Review of HIRLAM/HARMONIE SURFEX-related activities

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SURFEX SC meeting
2 Apr. 2015

Contents

Ongoing and planned R&D
- General
- Soil and vegetation
- Snow
- Sea ice
- Lakes
- Urban
- Physiography
- Technical developments and documentation

Points to discuss

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General: HARMONIE Climatology

HCLIM project includes SURFEX7.3:

- ISBA-DIF, ES-3L, FLake
- Prognostic sea ice (new)
- Modified SURFEX further for ALARO compability and snow prep step
- Many other modifications: https://hirlam.org/trac/wiki/HarmonieClimate

General discussion in HIRLAM/HARMONIE: snow-soil-vegetation, model + DA

Goal: to run advanced snow schemes in operational

- MEB is now possible with FR
  Thanks to Aaron Boon!
- Plans to test FR+ES+MEB in HARMONIE
- More serious plans for Soil DA for DIF!

Soil Scheme	Soil DA	Snow scheme	Snow-veg scheme	Snow DA	Application
FR	OI/EKF +OI(Canari)	D95	none	snowOI(Canari)	NWP
		ES	*MEB*	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
			none	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
		CRO	*MEB*	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
			none	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
	none	D95	none	none	climate
		ES	*MEB*	*none*	*climate*
			none	none	climate
		CRO	*MEB*	*none*	*climate*
			none	*none*	*climate*
DIF	*{OI/VAR/EKF} +OI(Canari)*	*D95*	*none*	*snowOI(Canari)*	*NWP*
		ES	*MEB*	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
			none	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
		CRO	*MEB*	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
			none	*[{snowOI/VAR/EKF}] +snowOI(Canari)*	*NWP*
	none	D95	none	none	climate
		ES	MEB	none	climate
			none	none	climate
		CRO	*MEB*	*none*	*climate*
			none	none	climate

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R&D: Soil and vegetation, DA

Plans:

- **Assimilation of satellite-based measurements of the hydrosphere - towards a combined meteorological-hydrological forecasting system** – raw radiance and backscatter data (satellite radiances from AMSR2/GCOM-W1, MIRAS/SMOS and SAR/Sentinel-1)
- **IMproving PRedictions and management of hydrological EXtremes - IMPREX** - satellite based surface products, the surface soil moisture from ASCAT

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R&D: snow modeling and DA

- Problems with permanent snow in Iceland were reported (melting)
- SE obs from NESDIS are too smooth for HARMONIE
- experiments using the probability of snow from satellite … - planned
- SE from Land-SAF, or Globsnow, or MODIS, SWE from microwave retrievals using HUT model – planned
- EKF for SWE – planned

COST ES1404 started! The eorking group on snow DA: a good overview, frames for cooperation and generating ideas

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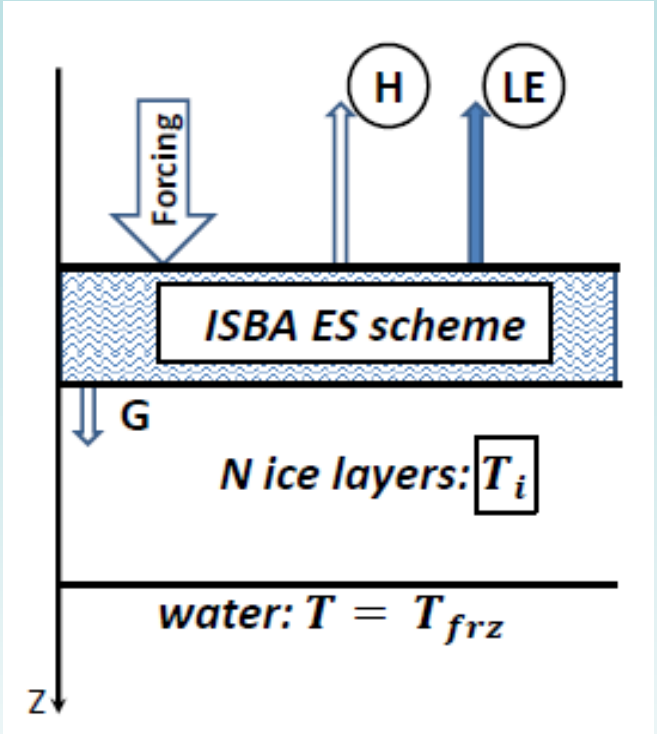
R&D: Ice modeling

