

Simulated MSG SEVIRI Imagery from HARMONIE-AROME

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Joint 28th ALADIN Workshop & HIRLAM All-Staff
Meeting 2018 - Toulouse, 16-20 Apr 2018

Outline

1. Simulated Satellite Images (SSI) – Introduction.
2. Tool: HARMONIE-AROME Simulated MSG-SEVIRI images.
3. Application areas.
4. Tool in progress: future work.

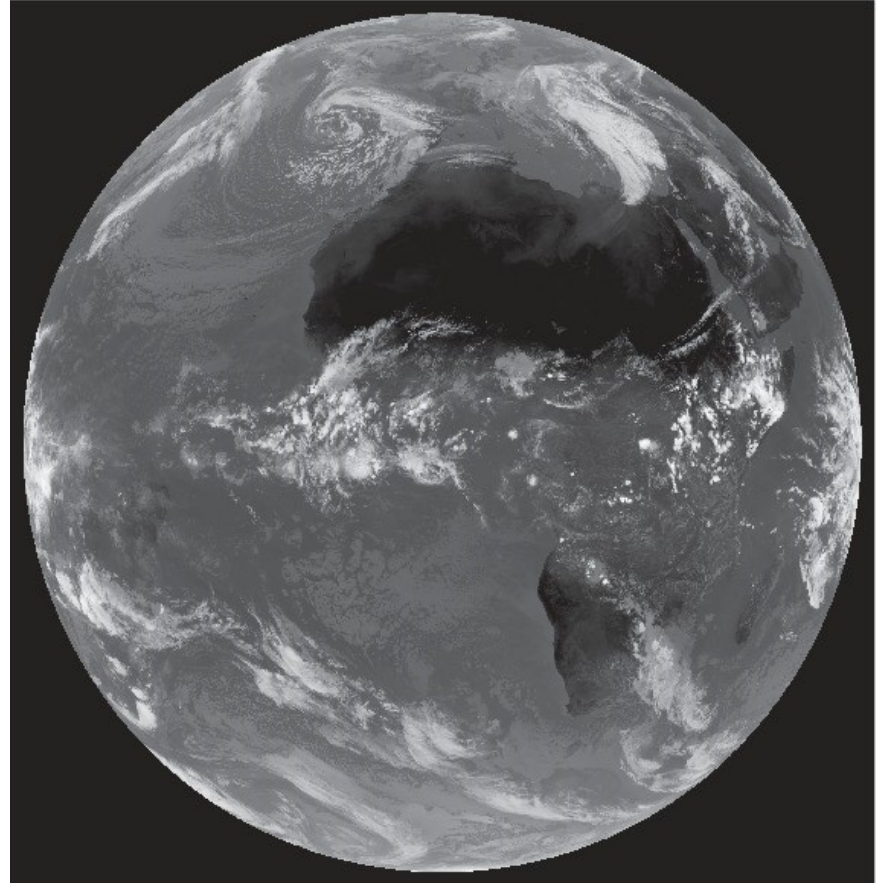
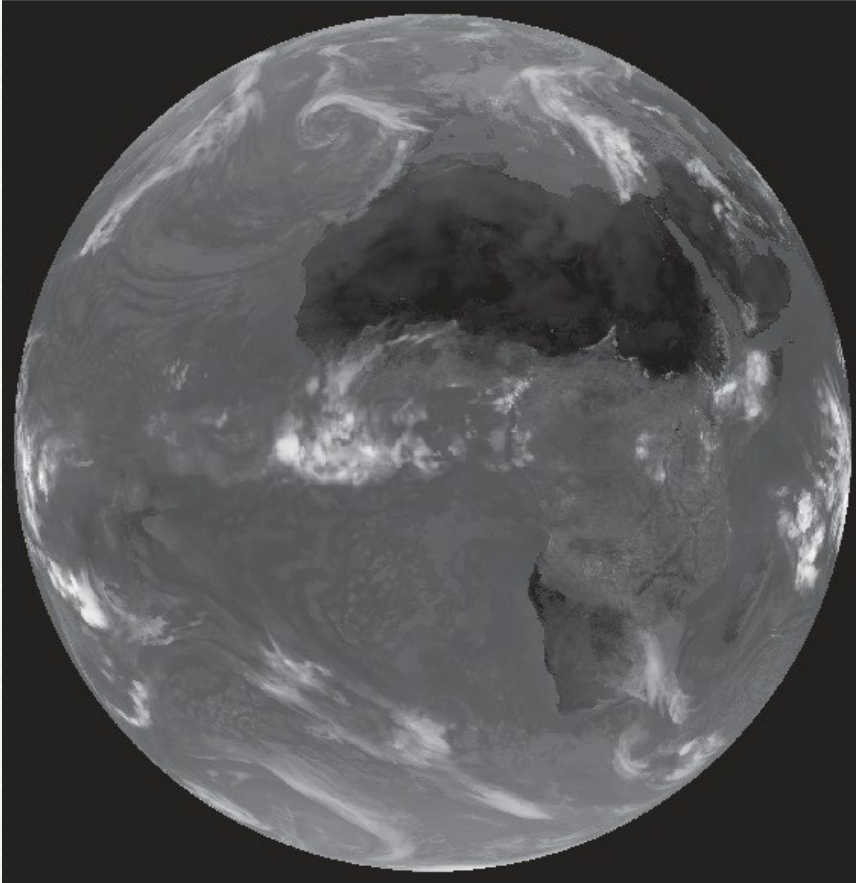
1. SSI - Introduction

