

Evaluation of the benefits of assimilating IASI-NG radiances for ozone in a Chemistry-Transport Model

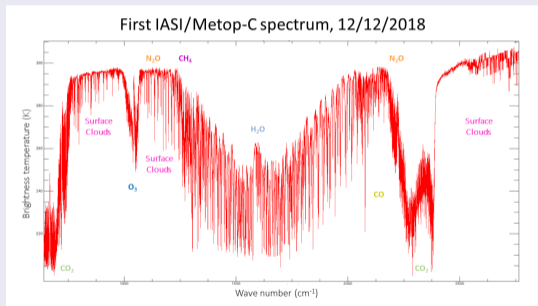
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CNRM - Météo-France

23 Sept. 2022

IASI measures radiation at the top of the atmosphere, with 8461 wavelengths.

IASI Spectral Band



From EUMETSAT

This wavelengths are sensitive to :

- Chemical Species (O_3 ; CO_2 , CO)
- Aerosol
- Climatic Variables (Surface Temperature; Humidity)

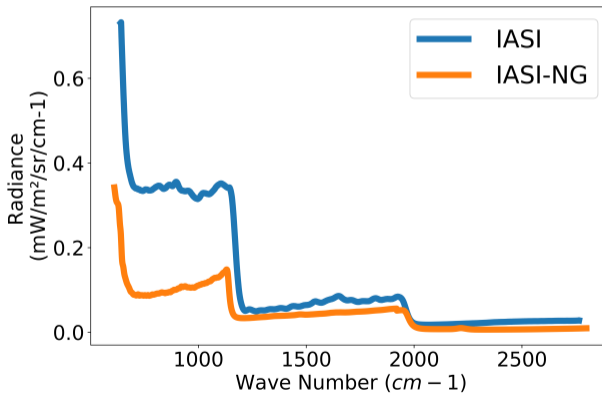
IASI's mission is about to end.

IASI-NG will be launched in 2024 on Metop-SG satellites.

Characteristics

	IASI	IASI-NG
Wavelength (cm^{-1})	[645 ; 2645]	Same
Channel Number	8 461	16 921
Spectral Sampling (cm^{-1})	0.25	0.125

Instrumental Noise



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- 1 Introduction
- 2 Simulation of IASI and IASI-NG
 - OSSE
 - Results
- 3 Impact of Number of Channel Assimilated
- 4 Conclusion

OSSE

We want to assimilate Radiance for Ozone in an hourly 3D-Var Method; on the month of June 2019

- Nature Run (NR) :
 - Represents our true state
 - Assimilation of 34 IASI Ozone Channels
- Control Run (CR) :
 - No Data assimilation
 - Different Emissions than NR

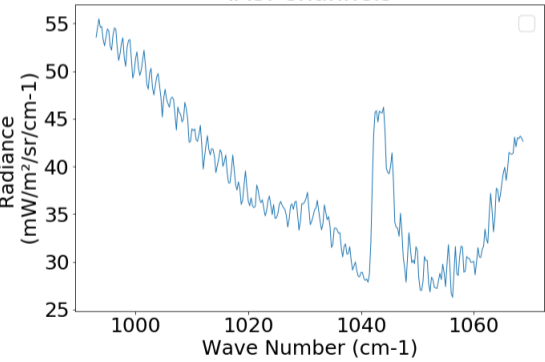
Assimilation Run

Assimilation, with CR configuration, of Observations simulated from the NR. For IASI and IASI-NG