- **Simple ice scheme**
  - H=const
  - heat diffusion 4L
  - snow on ice

  is technically possible
  - the ice fraction

  is from analysis



- **HIGHTSI** – planned and ongoing

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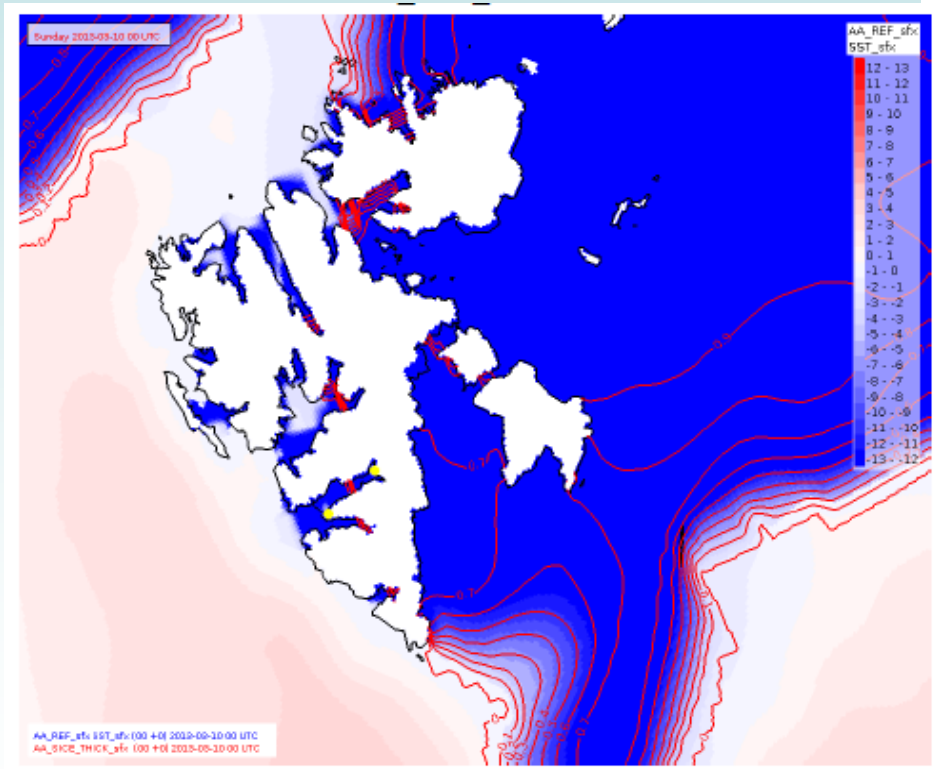
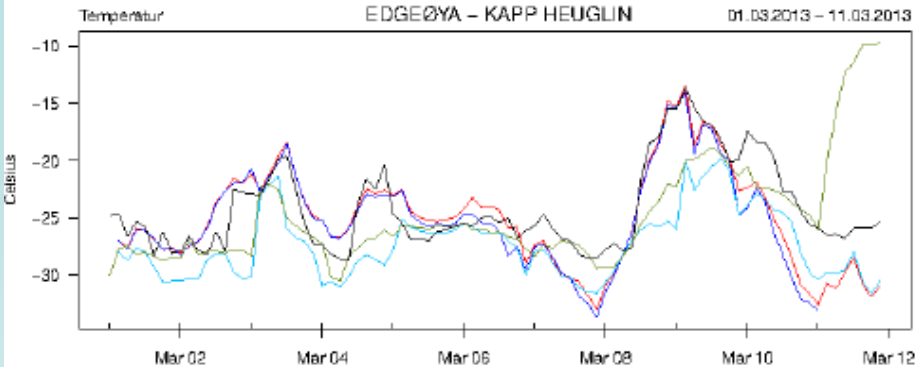
R&D: Ice modeling



AA_SICE_SNOW_3L_01 (1006)



	Min	Middel	Maks	Std	N
synop: 00,...,21/3	-28.7	-24.2	-13.6	3.7	88
AA_SICE_SNOW: 00+3,...,+24/3	-33	-25.1	-13.4	4.3	87
AA_SICE_SNOW_S: 00+3,...,+24/3	-33.7	-25	-14.1	4.2	80
AA_REF: 00+3,...,+24/3	-31.6	-27.4	-19.8	3	87
AROME_Norway:					0
AROME_Svalbard: 00+3,...,+24/3	-30.5	-24.8	-9.7	4.6	88