- RTTOV radiative transfer model (and others) can estimate
 - the radiances / brightness temperatures that a satellite instrument would measure ,
 - for a specific channel (supported by that RT model),
 - at a specific position of the satellite,
 - from an atmospheric profile + surface conditions, e.g. from an NWP analysis or forecast.
- We can present the simulated BTs as an image:
 - Model geometry - BT at the grid points.
 - Satellite geometry - BT at the pixel positions of the observed satellite images.

1. SSI - Introduction – other SSI / pseudo-images

IFS - Meteosat-10 - IR 10.8 - 20130403 12UTC (+00h)

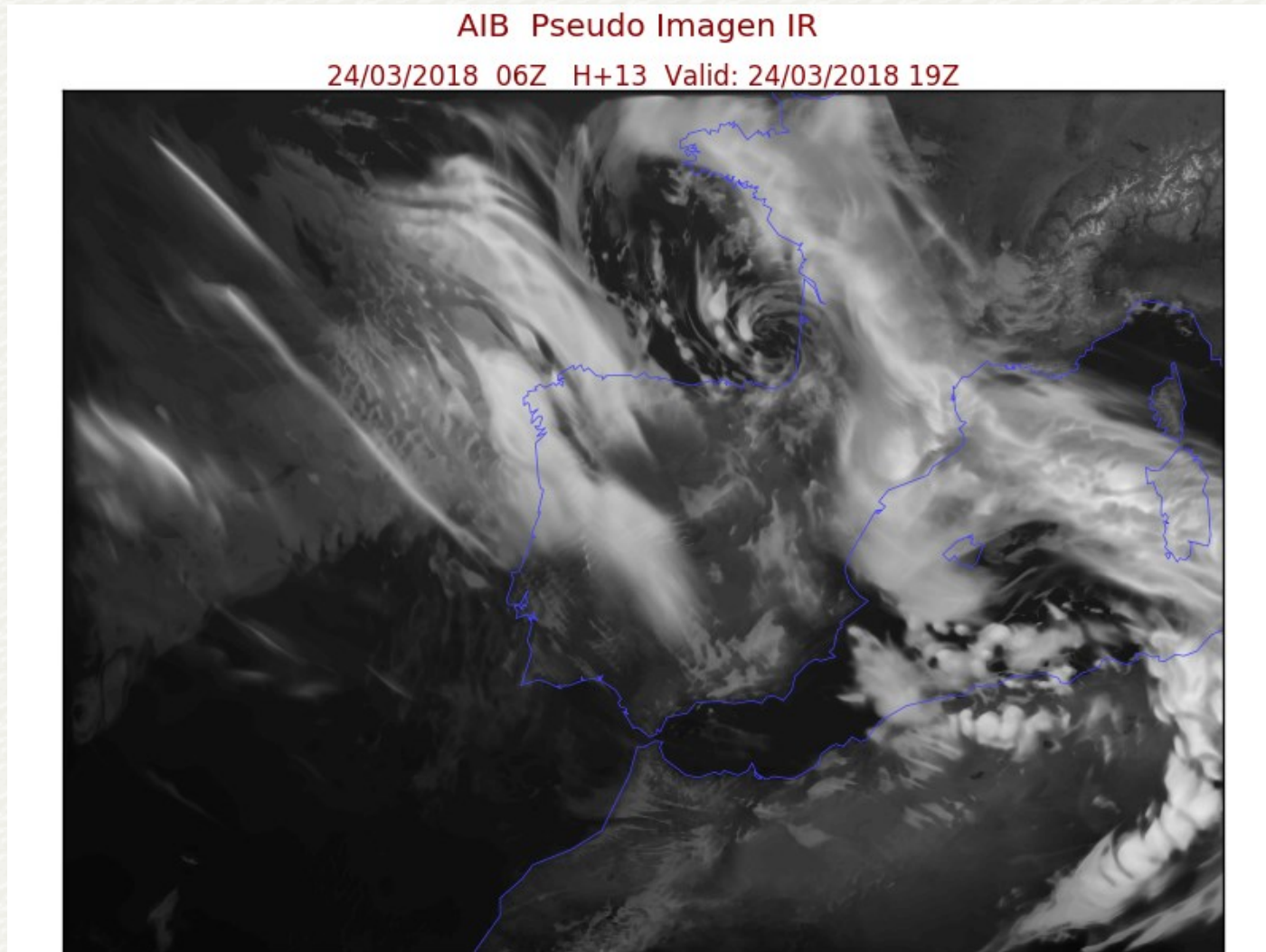
OBS - Meteosat-10 - IR 10.8 - 20130403 12UTC