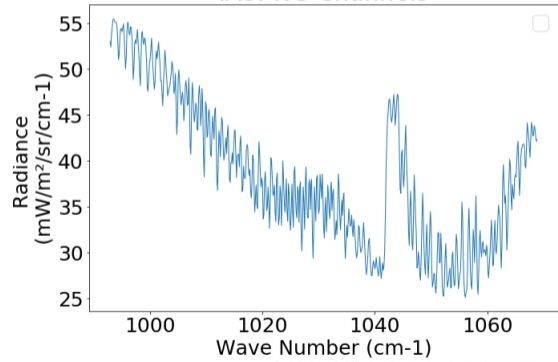
- ① Simulation of Observations, from NR using RTTOV
- ② Add the Instrumental Noise
- ③ Assimilate the Simulated Observations with noise in the CR space
- ④ Using a Diagnostics R Matrix for the assimilation

Exemple of simulated spectra

IASI Channels

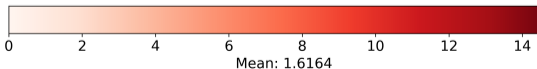
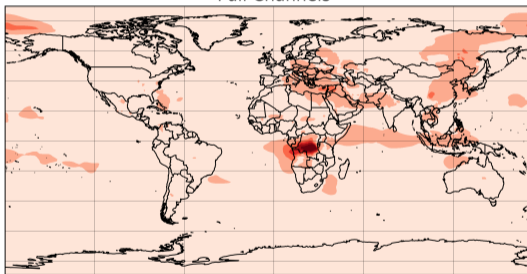


IASI-NG Channels

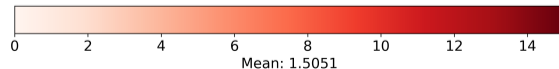
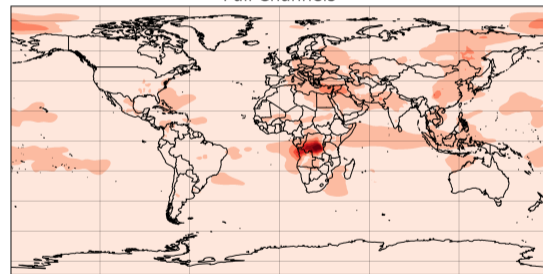


Score RMSE Total Ozone Column (*DU*)

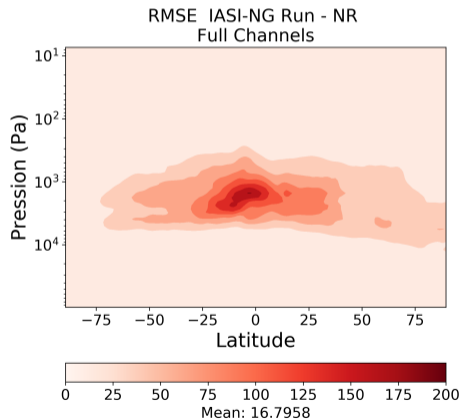
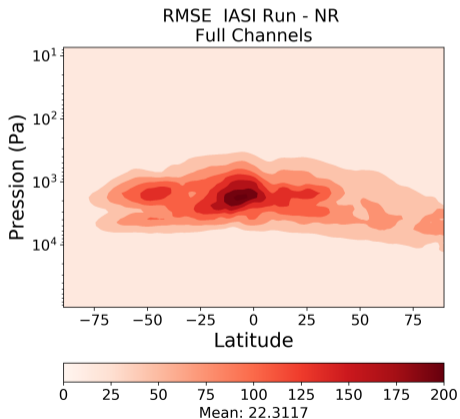
RMSE Ozone Column IASI Run - NR
Full Channels



RMSE Ozone Column IASI-NG Run - NR
Full Channels

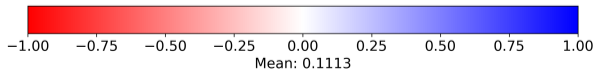
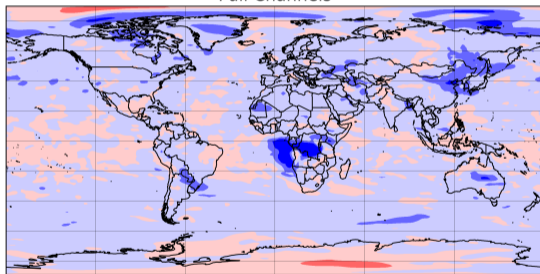


