IASI-NG

- The IASI heritage and the EU context
- What do we lack for tropospheric chemistry ?
- The IASI-NG mission

Cathy Clerbaux (LATMOS), Cyril Crevoisier (LMD), P. Coheur (ULB), Th Phulpin (CNES), and more

Spatial component of GMES: Five Sentinels



International coordination: GEO Atmospheric Composition Constellation

EU Componant = GMES

Current and future missions



VERY HIGH	HIGH	MEDIUM		
IRS (High resolution Infrared sounding)	MWI (micro-wave imaging)	UVNS - Provided by GMES as Sentinel-5		
MWS (Microwave sounding)	RO (radio-occultation)	3MI - Focus on aerosol		
VII (Vis-IR imaging)		DWL (Dopler wind lidar)		
SCA (Scatterometry)				

IASI climate and chemistry products





7 years (Apr. 2003-Aug. 2009) of monthly averaged mid-to-upper tropospheric CO_2 integrated content are available from AIRS (until July 2007) and then IASI.



Need to decorrelate T/CO₂ (or T/CH₄)
 ⇒ Use of AMSU obs (independent info on T).

•Easier to do in the tropics \Rightarrow better precision.

•We retrieve a mid-to-upper tropospheric content:

~"one degree of freedom".

~boundary layer not measured.

•Simultaneous retrieval of CO₂ and CH₄ with IASI: study of correlations (eg: biomass burnings)



[Crevois Fathy SlerbauxP, January, 2810, IASP00

Carbon monoxide total column



Cathy Clerbaux, January 2010, IASI con George et al., ACP, 2009

Greek fires, August 2007





Turquety et al, ACP IASI Special Issue, 2009 Coheur et al., ACP IASI Special Issue, 2009









First global mapping of ammonia using the IASI space sounder (July 2009)

JULY 2009 VOL 2 NO 7

SEA-LEVEL RISE Spatially variable

MISSISSIPPI DROWNING Deficit of sediments

SUSTAINING BLACK SMOKERS Ongoing magma intrusion

nature

eoscienc

Ammonia hotspots revealed from space

Clarisse et al., Nature Geo, 2009



IASI/METOP – Operational applications (GMES)

Pollution forecast





Ozone alerts

Fire detection





Long-range pollution

Volcanic plumes





Aviation thread

What do we need for climate-chemistry studies ?







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Long term stability

Temporal coverage + PM orbit Increase the detection limits



Better vertical resolution

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Improved sensitivity near the surface

Taking the assumption of a IASI-type of instrument, we can change pixel size, **spectral resolution, radiometric noise**

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What do we need for climate-chemistry studies ?









Long term stability

Temporal coverage + PM orbit Increase the detection limits





Better accuracy

Better vertical resolution

Improved sensitivity near the surface

Taking the assumption of a IASI-type of instrument, we can change pixel size, **spectral resolution, radiometric noise**

Current and future missions



What if [spectral resolution+ S/N] twice better than IASI (IASI-NG)?

Spectral resolution/Radiometric noise



MOPD /NEDT (of 280K blackbody)

 IRS-MTG
 IASI
 IASI-NG

 0.8 cm /0.20 K
 2.0 cm /0.10 K
 4.0 cm /0.05 K

Spectral resolution/Radiometric noise

MOPD=0.8 cm MOPD = 2.0 cm MOPD = 4.0 cm





Example : estimation of CO_2 in the 15 µm band



Spectral requirements and NeDT values for TIR LEO sounder

Band	Application ^a	Spectral range (cm ⁻¹) ^a	Species	Priority	Spectral resolution (cm ⁻¹) G/B/T		NeDT (K @ 280K) G/B/T
					Unapodised	βď	Unapodised
1	AC	650-750	C ₂ H ₂ , HCN	3	0.15/0.225/0.30	1.06	0.07/0.14/0.25
2	AC	750-850	PAN (HONO, C_2H_6 , NH_3 , CFC11)	2	0.15/0.225/0.30	1.07	0.07/0.14/0.25
3	AC	850-920	HNO ₃ (NH ₃ , CFC11)	2	0.075/0.15/0.30	1.09	0.07/0.14/0.25
4	AC, AQ	920-980	NH ₃ , C ₂ H ₄ (CFC12)	1	0.075/0.15/0.30	1.10	0.07/0.14/0.25
5	AC, AQ, C, OP	980-1080	O₃, CH₃OH (NH ₃)	1	0.075/0.15/0.30	1.12	0.07/0.14/0.25
6	AC, C	1080-1130	HCOOH (SO ₂ , NH ₃ , CFC12)	2	0.15/0.225/0.30	1.13	0.07/0.14/0.25
7	AC, AQ	1130-1200	SO₂ <i>PBL-FT</i> (PAN, NH ₃ , CFC12)	3	0.15/0.225/0.30	1.15	0.07/0.14/0.25
8	AC, C	1200-1350	$\mathbf{CH}_{4}, \mathbf{H}_{2}\mathbf{O}^{b}$ (N ₂ O, HNO ₃ , SO ₂ -UT)	2	0.15/0.225/0.30	1.18	0.07/0.14/0.25
9	AC	1350-1400	SO₂-UT (H ₂ O)	2	0.15/0.225/0.30	1.20	0.07/0.14/0.25
10	AQ, OP, AC	2050-2250	СО	1	0.075/0.15/0.30	1.44	0.07/0.14/0.25
11	AC, C	> 2700	CH ₄	3	0.15/0.225/0.30	1.67	0.14/0.25/0.3

^a AC: Atmospheric Composition, AQ: AirQuality; OP: Operational application; C: Climate

Endorsed by ESA and Eumetsat



SEMINAIRE DE PROSPECTIVE SCIENTIFIQUE 2009 APPEL A IDEES

INTITULE DU PROJET

IASI-NG

(Infrared Atmospheric Sounding Interferometer Nouvelle Génération)

Cyril Crevoisier (LMD), Cathy Clerbaux (LATMOS)

Now a « science team » has been set up and phase A industrial studies are launched

IASI is a great instrument for chemistry and climate studies, that provides global/local distributions for a series of species in near real time. Profile retrieval is still limited.

Sensitivity studies have shown that a better spectral resolution and S/N (« IASIx2 ») would improve vertical resolution + species detection limits + accuracy. Most of the improvement is located in the BL;

Convergence for the instrumental requirements from ESA/sentinels and Eumetsat/postEPS;

The IASI-NG concept is supported by CNES