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Met Éireann experiences upgrading HiRLAM

Eoin Whelan

9th April 2008

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Overview

- Operational details
- Problems encountered
- January 2008 storm forecast failure
- Conclusions & Suggestions

Operational Details

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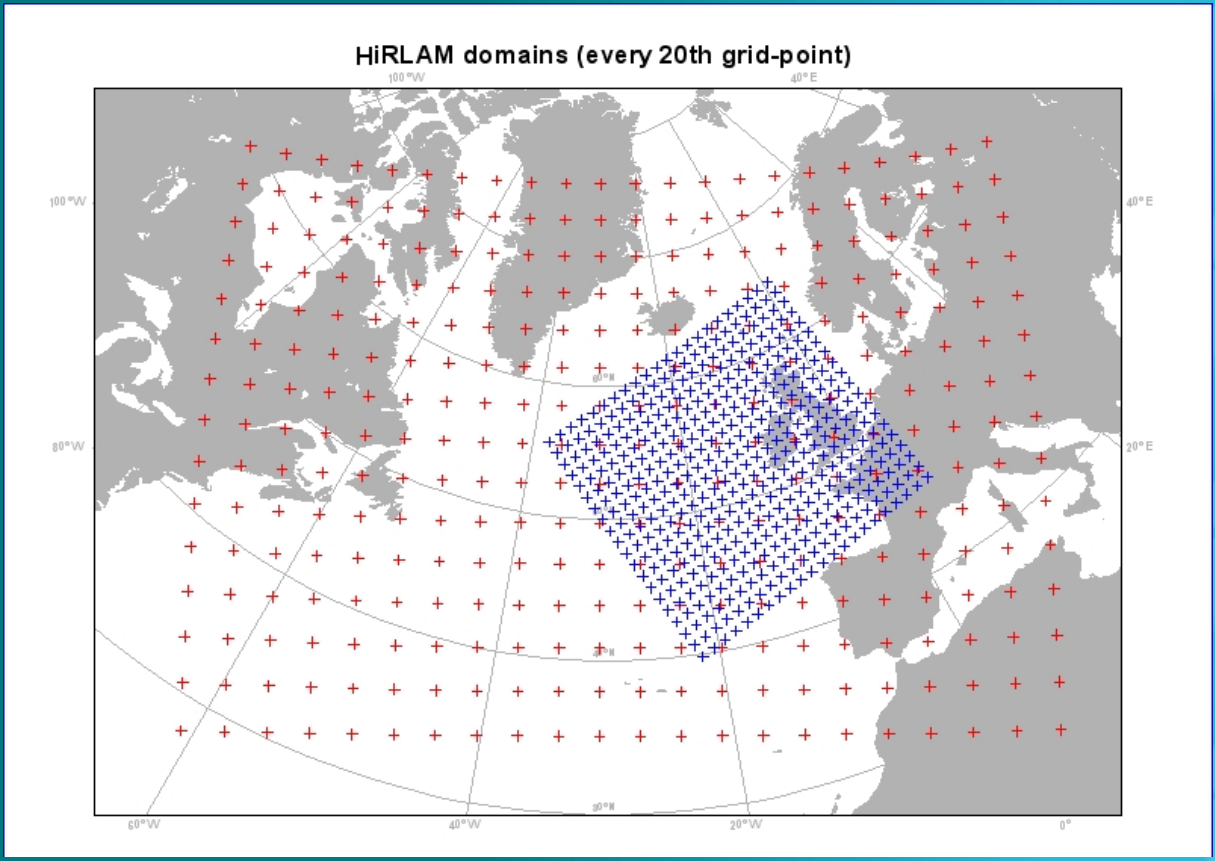
- Xiaohua's talk
- Met Éireann operational system poster



Problems encountered

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- Compiler dependent bug in span.x
- out of bounds access of array in getbck.F [4921]

- 40⟶60 levels: structure functions
- nonsep60 vs statbal60
- Poor analysis for z>500hPa