Score RMSE Vertical Section (ppbv)

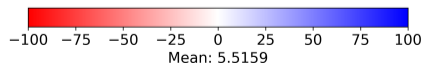
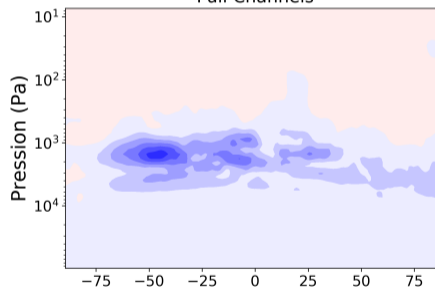


Comparison Score RMSE

Difference RMSE Ozone Column (IASI Run - IASI-NG Run)
Full Channels



Difference RMSE (IASI Run - IASI-NG Run)
Full Channels



Computing Time

Computing time for One Day :

- IASI 304 Channels : 2 hours elapsed time on 8 nodes
- IASI-NG 609 Channels : 4 hours elapsed time on 8 nodes

Comments

- IASI-NG provides better scores than IASI
- IASI assimilation is faster because we assimilate less channels than for IASI-NG.
- To reduce the assimilation time we decided to reduce the number of channels.

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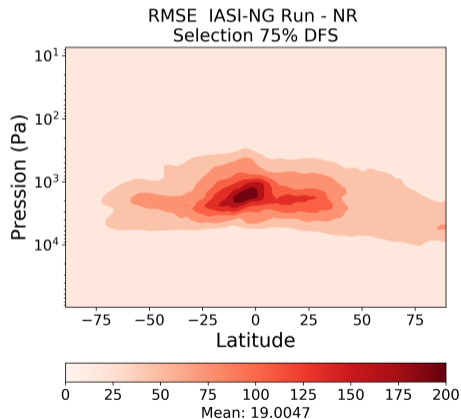
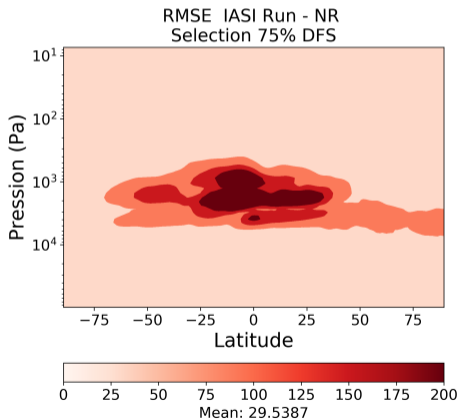
- 1 Introduction
- 2 Simulation of IASI and IASI-NG
- 3 Impact of Number of Channel Assimilated**
 - Selections
 - Comparison
- 4 Conclusion

We make a channel selection from the previous selection for IASI and IASI-NG. Based on the Degree of Freedom for Signal.

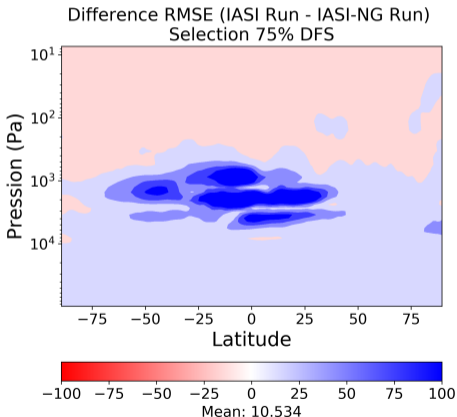
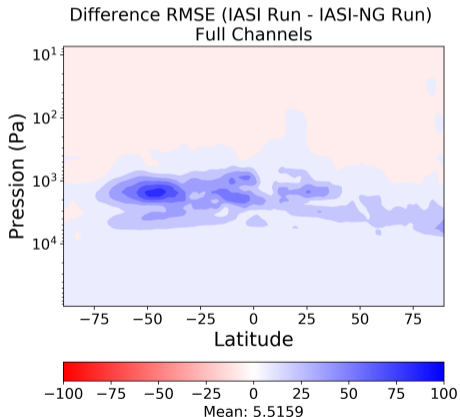
First we classify Channels with their impact on the DFS of Ozone

