LAPIS

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LABORATÓRIO DE ANÁLISE E PROCESSAMENTO DE IMAGENS DE SATÉLITES

USEFULNESS OF METEOSAT-9 INFORMATION FOR FOG TOP DETECTION IN BRAZIL: FIRST MEASUREMENTS

by

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3r WMO/WWRP International Symposium on Nowcasting
and Very Short Range Forecasting
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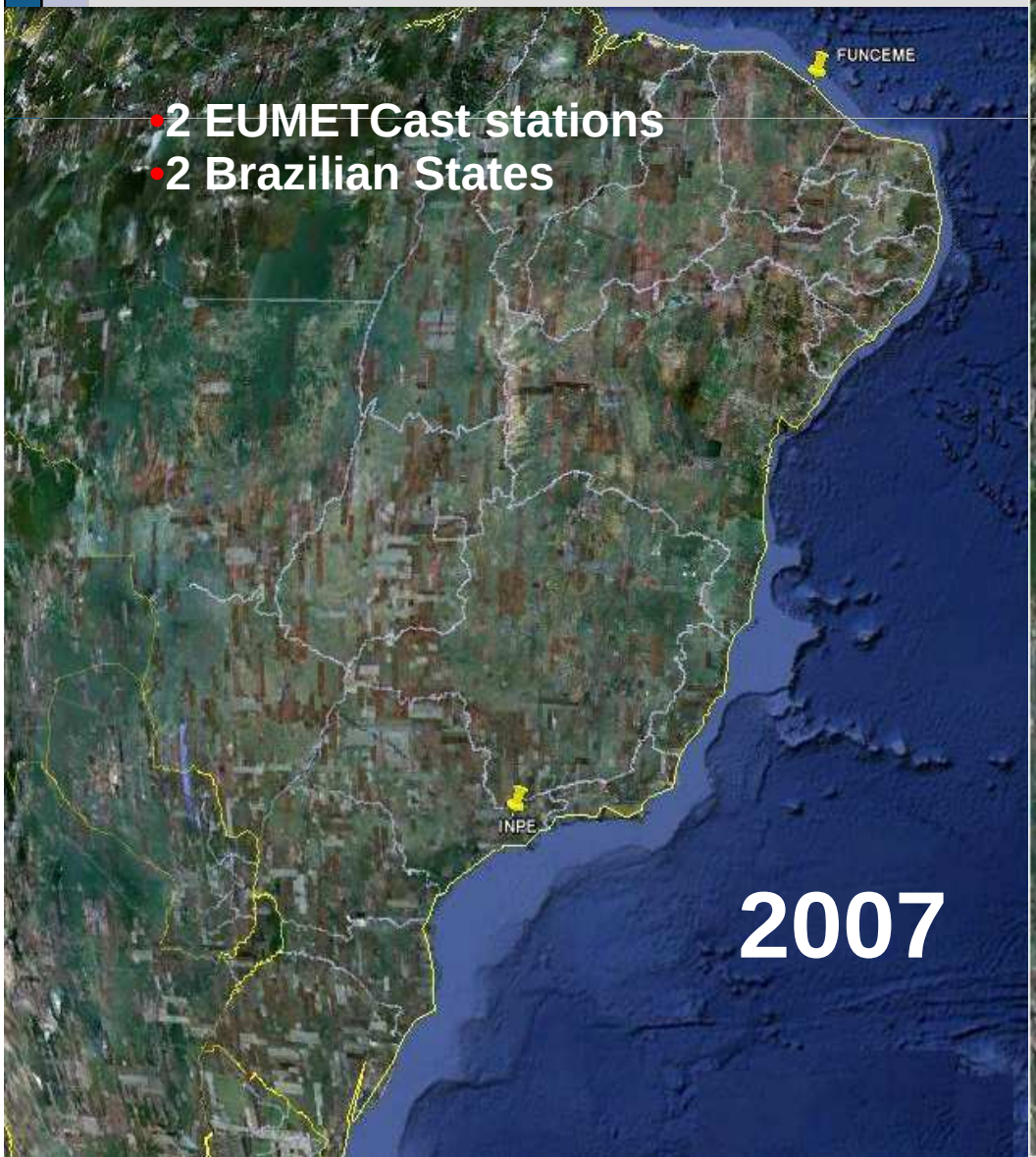
Centro de convenções - Bolsa do Rio de Janeiro, Rio de Janeiro

WSN 12
Rio de Janeiro - Brasil



- 2 EUMETCast stations
- 2 Brazilian States

- +50 EUMETCast stations
- 17 Brazilian States

Why are satellite data important for forecasts?