	Middelfeil	Skt.feil	RMSE	MAE	Maks.abs.feil	N
AA_SICE_SNOW – synop	-0.9	2.6	2.8	2.2	6.7	87
AA_SICE_SNOW_S – synop	-1	2.6	2.9	2.2	7.7	80
AA_REF – synop	-3.2	2.5	4	3.2	10.5	87
AROME_Svalbard – synop	-0.5	4.7	4.8	2.9	16.1	88

- tests over AROME Arctic domain
- SST and SIC fields in fiords need improvements

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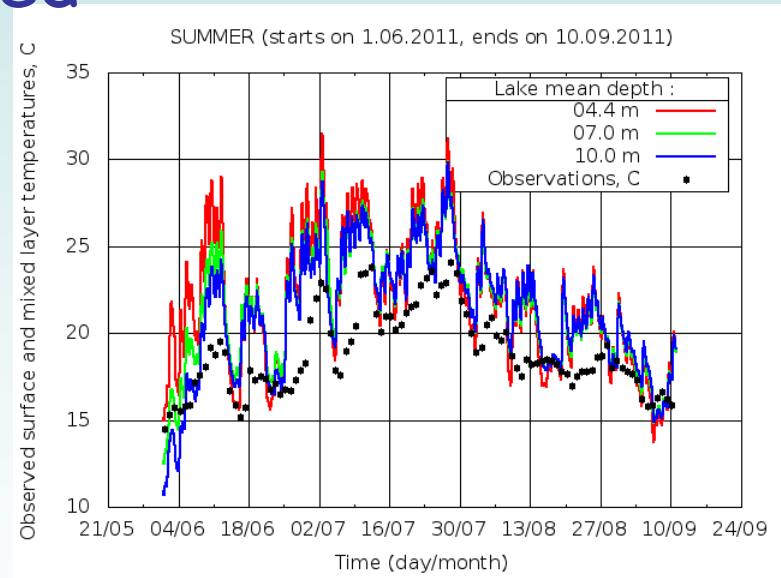
R&D: Lake modeling

- tests with PGD: problems with consistency of the lake depth and lake fraction fields were found
- GLDBv2 is included into SURFEX
- FLake in 2D – ongoing, planned
- to include the improved lake climatology into SURFEX and HARMONIE – ongoing, planned
- 1D experiments for Lake Kyyvesi to study the model error during different seasons



R&D: Lake DA

- **in ver**, with EKF:
  - a posteriori statistics, statistics of errors, bug fixes
  - testing with deep water temperature obs, include into SURFEX and HARMONIE - planned
- **in hor**: new structure functions for OI (different from SST) - ongoing

Name (longitude, latitude)	D (m)	I (%)	Name (longitude, latitude)	D (m)	I (%)
Kuivajärvi (23.9, 60.8)	2.2	94.8	Rehja-Nuasjärvi (28.0, 64.2)	8.5	95.5
Tuusulanjärvi (25.1, 60.4)	3.2	94.3	Vaskivesi (23.8, 62.1)	7.0	97.1
Pääjärvi 1 (24.5, 62.9)	3.8	96.6	Haukivesi (28.4, 62.1)	9.1	94.9
Pesiöjärvi (28.7, 64.9)	3.9	95.4	Kallavesi (27.7, 62.8)	9.7	96.3
Kyyvesi (27.1, 62.0)	4.4	96.5	Pielinen (29.6, 63.3)	10.1	94.6
Jääsjärvi (26.1, 61.6)	4.6	96.2	Konnevesi (26.6, 62.6)	10.6	95.4
Nilakka (26.5, 63.1)	4.9	96.6	Saimaa (28.1, 61.3)	10.8	94.5
Pyhäjärvi (22.3, 61.0)	5.5	96.4	Ala-Rieveli (26.2, 61.3)	11.2	92.4
Längelmävesi (24.4, 61.5)	6.8	94.4	Päijänne (25.5, 61.6)	14.1	93.7
Ounasjärvi (23.6, 68.4)	6.6	97.3	Inarijärvi (27.9, 69.1)	14.3	97.1
Lappajärvi (23.7, 63.1)	6.9	93.4	Näsijärvi (23.8, 61.6)	14.7	94.0
Oulujärvi (27.0, 64.5)	7.0	95.0	Pääjärvi 2 (25.1, 61.1)	14.8	96.7
Unari (25.7, 67.1)	7.0	94.0	Kilpisjärvi (20.8, 69.0)	19.5	96.8
Kevojärvi (27.0, 69.8)	7.0	98.0			