Instrument	Full DFS	Number of Channel for DFS 75 %	75% DFS
IASI	0.976	70	0.732
IASI-NG	1.980	90	1.485

Score RMSE Vertical Section (ppbv) Selection Runs



Comparison Score RMSE (ppbv) Ozone Column



Mean on the Field of RMSE Score

Selection	IASI	IASI-NG	Gain (Percent)
Full	22.312	16.796	24.7
75 % DFS	29.539	19.005	35.6

Computing Time (hour)

Selection	IASI	IASI-NG
Full	2 :00	4 :00
75 % DFS	1 :15	2 :45

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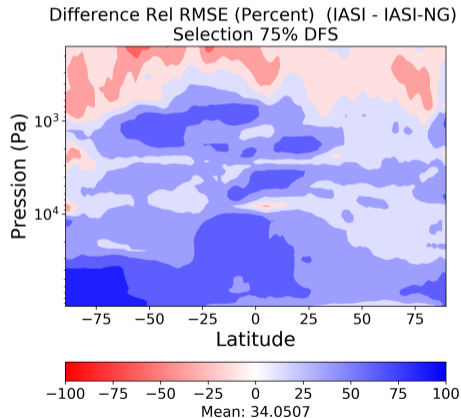
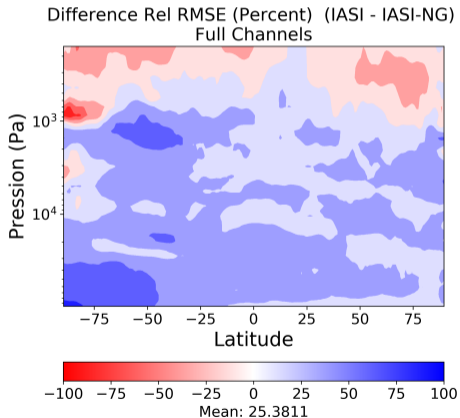
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- IASI-NG Radiances will be assimilated for Ozone
- IASI-NG will improve the quality of Ozone Analysis compare to IASI
- It will be possible to chose a little number of Channel to reduce the computing time

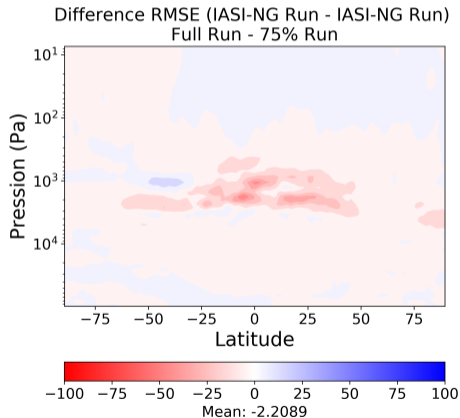
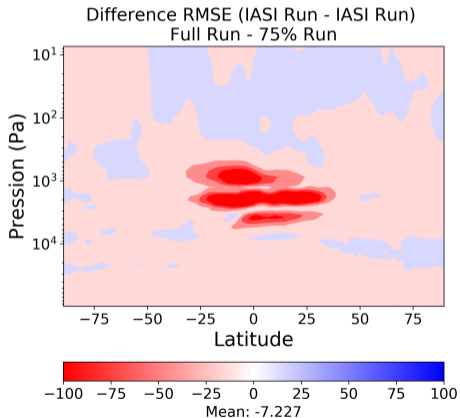
The Next step is to extend to more species as CO or some aerosols

Thank You For Your Attention
Some Questions ?

Relative Difference



Difference



Relative Difference