Meteosat-10 IR10.8 / SSI from IFS

OBS Meteosat-10 IR10.8

1. SSI - Introduction – other SSI / pseudo-images



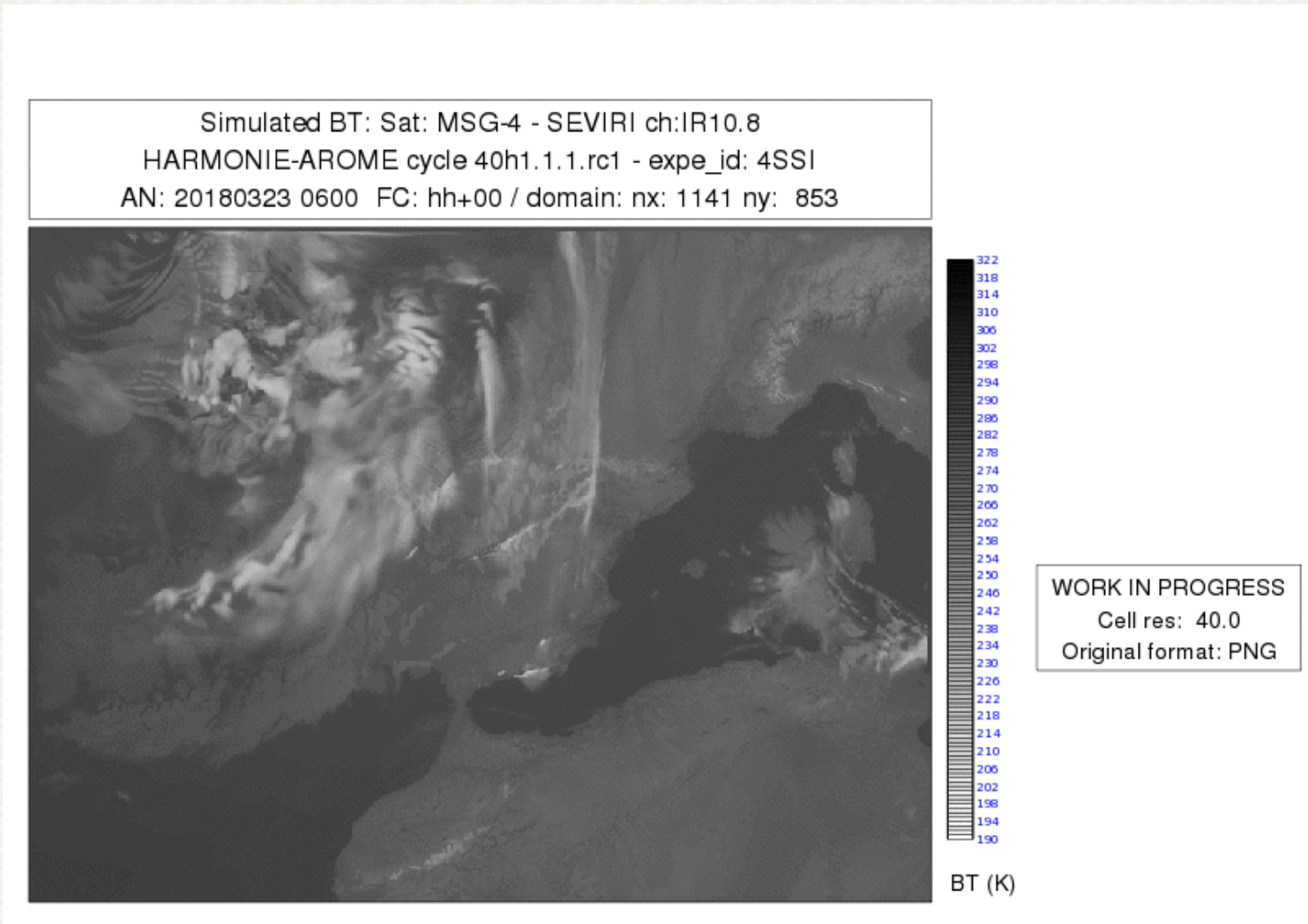
2. Tool: HARMONIE-AROME Sim. MSG-SEVIRI images

