Geo-satellite monitoring and Dust detection with IASI measurement in the weather forecast

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Plan

Geo-satellite monitoring

Dust detection in global data assimilation

- Aerosol dust specification
- IASI instrument
- Theory
- Results



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ECMWF Data Coverage (All obs DA) - GRAD 20/Feb/2015; 00 UTC Total number of obs = 437855

56326 Met7
175576 Met10
33108 MTSAT-2
76168 Goes15
96677 Goes13



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GEOS-13 : sensor lost from 23/05/2013 to 12/06/2013.



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Extending the autumn eclipse season for Met-7 (August to October for \triangleright time slot 11.00pm).



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> Manoeuvre time :

- ✓ Met-7 from 14/05/2013 to 20/05/2013.
- ✓ MTSAT-2 from 31/10/2013 to 27/01/2014, replace by MTSAT-1.
- ✓ MTSAT-2 from 06/11/2014 to 07/01/2015.
- Meteosat-10 decontamination :
 - ✓ 01/07/2013 to 15/07/2013.
 - ✓ 14/01/2014 to 27/01/2014.
 - ✓ 03/12/2014 to 15/12/2014



Conclusion

• Geo-satellite Monitoring :

- GOES 13, GOES 15, Meteosat 7, Meteosat 10 : no major change
- MTSAT 2 : every year between 2 and 3 months lost.

- Future satellite:
 - Replacement MTSAT 2 by HIMAWARI 8 (Summer 2015).
 - HIMAWARI 8 was launched 7th October 2014.



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Aerosol specification

• Definition : small particles (solid or liquid) suspended in the atmosphere

Different tropospheric aerosol kind

Natural sources (radius 1 to 10 µm) Sea salt Dust Volcanic ash



Quantity Desert Dust : 1500 10⁹ kg/year



Human sources Transformation gas-particle SO – NO Aitken kernel (nm) Fin mode (radius from 0.1 to 1 µm)







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Aerosol dust specification



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Aerosol specification





Aerosol dust specification : **Dust transport**



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Matricardi, 2005

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- Platforms :
 - Metop-A, launched 19th October 2006.
 - Metop-B, launched 17th September 2012.
 - Metop-C, will launch October 2018.
- Instruments on platform :

	GOME-2
□ ASCAT	🗖 AMSU-A
	AVHRR
GRAS	
A-DCS	SARSAT





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Theory : Collard tests

If cloud detect is TRUE, aerosol detect is operated: $Mean[\alpha_{\vartheta}(T_{\vartheta}^{obs} - T_{\vartheta}^{mod})] \ge \beta \Rightarrow aerosol detected$



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Theory

Peyridieux 2010: aerosol can be detect in infrared by Brightness Difference Temperature (BTD).

ECMWF : new dust detection on all pixels:

✓ 2 Brightness Temperature Differences (BTDs):

- > TB(8.143 μm)-TB(11.848 μm) = BTD1
- > TB(9.304 μm)-TB(11.478 μm) = BTD2
- ✓ TB(X µm) =mean[TB(643.5+0.25X µm);TB(646+0.25X µm)] (11 measurements)

IF BTD1 < 0.2 AND BTD2 < -1.7, PIXEL DECLEARS DUST



(Met-10 : 7.3, 8.7, 9.7, 10.8, 12 μ m could be used)



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Results : MODIS AOD



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Green Dot : pixel clear Red Dot : pixel aerosol

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Results : MACC AOD





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Results : MODIS AOD



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Diff on Z500 between CTRL and w/o IASI May 2014 -100 -15 20 50 100 160°W 20°E 60°E 140°W 120°W 100°W 60°W 40°W 20°W 0°E 40°E 80°E 100°E 120°E 140°E 160°E 80°W S Ì The second Ð 000 ~





80°N

70°N

60°N

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80°N

70°N

60°N

Diff on Z500 between New test and w/o IASI May 2014







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Results : Neutral impact except for some extreme events







Results : Neutral impact in forecast







New dust detect for IASI :

– Improvement the detection :

- Extreme events (East Atlantic Ocean).
- Small concentration (Caribbean Sea, Mediterranean Sea).

 Neutral impact on the forecast but improvement for some extreme events.



Summary

- Geo-satellite Monitoring :
 - GOES 13, GOES 15, Meteosat 7, Meteosat 10 : no major change
 - MTSAT 2 : every year between 2 and 3 months lost.
- Aerosol detection in Infrared :
 - Improvement the detection.
 - Neutral impact on the forecast but improvement for some extreme events.



Future

- Geo-satellite :
 - Monitoring for 5 geo-satellites.
 - Replacement MTSAT 2 by HIMAWARI 8 (Summer 2015).
- Aerosol detection in Infrared :
 - Dust detection will be applied to other Infrared instruments.
 - Try to detect other kind of aerosol, for example : volcanic ashes.



Questions ?