Problems encountered

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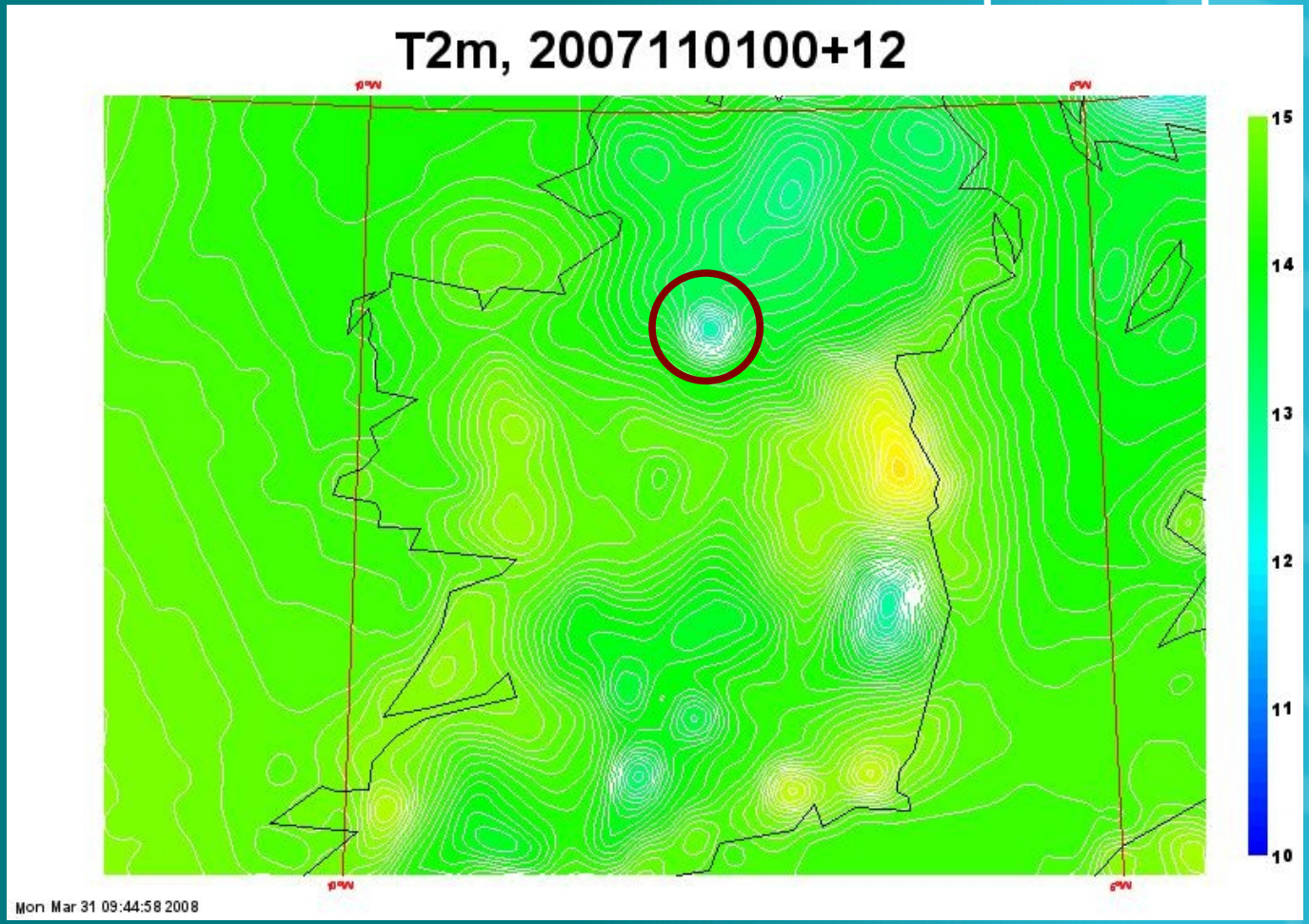
- surface scheme: t2m in winter
- fixes for soil and cloud ice [4630]



Problems encountered

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- Surface scheme: temperatures over sea-ice
- Cold bias in HiRLAM surface scheme
- See “Problems again” on https://hirlam.org/pipermail/sysopr/2008-March/subject.html