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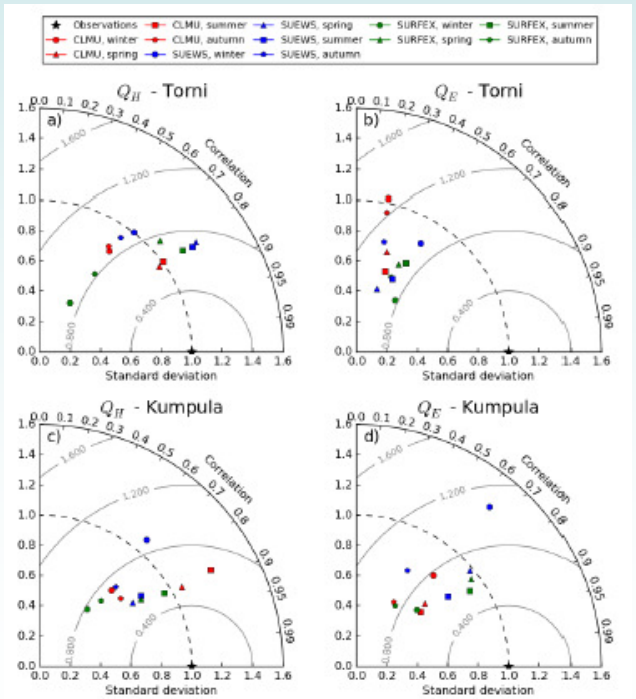
R&D: Urban modelling

Intercomparison study
-SURFEX (TEB), SUEWS (U Helsinki)
and CLM-U (KU Leuven)
- obs: year 2012,
SMEAR III tower
and Hotel Torni
- fluxes,
much attention to
snow and
winter stability



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R&D: Urban modelling

- Conditions of roads and pavements
- Heating demand, cooling demand
- Urban flooding
- Freezing and thawing of soil
- Local energy production: Solar, wind
- Urban planning, (e.g. building density, green roofs) and local interpretation climate scenarios

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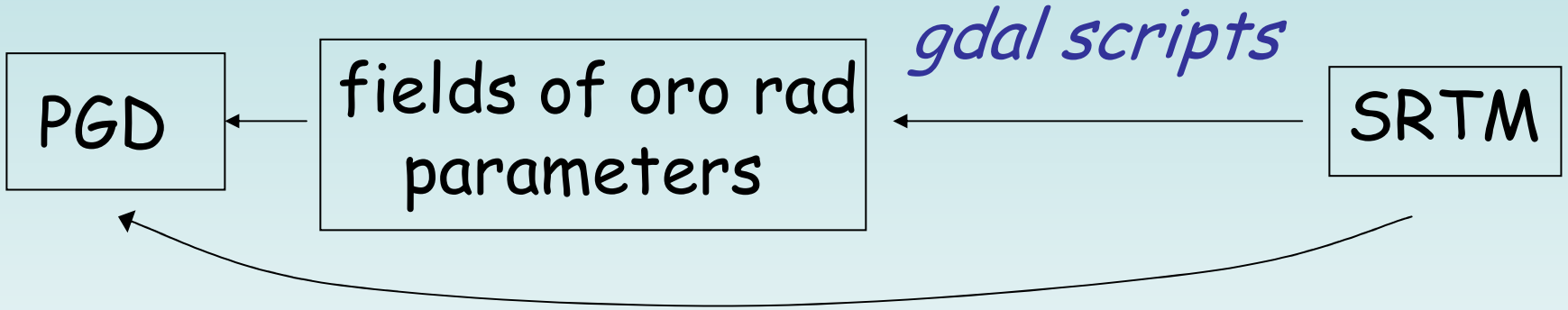
R&D: orographic radiation parametrization

