 2015



Nils Gustafsson and his son David in our new sailing boat, October 2018.





**THANKS!**