Problems encountered

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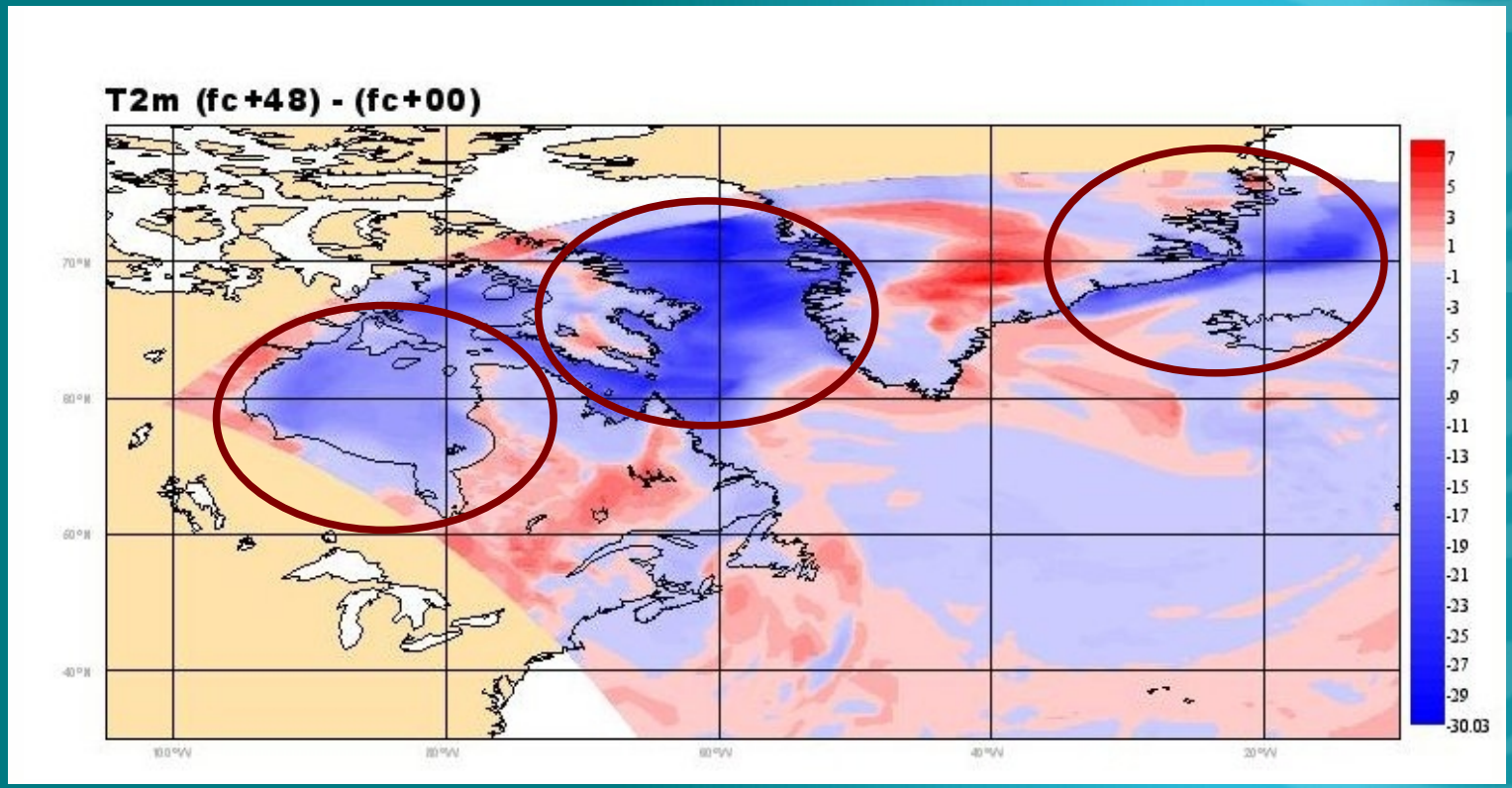
- Known issue/problem – see Newsletter 51 (p101)
- Possible resolution in 7.3 or before?



January storm forecast failure

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- Very active situation in Atlantic
- January 7th: "...Donegal got snow instead of very strong winds - **unhappy customers up there**"
- January 8th: Poor analysis at 12z
- Deepening depression not picked up by HiRLAM for forecast for 8th/9th January