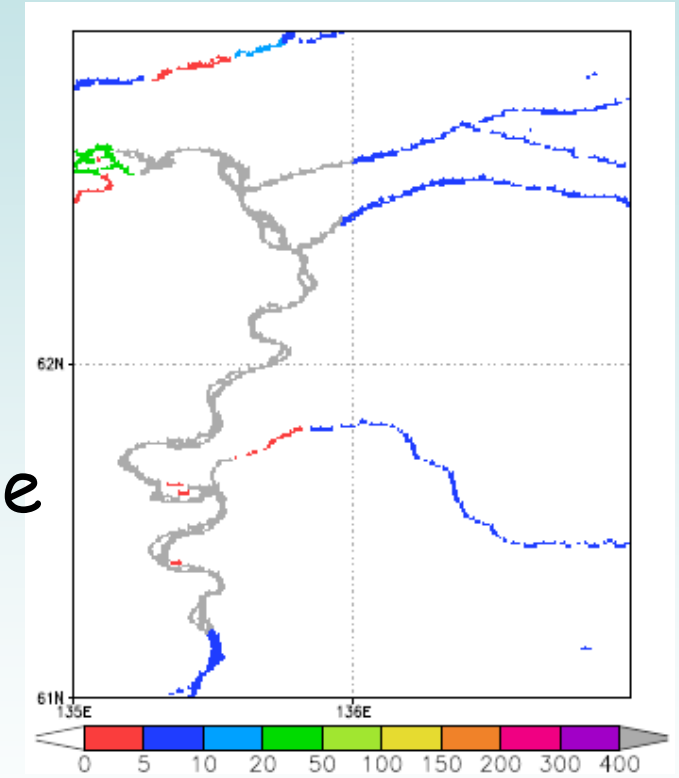


- CALL ORORAD in COUPLING_SURF_ATM_n before calling the tile loop
- Include into the MUSC environment

R&D: Physiography

- **Geospa** web meeting in December: ideas for cooperation

- **GLDBv2**: problems for large rivers detected, fixing is ongoing
- **GLDBv3**: indirect estimates of the mean lake depth for the Sourthern Hemisphere – almost done
- **GLDB**: first steps towads fine resulution, Globcover



R&D: Physiography

- Philosophy of fractions of tiles within Covers => inconsistency problems with other datasets, such as the lake database. Solution: don't use this approach for lakes.

	Cover type	Current partition	Remarks	Suggestions
124	Warm tropical wetlands	nature – 80% inland water – 20%	-	nature – 100 %
125	Subpolar wetlands	nature – 80% inland water – 20%	-	nature – 100 %
176	Rice fields	nature – 80% inland water – 20%	"False" cover, does not exist on the binary map	-
238	Temperate wetlands	nature – 80% inland water – 20%	"False" cover, does not exist on the binary map	-
239	Subpolar wetlands	nature – 80% inland water – 20%	Exist only in Iceland	nature – 100 %
240	Peat bogs	nature – 80% inland water – 20%	"False" cover, does not exist on the binary map	-
241	Salines and salt marshes	nature – 50% inland water – 50%	"False" cover, does not exist on the binary map	-
242	Intertidal flats	nature – 50% sea water – 50%	"False" cover, does not exist on the binary map	-
243	Coastal lagoons	sea water – 100%	"False" cover, does not exist on the binary map	-
249	INLAND WATERS1	inland water – 100%	Polders and coastal lagoons	sea water – 100%
550	UNDEFINED1	nature – 45% inland water – 55%	In Europe: sea water near the coast, coastal lagoons, river estuaries. In Ukraine and Turkey: lakes. In Asia:	Several cover fixes in binary map: from 550 to 2 or from 550 to the major cover type in the

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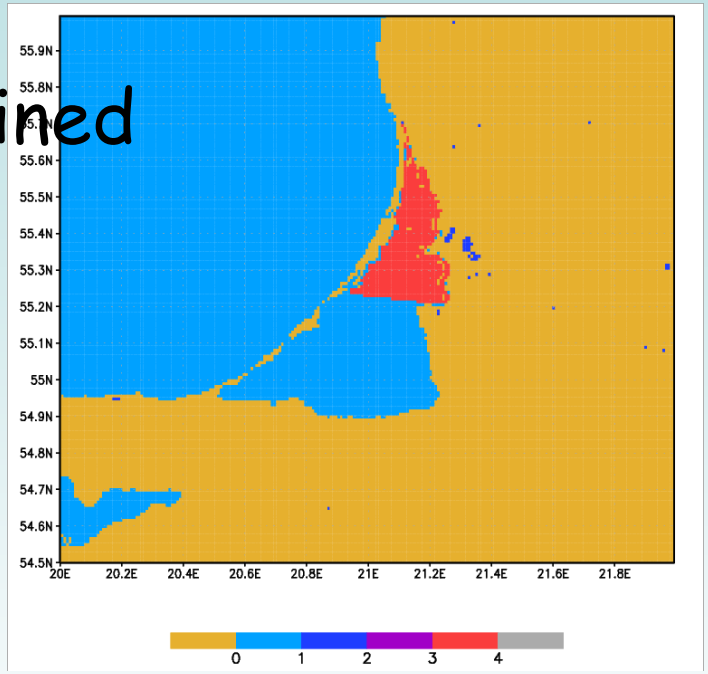
R&D: Physiography

- "Water body" covers were carefully examined:
- Some Covers are poorly defined
  Solution:
  to fix the binary cover map,
  done,
  Should be coordinated
  with other developments!