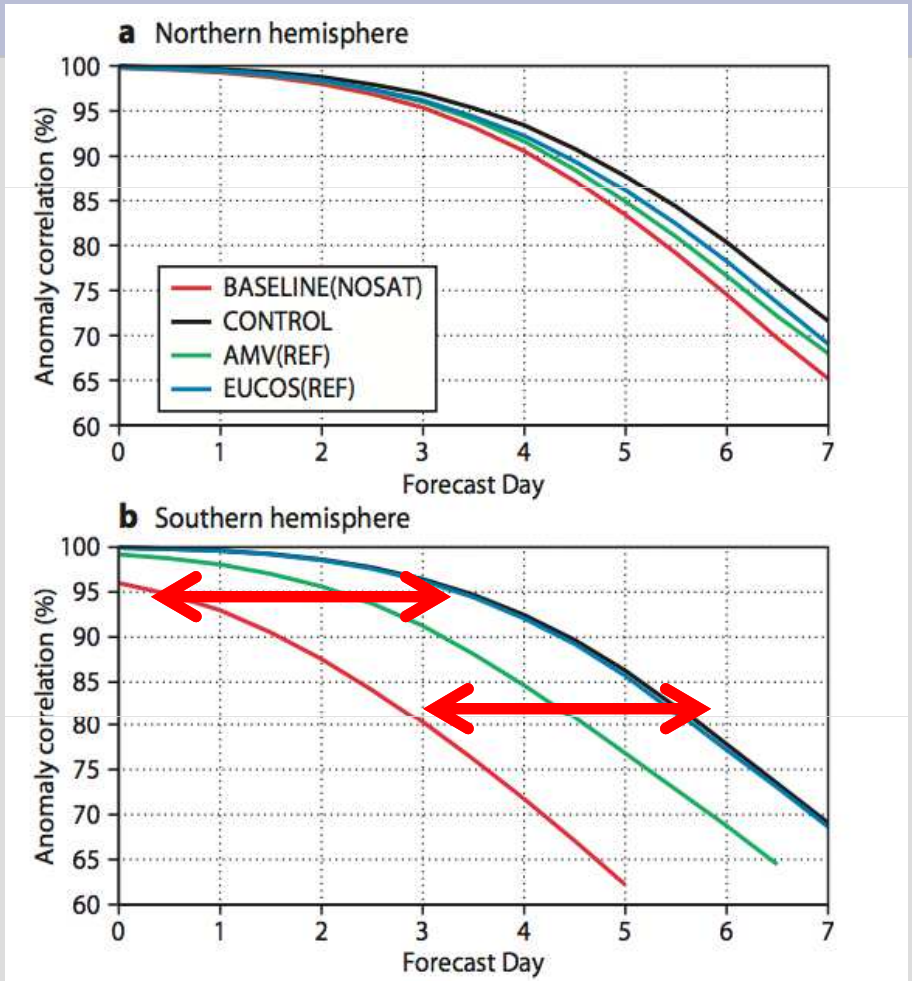


Figure 4 Comparison of *EUCOS(REF)* and *AMV(REF)* with *BASELINE (NOSAT)* and *CONTROL* for (a) northern hemisphere (20°–90°N) and (b) southern hemisphere (20°–90°S).

- Forecast skill strongly dependent on satellite data
- E.g. Southern hemisphere: Day 3-4 forecasts now as good as Day 1 forecasts without satellite data.

Source: Kelly and Thepaut, 207 ECMWF Newsletter 113

Land transportation

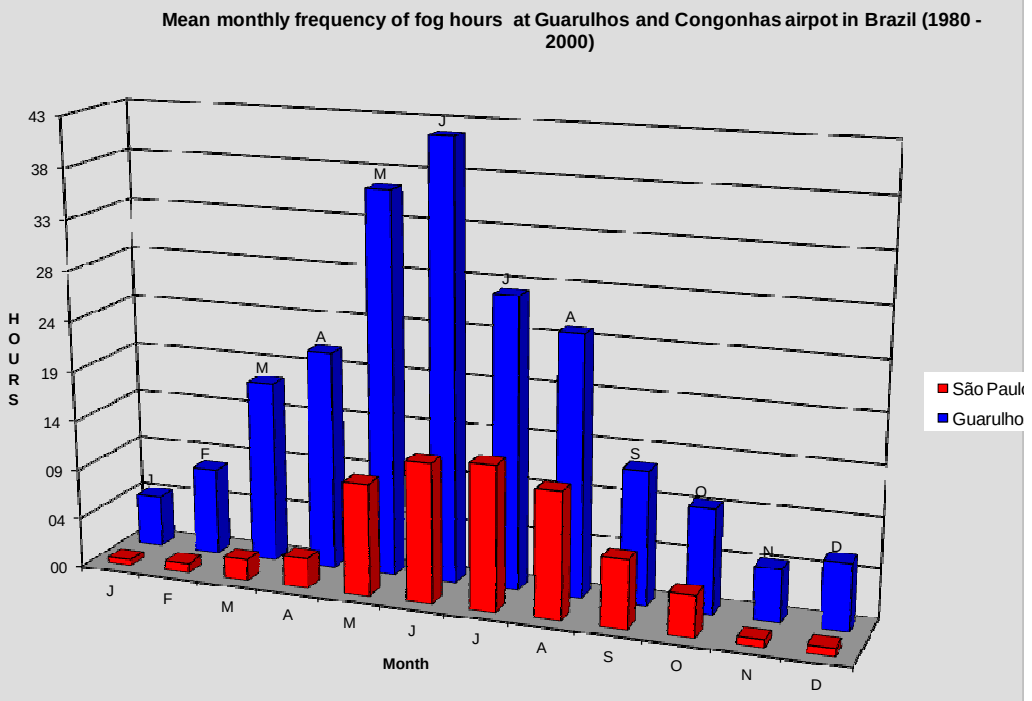
- collision in dense fog

Aviation

- Risk of collision with other aircraft

MOTIVATION: Fog event that occurred over the southeastern Brazil, on 15th September 2011.

Mean monthly frequency of fog's hours in GRU and Congonhas in SP



Research stages...

- Use MSG satellite imagery to identify and highlight potential areas of fog

- MSG “fog imagery” → Need early detection of shallow fog
- MSG “microphysics” would be helpful → Better cloud-top TB retrievals

In progress...