January storm forecast failure

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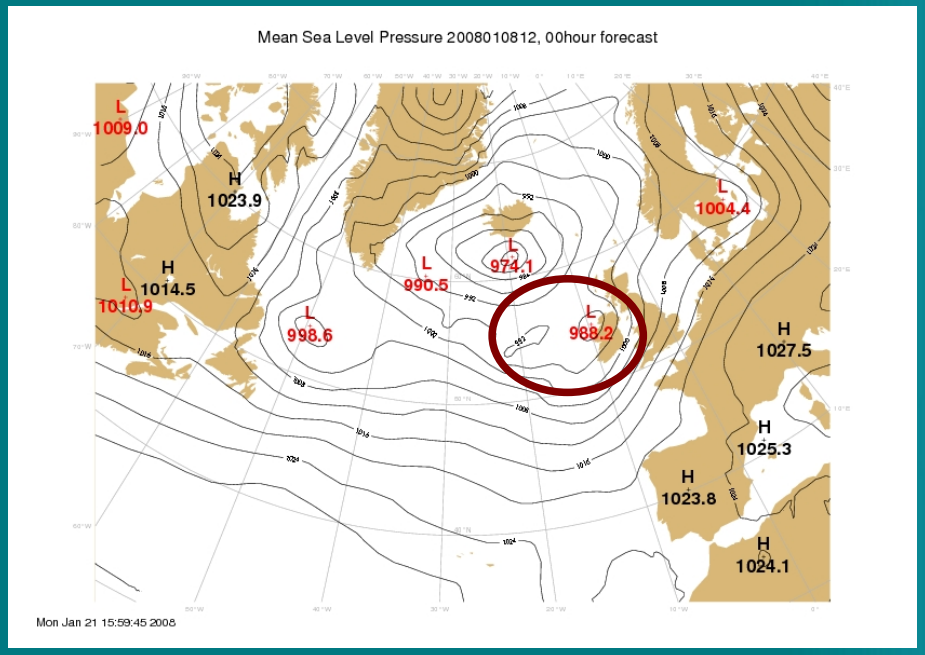
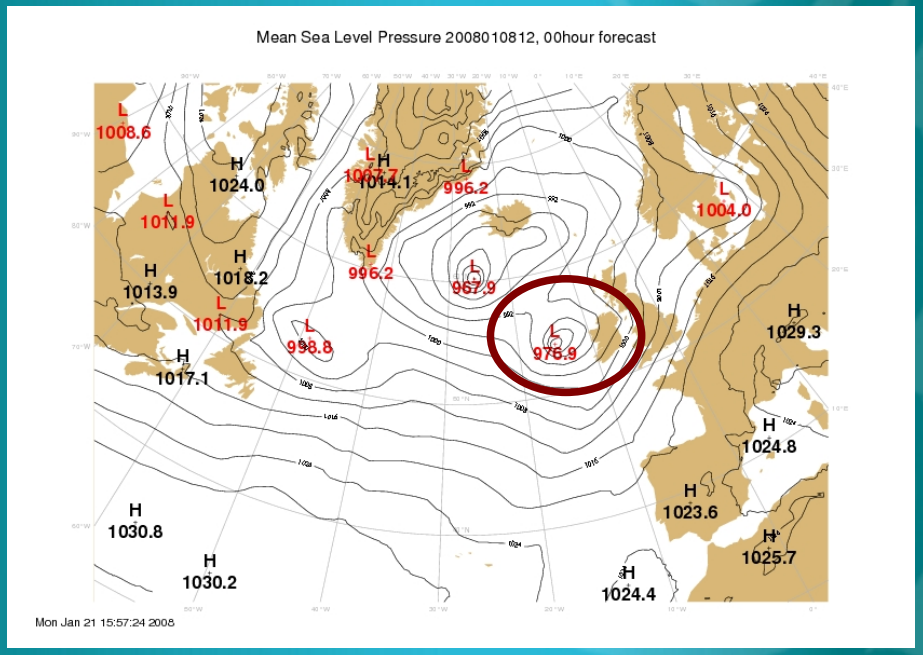
- ECMWF (right) and HiRLAM (left) analyses at 12z on Janury 8th
- ~10hPa difference west of Ireland





January storm forecast failure

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- DMI and RCR performed well
- What had we done wrong?
- What differences between set-ups?