- Tool in development: the idea is to produce
 - Simulated Meteosat-11 images (MSG, SEVIRI).
 - From HARMONIE-AROME forecasts, using RTTOV.
- HARMONIE-AROME:
 - Detailed description of the atmosphere.
 - Default nominal horizontal resolution is 2.5 km – comparable to the horizontal resolution of the MSG satellites (3km at the SSP).
- RTTOV (software package: RT model + extras)
 - V12 can estimate BTs for the 12 SEVIRI channels.
 - But what is not in the model is not going to come out in the image!

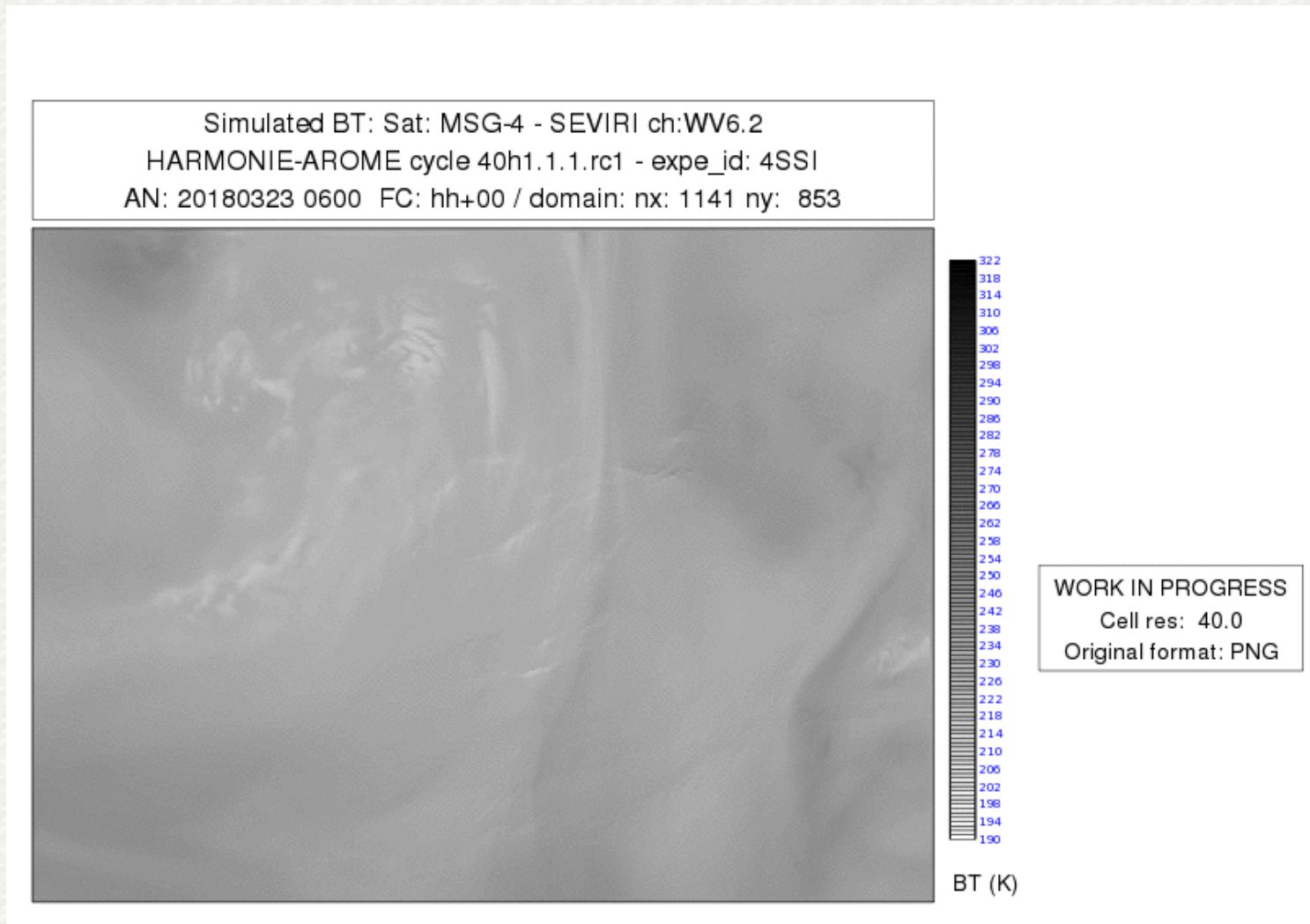
2. HARMONIE-AROME Simulated MSG SEVIRI Images.