- Representative thermodynamic soundings for prediction of cloud/fog formation/clearance
- Local surface wind, humidity & temperature
- Very detailed cloud & visibility observations and forecasts required for aerodromes

Future...

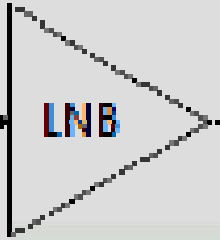
- Very accurate fog observations and nowcasts along major roads

Standard EUMETCast station

1) ANTENNA 2.4 m

3) Cable

4) PCI TV TechniSat SkyStar 2



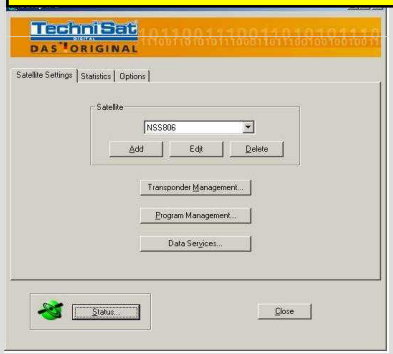
LNB

2) LNBF

Placa DVB

Receptor

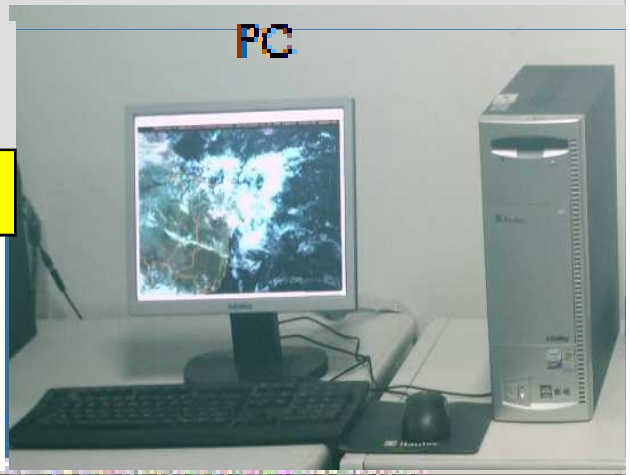
6) TelliCast Client



Software TelliCast
EUMETCast Key

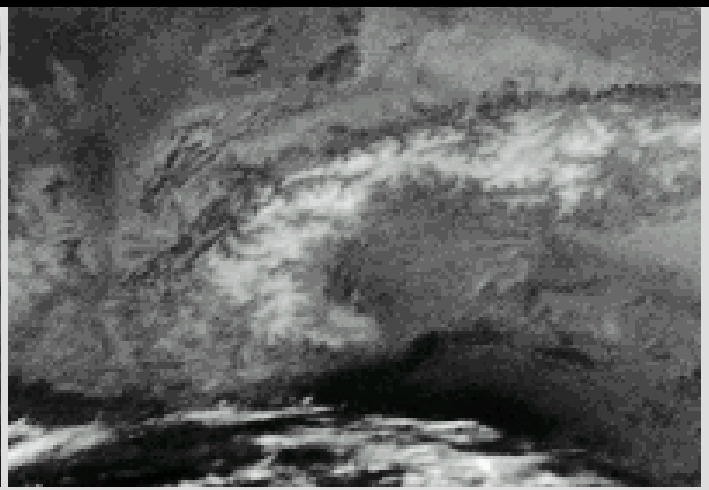
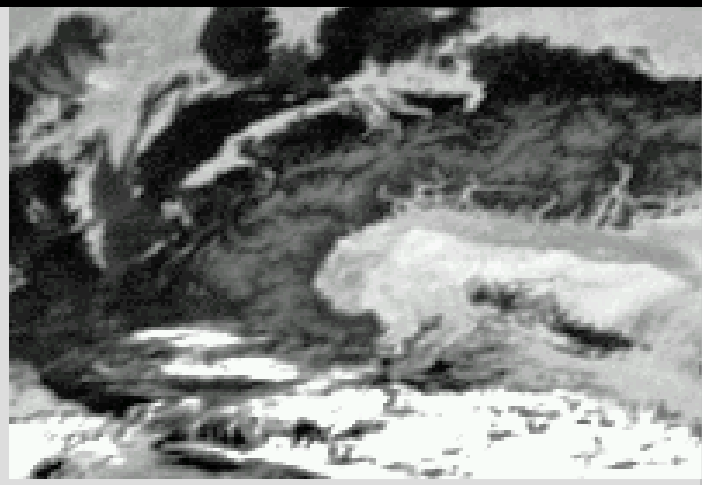
5) EKU (USB)