- Model Version
- Extra observations – ATOVS data
- Large-scale mixing

January storm forecast failure

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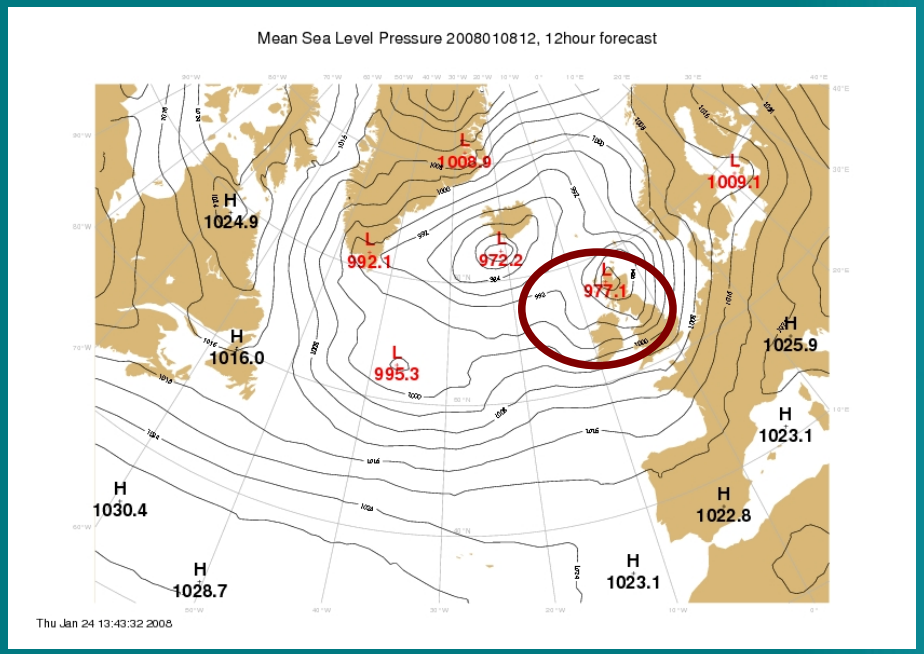
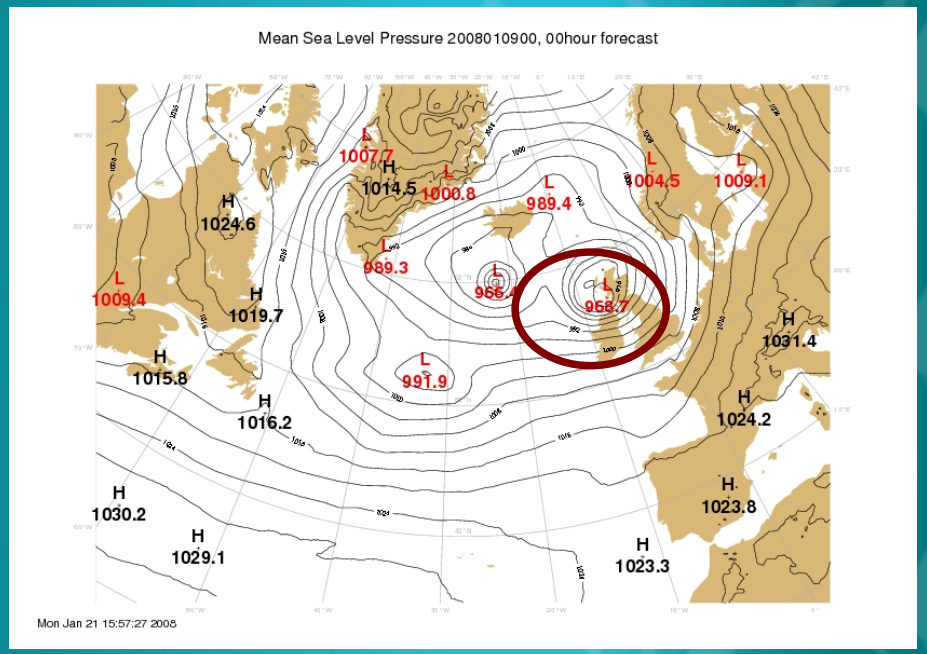
- Test impact of Version, ATOVS, LSMIX
- Chose 00z on 9th January as verification time for tests





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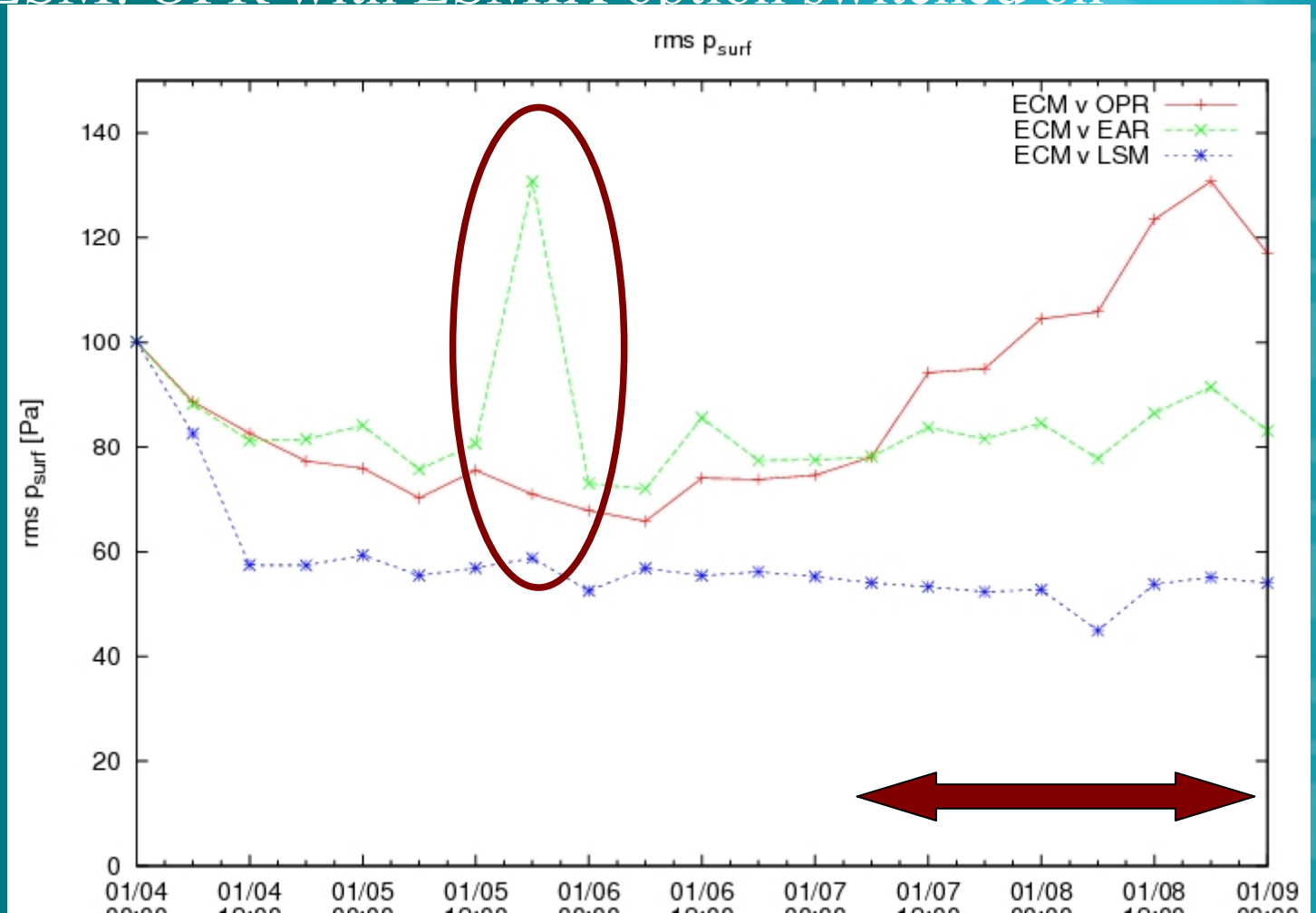
- Tests carried based on cycles "spun-up" from 00z on 4th January
- Analyses at 12z on 8th January examined
- Forecasts valid at 00z on 9th January examined
- HiRLAM analyses and forecasts verified against ECMWF analyses
- RMS difference in analysis p_{surf} was used as measure of accuracy