- Tool in progress, using:
 - HARMONIE-AROME cycle 40h1.1.1.rc1 / RTTOV v 12.
 - MSG SEVIRI channels IR10.8 and WV6.2.
 - Model geometry.
- Next: HA/RTTOV simulation: loop hh+00, hh+01, ..., hh+24.
 - Storm Hugo last March.

2. HARMONIE-AROME Simulated MSG SEVIRI Images.



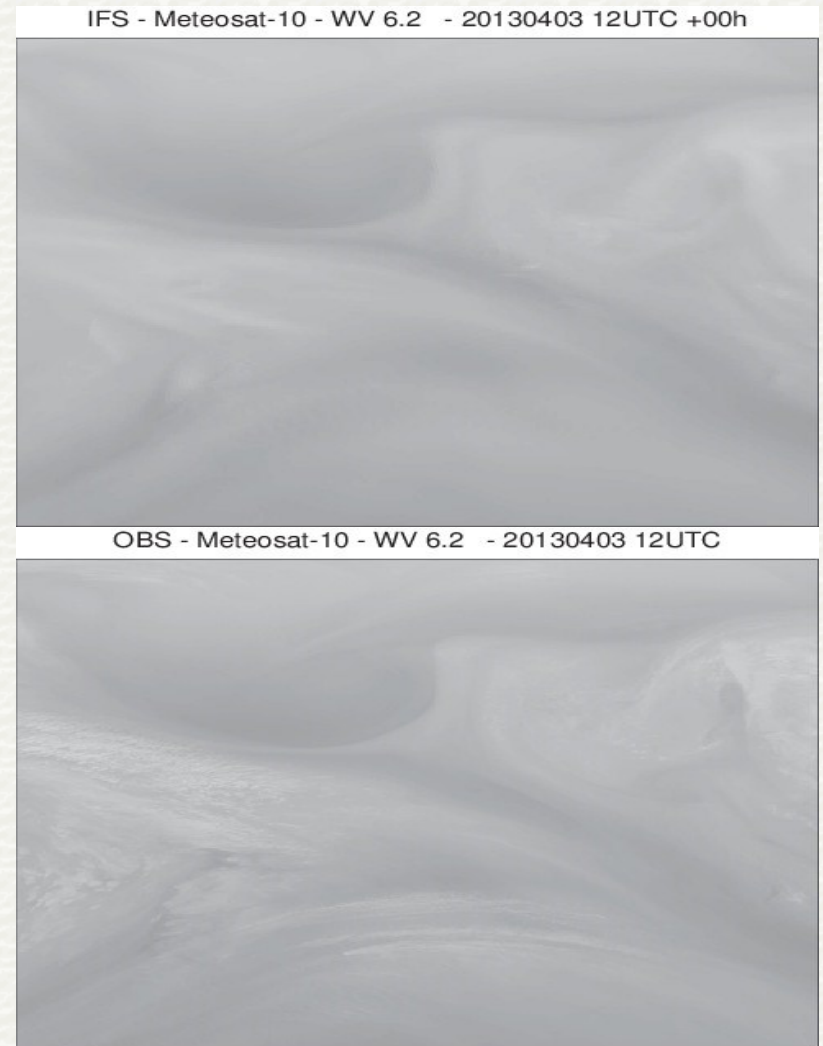
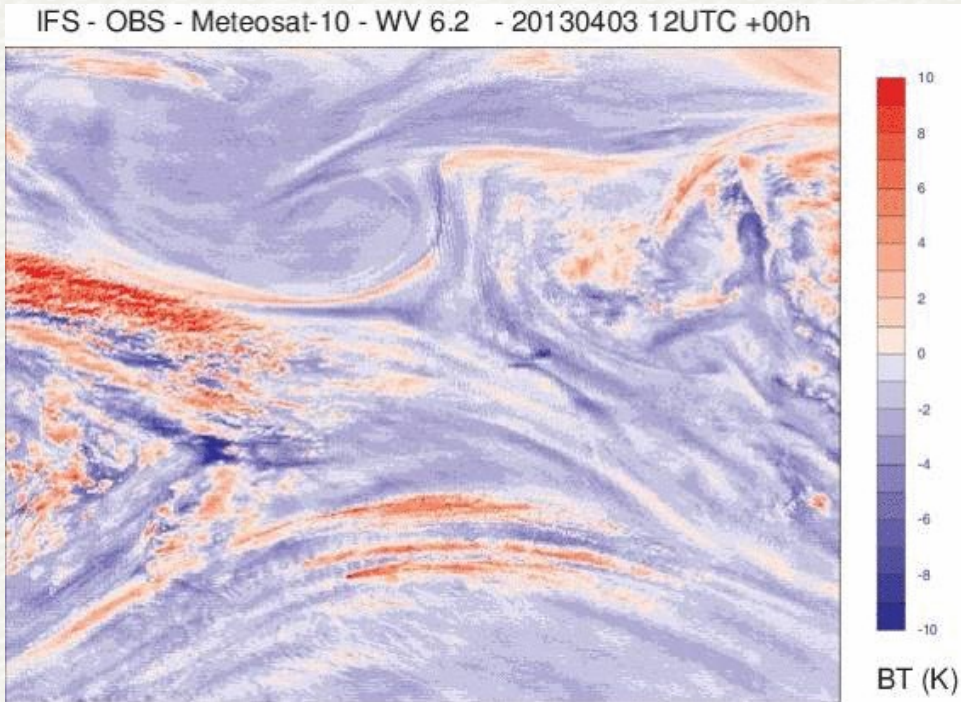
2. HARMONIE-AROME Simulated MSG SEVIRI Images.



