

# Low troposphere monitoring with TRAQ mission.

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## Low troposphere monitoring with TRAQ Mission

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#### **Air Quality Monitoring from space**

• With state-d-the-art techniques some key species like NO<sub>2</sub> or SO<sub>2</sub> are well retrieved from UV-VIS ensors, but there is still some disagreement between products. The O<sub>2</sub> estimate is good in the stratesphere but not fully satisfactory in the troposphere. Some promising results have been obtained with TES. OO is retrieved with good precision by MOPITT. First encouraging results for Oa and CH<sub>2</sub> over land have been presented by SCIAMACHY. Simulations indicate promising results from IASI. However trace gas retrieval are far from being operational in the troposphere. Studies to define proper tropospheric missions are slow to converge. There are noticeable differences between the requirements of CAPACITY, MTG and IGAC.
• Techniques must be improved to provide parameters with adequate revisit and vertical resolution.

ss to low tropospheric trace gases and micro-particles has to be proved

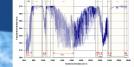
#### IASI FIRST LESSONS

ASI is a FTIR spectrometer devoted to operational atmospheric sounding to be flown on the fetOp series (European polar meteorological satellities) from 2006 to 2020.

ASI will deliver atmospheric spectra from 655 cm<sup>-1</sup> to 2760 cm<sup>-1</sup> with 0.25 cm<sup>-1</sup> spectral sampling.

he instrument was designed by CNES and manufactured by Alcatel, with co-funding from CNES





On this basis, CNES designed a new generation infrared instrument : SIFTI

SIFTI

High revisit frequency: typically every two hours during daytime

Low troposphere profiles : Access to primary pollutants in the BL , specially NO $_{\rm x}$  SO $_{\rm x}$  CO, VOcs and O $_{\rm 3}$ 

Micro-particles: PM10, PM2.5 or total burden

### LOW ORBITS WITH HIGH REVISIT OVER MID-LATITUDES

Several types of orbits were studied : GEO, MEO, Molnya, LEO The ones offering the best trade-off to afford a revisit of 2 hours is a phased inclined orbit already studied at CNES for :

JASON: The orbit is a 1200 km, inclined at 66°, 10-day phased orbit TROC: A dedicated orbit was studied for TROC (proposal to ESA Earth Explore

Technical issues are power availability and consistency with data acquisition cycles. Solutions like yaw steering or yaw flip are well-mastered by CNES







SIFTI daily Coverage

Altitude: 720 km Inclination: 57° Phased orbit: 3 days

#### **TRAQ Mission objectives and Requirements**

TRAQ is a scientific mission devoted to :

- Mapping of emission sources
- Transport
- Climate and air quality
- It is also
- A gap filler (after Envisat, EOS, ...) · A GMES preparatory mission
- A demonstration mission



PARASOL
arasol is a micro-satellite in the A-Train. The instru
EOS 1 and 2. Its main characteristics are



· On the aerosols

On the clouds and other parameters

eters		Consistency	Comparison to other products
	Cloud cover	80 %Qlgood	MSG andtMODIS No significantbias. RMS = 0,2
	Water vapor		Redissondes Biss = -0,45 /0 kg/m² ; RMS =4,1/3,4 kg/m²
	Cloud Phase		MODIS Bon accord dans 65 % des cas
	Cloud Optical thickness		(ATSIL2) and MODIS Pas de blais 'anormal', RMS (10%)-50%
	Albedo VIS	80 % OI record Accourse; 0.02 7	
	Albedo SW		CERES Blats = - 2,2 % ; RMS = 20 %
	Pressure Rayleigh		ARM and CLOUDNET Bisis = 35 - 105 hPs ; RMS = 123 /150hPs
	Pressure O2		ARMand CLOUDNET Bisis = +50 - 33 hPs ; RMS = 90 / 72 hPs



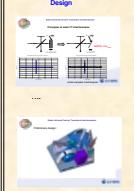
Day was any

decree

SIFTI is designed to measure very precisely the infrared spectrum in the fundamental bands of O<sub>3</sub> and CO. The spectral resolution is chosen to resolve the profile of pressure broadened lines and to allow selection of the most the most uncontaminated ones. The noise figure is very low to reduce its impact on

retrieval.

The spatial resolution is 10 km with a basic sampling every 50 km. The scan sampling can be optimized by pointing in the cloud holes as determined in real time by an integrated imager called CLIM (hole hunting or

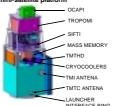


for high spectral resolution with expected very good radiometric performances. A breadboard, for testing this technical concept in the thermal infared will be

#### TROPOMI

### TRAQ PAYLOAD

The accomodation of these various instruments on the same payload has been studied by CNES. Attention was paid to minimize the total weight and power in order to be compatible with a mini-satellite platform



#### **OCAPI**

OCAPI is a multichannel imaging radiometer polarimeter. It inherits from Polder/Parasol but with higher spatial resolution and MODIS (SWIR channels)



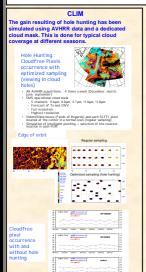
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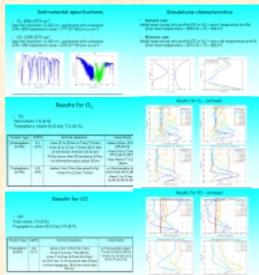


SIFTI + TROPOMI



## Simulations of performances: SIFTI stand alone





JV-VIS and IR provide complementary information and are both required for air quality studies. Besides the combined use for O<sub>3</sub> and CO retrieval, TRAQ will also take advantage of the synergy of the various instruments for: Surface albedo (OCAPI + TROPOMI)

Aerosols properties (OCAPI + TROPOMI)

- Clouds parameters (cover, height, temperature, albedo) (CLIM, OCAPI, TROPOMI, SIFTI)

#### CONCLUSIONS

To get profiles of polluting species and specially low tropospheric contents, thermal infrared spectrometers are deemed necessary along with UV-VIS sensors.

Shortwave infrared is also useful to get CO in

the boundary layer.

spaceborne technique available to detect aerosol micro-particles and should be included in a payload devoted to Air Quality

TRAQ is a mission offering the opportunity of improving our knowledge on Air Quality but also allowing to define the characteristics of a future operational mission within the GMES framework.