January storm forecast failure

- OPR: operational output
- EAR: OPR using ATOVS data
- LSM: OPR with LSMIX option switched on



January storm forecast failure

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- Using RMS difference as a measure:
  - ATOVS produces “improvements” over operational set up
  - Still some technical issues with ATOVS data (12z on Jan 5th)
  - LSMIX produces time-series least different to ECMWF
  - What about model output?

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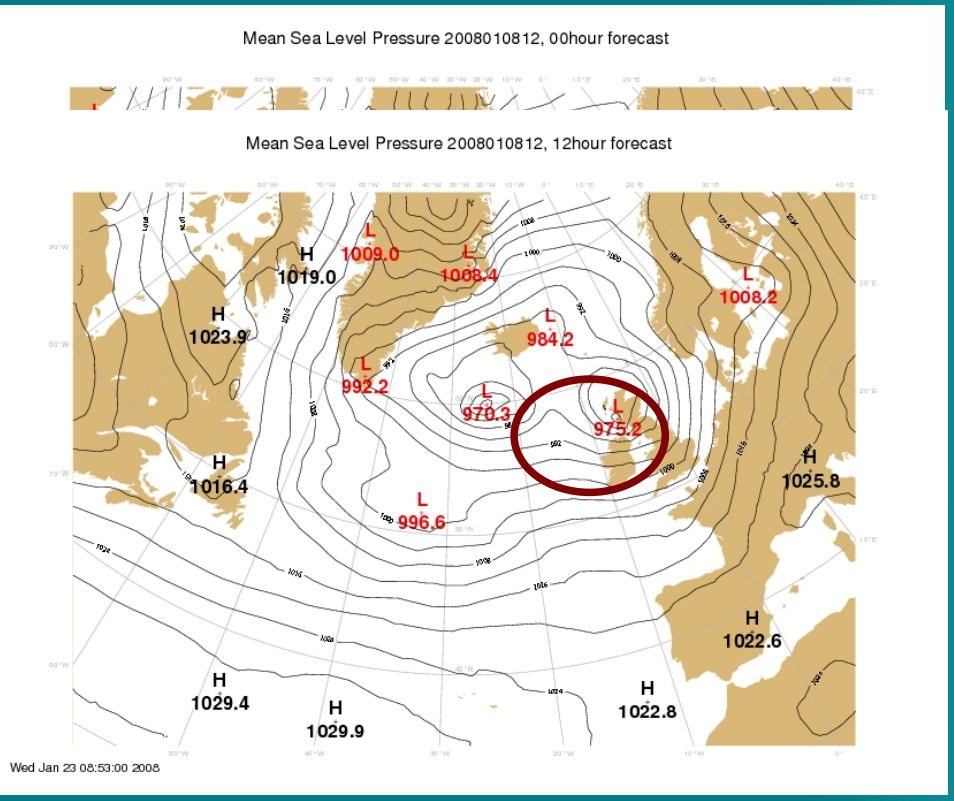
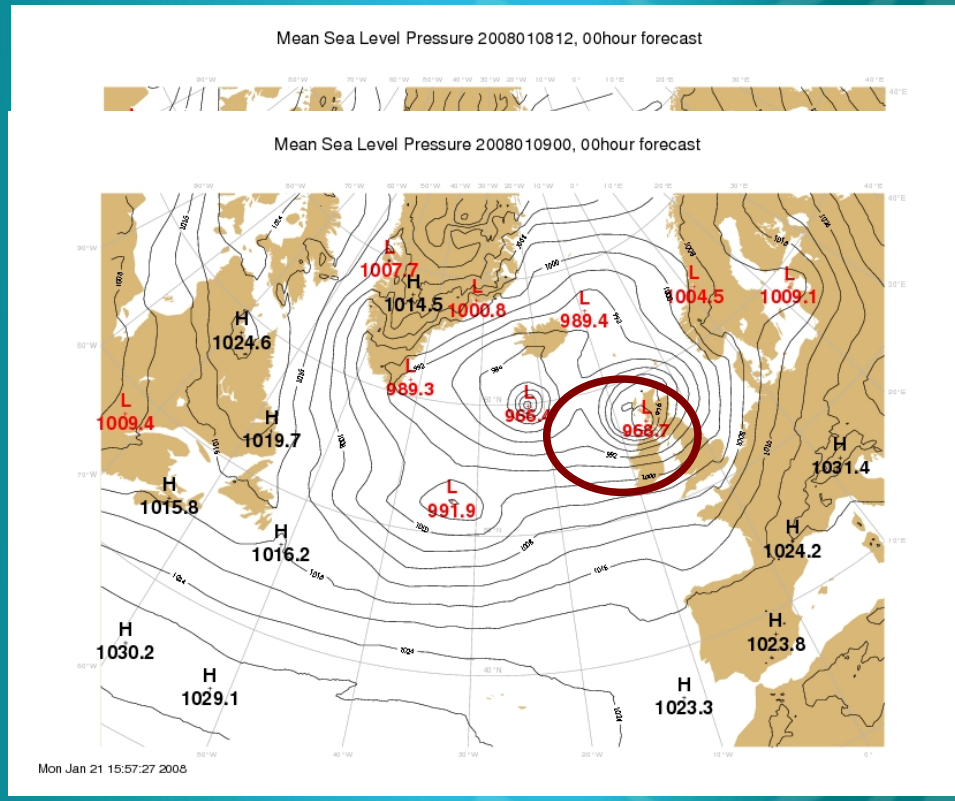
- ATOVS data