Curonian lagoon, Covers types contain from 2 to 50% of land

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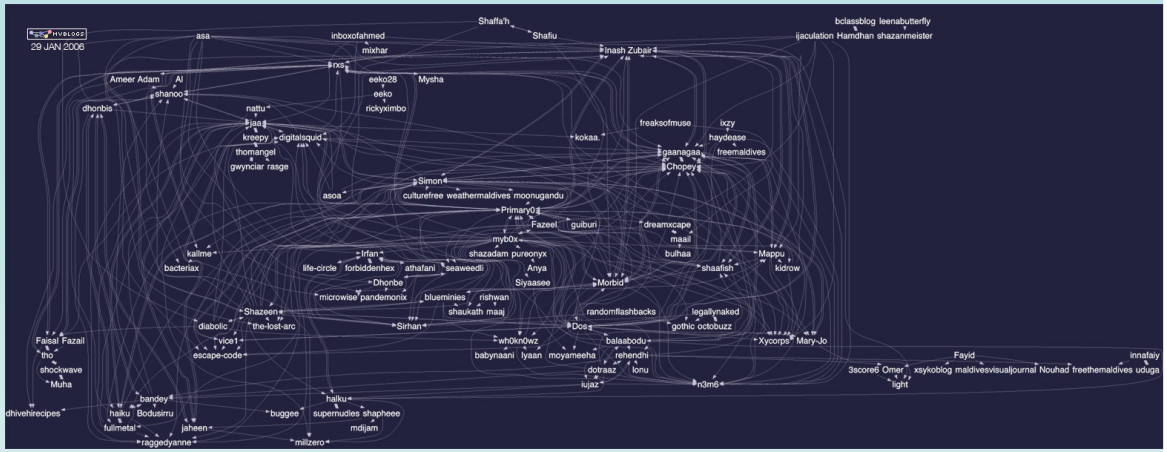
Technical

- Changes of an initial state from ECMWF with PREP and related changes in GRIB2 handling
- FORTRAN 2003 features: for the discussion
- For svn or git – to use more possibilities, as in HIRLAM/HARMONIE: for the discussion

Documentation

- Status of various options: tested? in which mode? : for the discussion
- Contact people on different topics: for the discussion
- Default values in SURFEX: recommended or bogus? : for the discussion

Documentation



- Code structure?
- DOXYGEN: lists, graph …
- to unravel the graph:
  plain routines, utils, blocks - ongoing

PGD	ALLOC_SURFEX		
	GOTO_SURFEX		
	PGD_GRID_SURF_ATM	SURF_VERSION	
		INI_CSTS	
		PGD_GRID	
		PGD_GRID_IO_INIT	
	SPLIT_GRID	SPLIT_GRIG_CONF_PROJ	*GET_GRIDTYPE_CONF_PROJ*
			SPLIT_GRID_PARAMETERN0 (many)
			SPLIT_GRID_PARAMETERX1 (many)
			PUT_GRIDTYPE_CONF_PROJ
		SPLIT_GRID_CARTESIAN	*GET_GRIDTYPE_CARTESIAN*
			SPLIT_GRID_PARAMETERN0 (many)
			SPLIT_GRID_PARAMETERX1 (many)
			PUT_GRIDTYPE_CARTESIAN
		GET_SIZE_FULL_n	
	PGD_SURF_ATM	READ_PGD_ARRANGE_COVER	
		READ_PGD_COVER_GARDEN	
		INIT_READ_DATA_COVER	
		INIT_DATA_COVER	
		READ_PGD_SCHEMES	

ALLOC_SURFEX	* *ALLOC* allocation of all the variables		
GOTO_SURFEX	*GOTO_MODEL_SURFEX*	GOTO_WRAPPER_* according to schemes	* *GOTO_MODEL* different variables in the scheme
INIT_IO_SURF_n	INIT_IO_SURF_OL_n	*READ_SURF*	
		GET_DIM_FULL_n	
		GET_SIZE_FULL_n	
		GET_TYPE_DIM_n	
		INIT_IO_SURF_MASK_n	
		INIT_OUTFN_SURF_ATM_n	GET_DIM_FULL_n
			OL_DEFINE_DIM
			GET_DATE_OL
			CREATE_FILE(many)
			DEF_VAR_NETCDF(many)
			OL_WRITE_COORD(many)

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Thank you!

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