PC



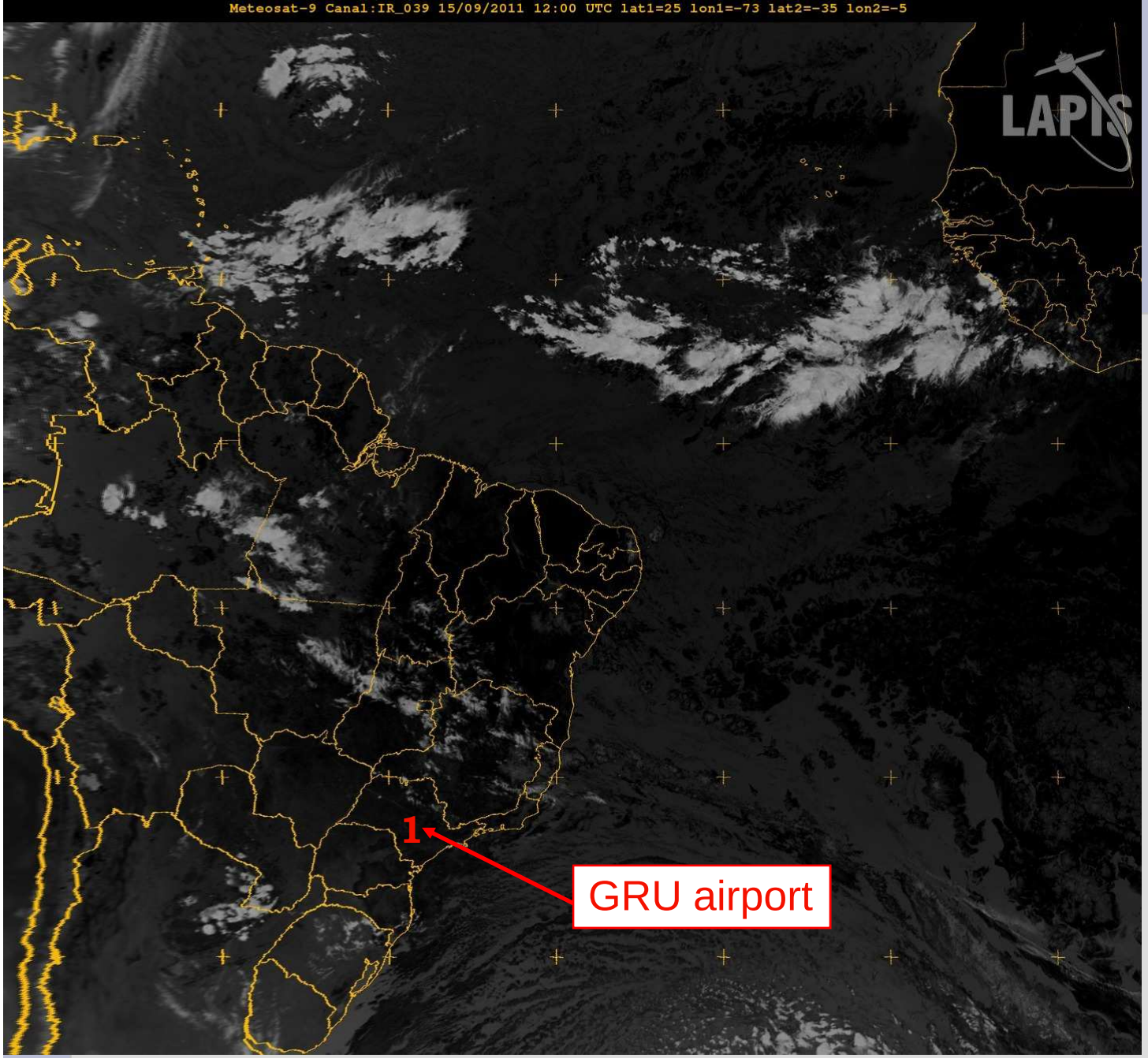
Supporting research

All we have to know is how to describe a fog object: its properties and its behaviors

MSG →	PROPERTIES →	IR3.9-IR10.8
		
Night **Fog darker than clear ground**	**Dawn** **Fog and clear ground equal**	**Day** **Fog brighter than clear ground**

Spectral feature of fog in multiple satellite channels

1. **Scattering radiation feature (Daytime)**
2. **Emitting radiation feature (Nighttime)**