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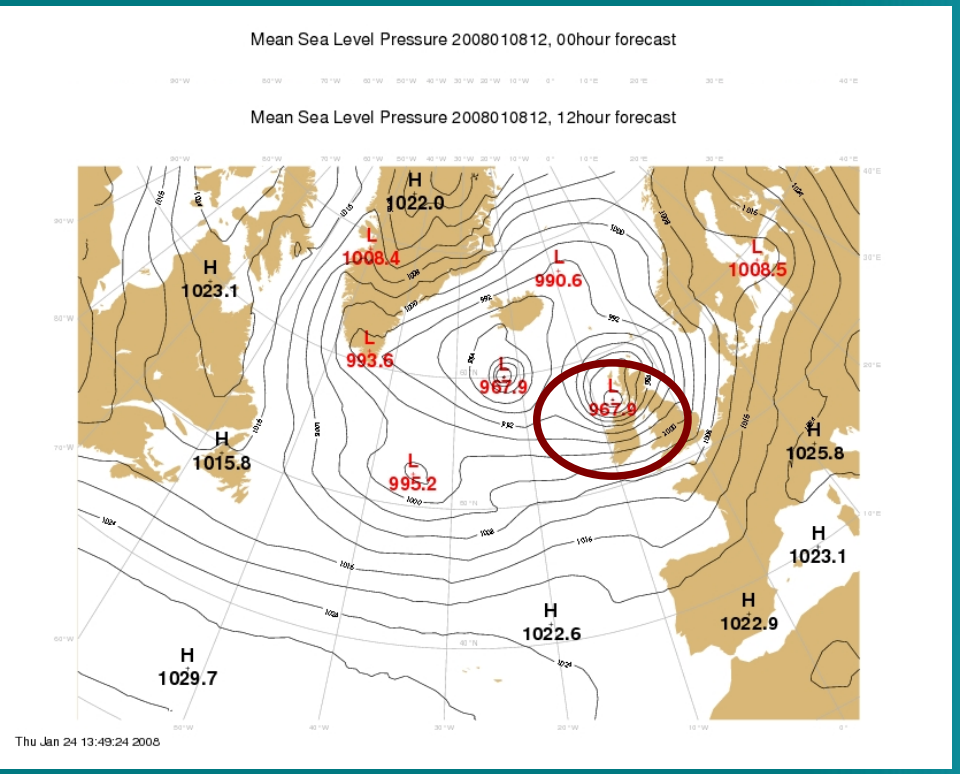
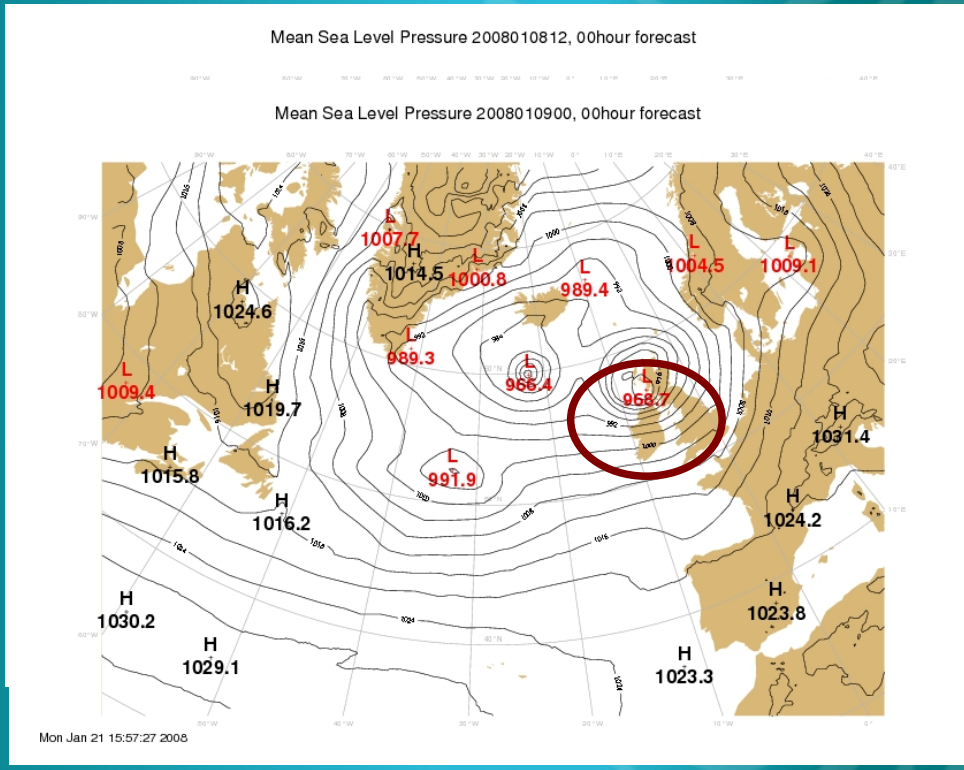
- LSMIX switched on