3. Application areas: weather forecasting.

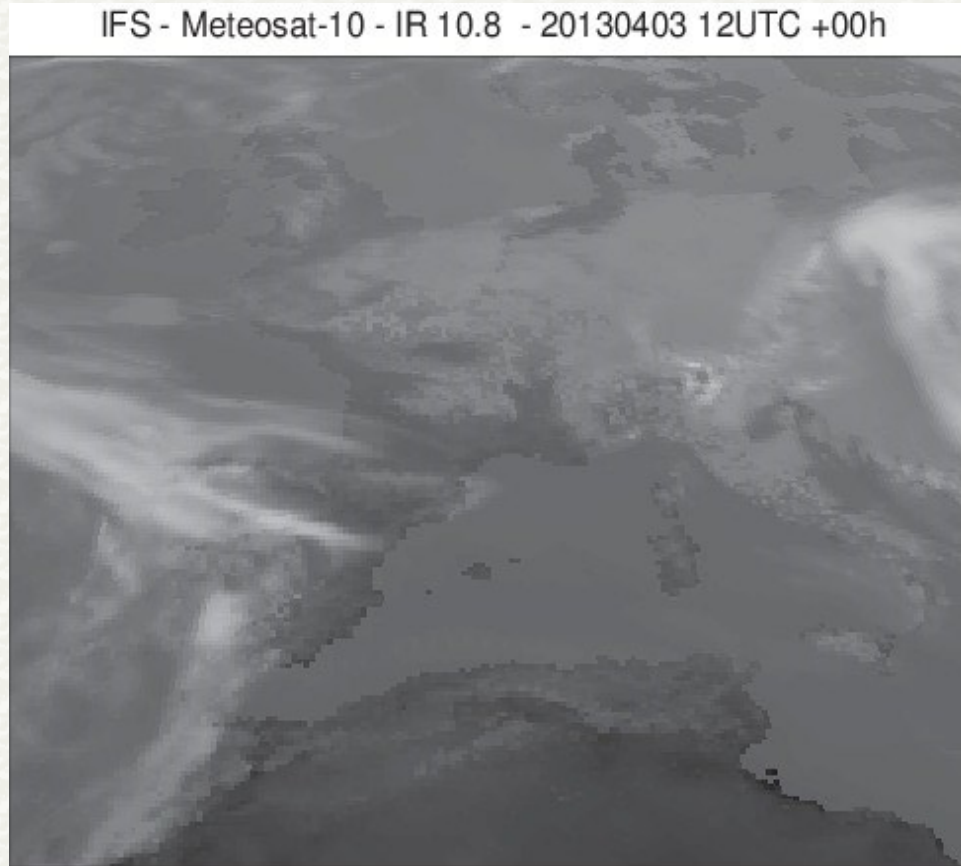
- Operational forecasting:
 - WV6.2 images often used as a snapshot of the state of the atmosphere.
 - Early assessment of the quality of an NWP analysis – compare SSI for AN or very short range vs. OBS.
- Also case studies.
- The difference image SSI – OBS highlights features not seen by the naked eye (often the case with WV images):
 - Both images must have the same geometry.
 - SSI must replicate a specific channel, e.g. WV6.2 on MSG.

3. Application areas: forecasting – example.



Red means: at high levels model feature is:
warmer / drier / lower height /
cloud cover is lower /
optical depth is lower.

3. Application areas: forecasting – example.



Just to show the area in the loop: Western Med.

3. Application areas: model development.

- Visual comparison - or diff SSI - OBS, as above.
- Objective comparison:
 - BT frequency distributions.
 - Effective horizontal resolutions.
 - Object-based methods.
 - Index-based methods.
- Overall assessment of the quality of a model / version.
 - Or specific aspects, e.g. cloud microphysics.
- Early times for objective comparison: many challenges...

4. SSI - tool in progress: plans for future work.

- Tool not yet there. Near future: something simple but sound to the trunk.
 - Thorough testing.
 - A couple of fixes needed.
 - Wiki documentation.
 - Simulated BTs in GRIB ed2 format – currently hijacking GRIB ed1.
 - Take into account position of satellite (currently as if every grid point was the nadir of the satellite).
 - Map to satellite geometry: BT in pixels (interpolation / nearest grid point).

4. SSI - tool in progress: plans for future work.

- Replace defaults with explicit estimates - e.g. surface emissivity - now left to RTTOV.
- Extend to other SEVIRI channels: VIS, WV7.3, IR12.0, ...
- Optimisation – computationally expensive application.
- Optional offline tool, to get SSI from archive?
- Optional extension above the top of HA with IFS?
- Optional extension with O3 from IFS?

Thanks to

ECMWF: Cristina Lupu, Iain Russell , ...

AEMET / NWP ++ : Alvaro Subias, Daniel Santos, Alberto Jimenez, ...

AEMET / EUMETSAT Nowcasting SAF: Miguel Angel Martinez

AEMET / Forecasters: Felisa Aguado, Olinda Carretero, Benito Elvira

Thank you for your attention

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Acronyms

- BT - Brightness Temperature.
- IR – Infra-Red.
- MSG - Meteosat Second Generation. MSG-4 (Meteosat-11) is the current EUMETSAT geo. sat. at 0 lon.
- RT - Radiative Transfer.
- RTTOV - Radiative transfer model (Radiative Transfer for TOVS, originally).
- SEVIRI - Spinning Enhanced Visible and Infrared Imager (instrument on MSG satellites).
- ToA - Top of Atmosphere.
- WV – Water Vapour.