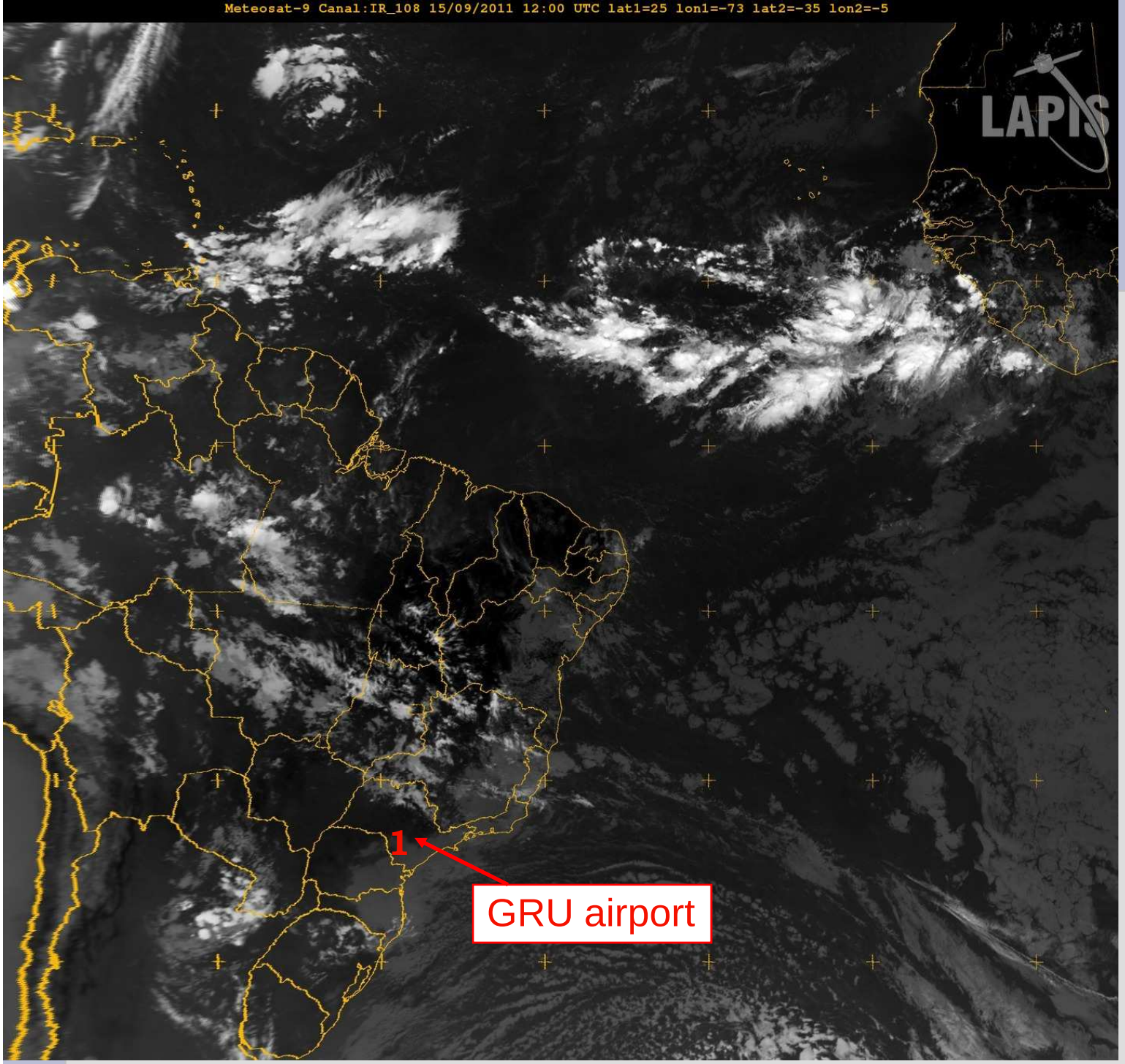
Day-time Fog

MSG-1
15 Sept. 2011
12:00 UTC
Channel 04
(IR 3.9)

1= low-level fog or stratus

Detection of fog during Night-time much better with IR3.9 channel

Detection of fog during day-time also good with solar component of IR3.9

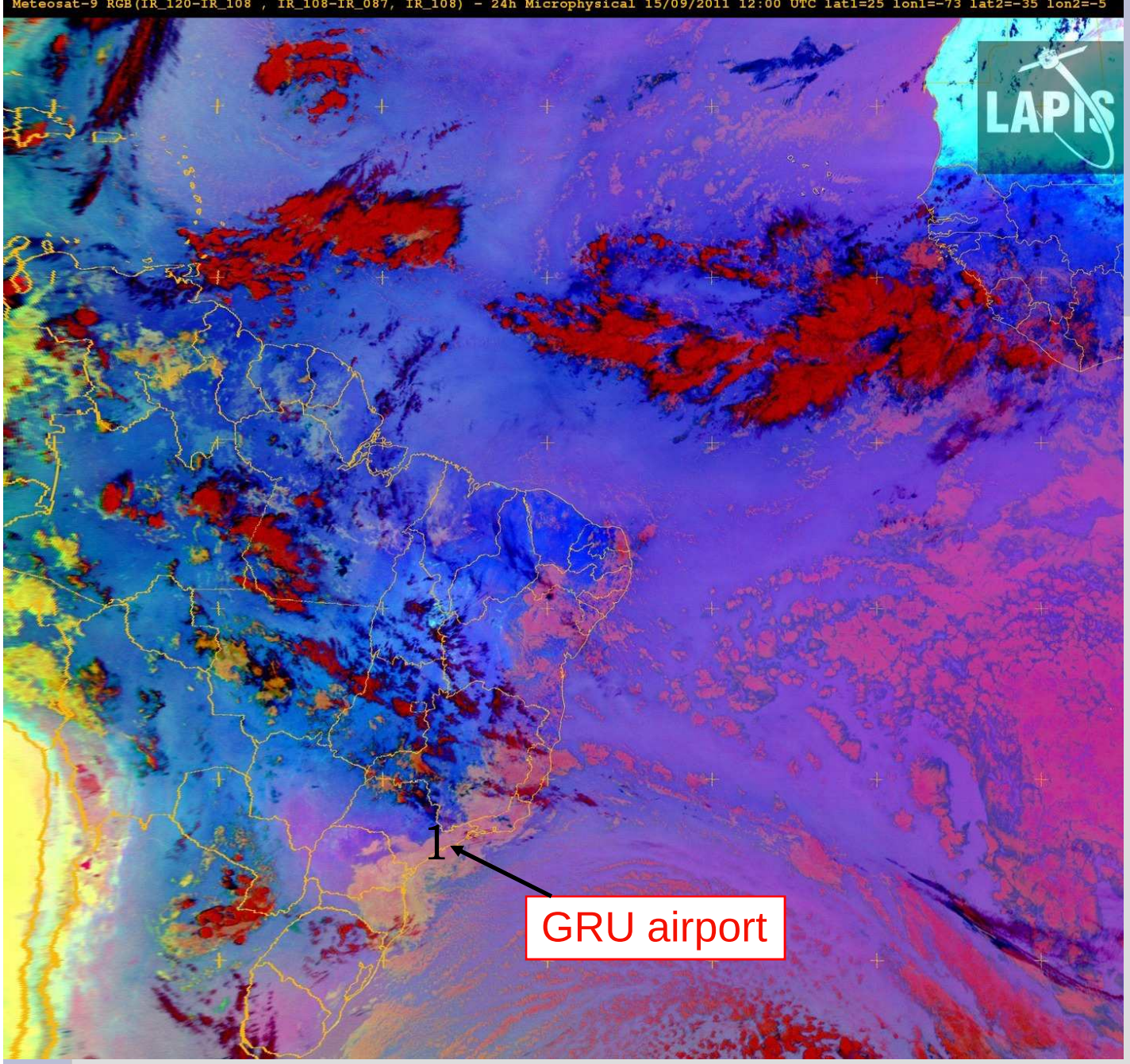


Day-time Fog

MSG-1
15 Sept. 2011
12:00 UTC
Channel 09
(IR10.8)