January storm forecast failure

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- ATOVS data improved performance but still failed to produce storm of 8th/9th Jan
- Still have technical issues with ATOVS data
- LSMIX improved performance
- LSMIX provided useful forecasts 42 hours prior to 00z on 9th January
- Implemented operationally on 29th January for 12z forecast

Conclusions & Suggetsions

- Scripts available to use compiler to test code
- Known problems – user experiences
- Highlighting of fixes/corrections

- ATOVS data will be useful
- LSMIX provides useful “insurance policy” for HiRLAM forecasts

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Thank you for your Attention
Questions?

Operational details:

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•*Analysis* : Hirlam 3DVAR [3-dimensional variational assimilation]. The analysis runs on 60 hybrid [eta] levels. Upper-air observational data is accepted on all standard and significant levels (10 hPa to 1000 hPa) and interpolated to eta levels.

•*Assimilation Cycle* : Three-hour cycle using the forecast from the previous cycle as a first-guess. [It is also possible to use an ECMWF forecast as a first-guess].

•*Initialisation* : Digital Filter

•*Forecast Model* : Hirlam 7.0rc1 reference system grid point model. This is hydrostatic model and it is run on a rotated latitude-longitude grid with the South-Pole at (-30° longitude, -30° latitude). Fields are based on a 438x284 grid corresponding to a 0.15° x 0.15° horizontal Arakara C-grid. There are 60 levels in the vertical.

•*Integration Scheme* : We use a two time-level three-dimensional semi-Lagrangian semi-implicit scheme with a time-step of 300 seconds.

•*Filtering* : Fourth order implicit horizontal diffusion.

•*Physics* : CBR vertical diffusion scheme; Sundqvist condensation scheme with the 'STRACO' (Soft TRAnsition COndensation scheme) cloud scheme; Savijarvi radiation scheme.

•*Lateral Boundary Treatment* : Davies-Kallberg relaxation scheme using a cosine dependent relaxation function over a boundary zone of 8-lines. The latest available ECMWF 'frame' files are used [based on 4 ECMWF runs per day at 00Z, 06Z, 12Z and 18Z,