1= low-level fog or stratus

IR10.8 channel not very useful for fog detection



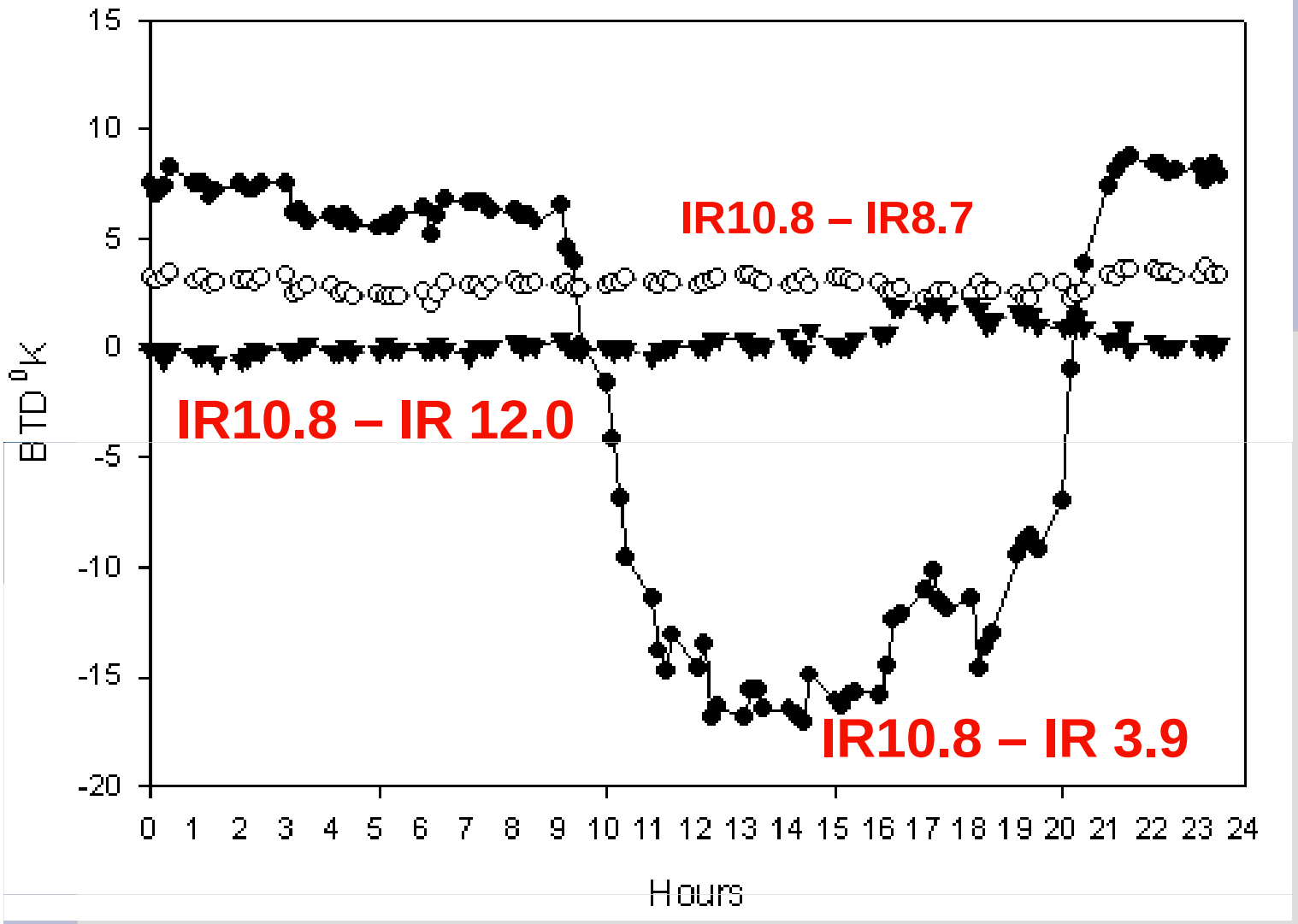
Day-time Fog

MSG-2
15 Sept. 2011
12:00 UTC
RGB Composite

R = IR12.0 - IR10.8
G = IR10.8 - IR3.9
B = IR10.8
Bluish colors

1= low-level fog or stratus

Detection of fog during day-time much better with RGB
Recommended RGB for Monitoring of Night-time Fog → Day-time Fog

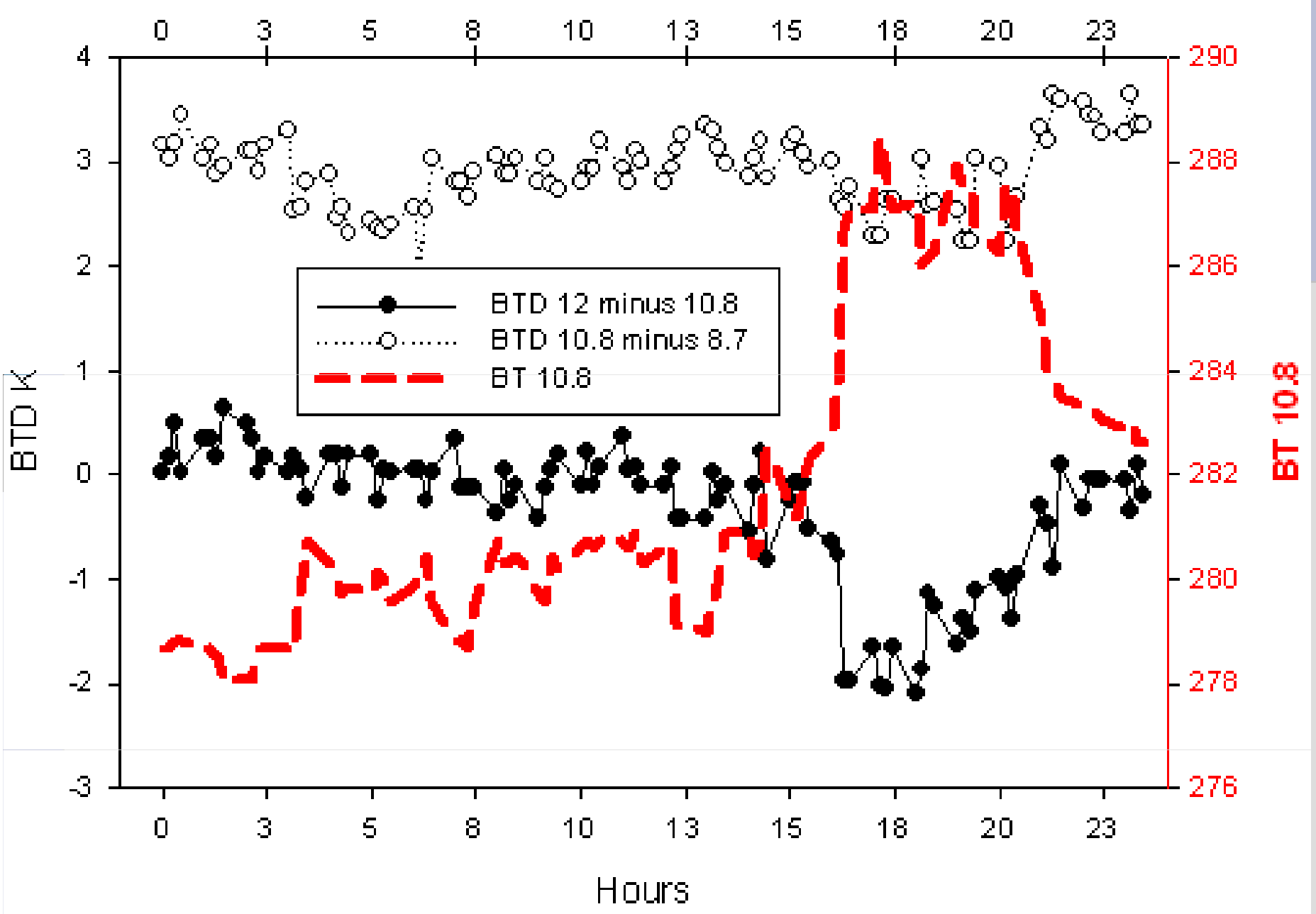


MSG-2
15 Sept. 2011
UTC (fog in morning)

...pixel at Guarulhos' airport in São Paulo, Brazil

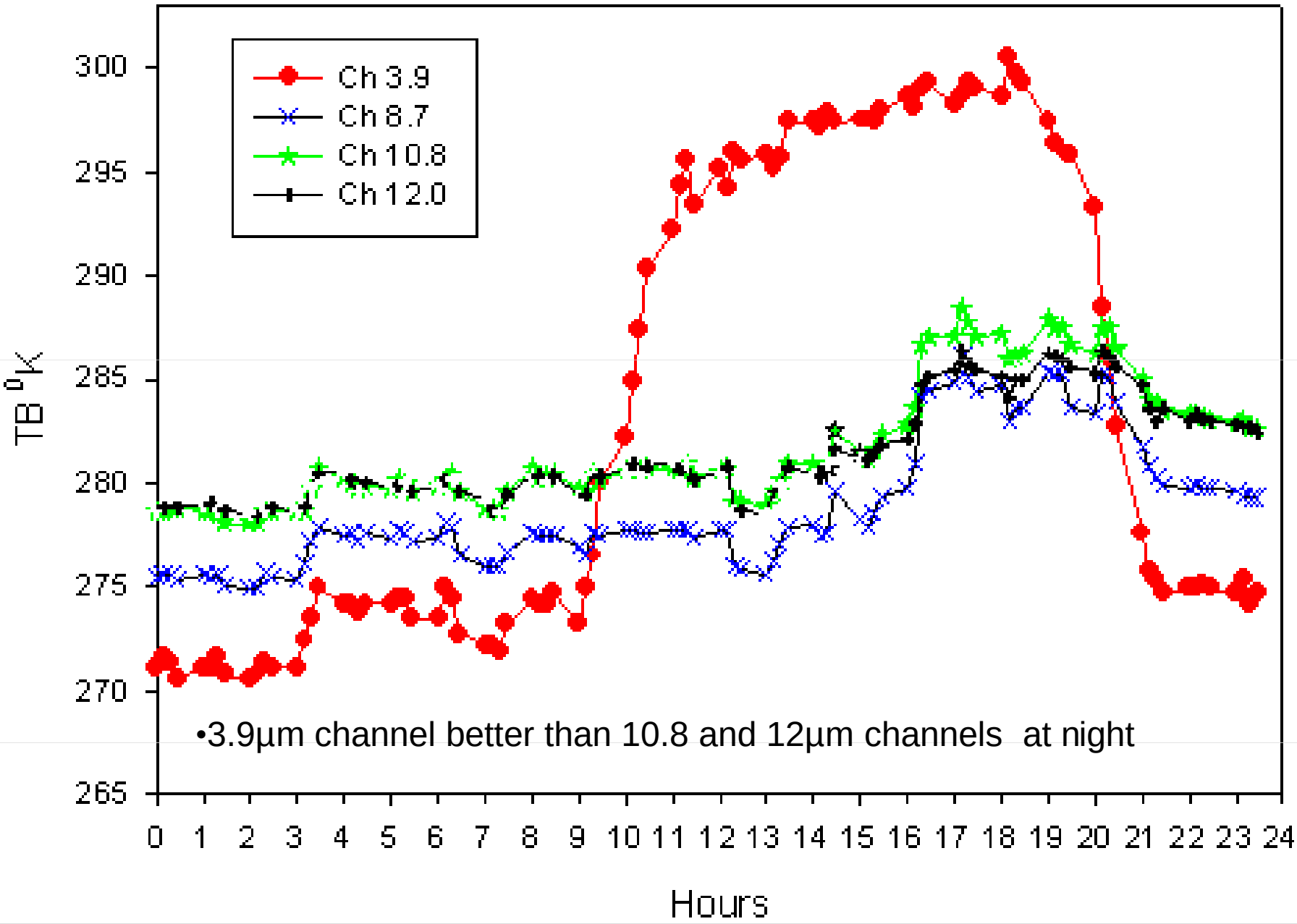
Brightness Temperature Difference (BTD)

- **IR10.8-IR3.9: fog detection difficult because of compensating effects (fog colder in IR3.9 than in IR10.8 because of lower emissivity, but reflection of solar radiation)**
- **IR10.8-IR8.7 and IR10.8-IR12.0 : only small difference between fog and clear ground**



- **IR10.8-IR8.7: fog +2/+3 K**
- **IR12.0-IR10.8: fog -0.5 K, clear ground around -2K**

… fog at night <u>not visible</u> in IR12.0-IR10.8 temperature difference images



MSG-2 15 Sept. 2011 (UTC)
...pixel at Guarulhos' airport in São Paulo, Brazil
Brightness Temperature Difference (BTD)

SUMMARY

In operational applications, the difference IR8.7-IR10.8 may be the best to detect fog/low stratus (day- and night), because of:

- Less noisy than the difference IR3.9 - IR10.8 (works well also over Brazil)
- 24-hour capability with "constant" colour for fog/low stratus (unlike IR3.9-IR10.8 difference)

CONCLUSION: The results suggest that fog tops were successfully detected over southeastern Brazil for 15th September 2010 by using RGB composite technique for three SEVIRI bands IR12, IR10.8, and IR8.7.

Limitations

The Fog Monitor's satellite display helps to highlight potential areas of fog, but in doing so, can also sometimes highlight areas mistaken for fog. These "false positive" results are often artifacts of how the satellite data is processed.

- **Low sun conditions**
- **Brightness Averaging at Feature Boundaries**
- **Brightness averaging between clouds and surface**
- **Brightness averaging of cloud shadows**
- **Sun Glint**

Thank you for your attention!

LAPIS

LABORATÓRIO DE ANÁLISE E PROCESSAMENTO DE IMAGENS DE SATÉLITES

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- Estação de Recepção

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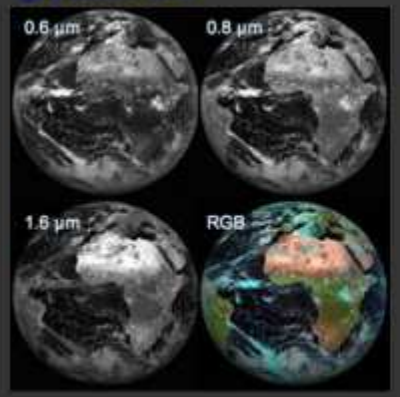
EUMETSAT



Lapis

Qui, 24 de Setembro de 2009 11:08

O **L**aboratório de **A**nálise e **P**rocessamento de **I**magens de **S**atélites (LAPIS) da Universidade Federal de Alagoas (UFAL) realiza atividades de pesquisa, assistência tecnológica e treinamento de recursos humanos para a recepção, processamento, interpretação e integração de imagens dos satélites da série METEOSAT. Para atender a essa demanda, em 2007 a UFAL instalou e operacionalizou a terceira estação de recepção de imagens do satélite METEOSAT Segunda Geração (MSG) do Brasil. Como atividades de pesquisa e transferência de conhecimento, a equipe do LAPIS elabora aplicativos para tratamento de imagens, disponibiliza produtos meteorológicos e ambientais derivados do MSG para setores operacionais e oferece treinamento na área. Desenvolvidas inteiramente com ferramentas open-source e freeware.

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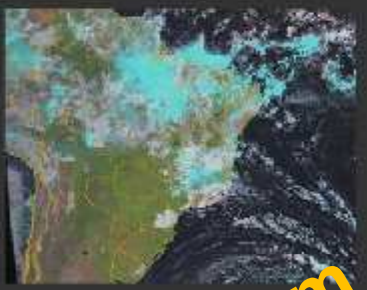
Eventos

- 2006
- 2007
- 2008
- 2009



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