Calisph'Air

what's up in my atmosphere?

"Promote the teaching and learning of science, enhance environmental literacy and stewardship, and promote scientific discovery" GLOBE

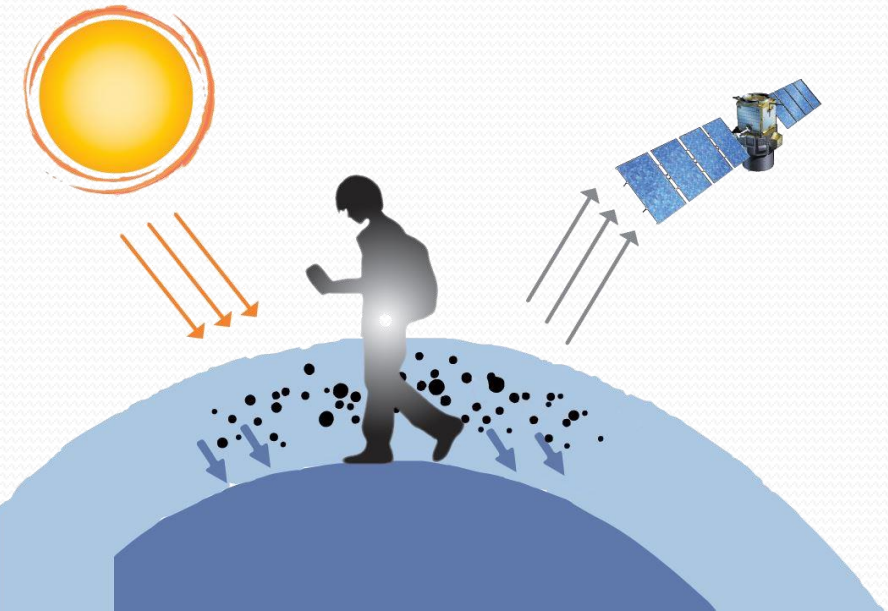
cnes

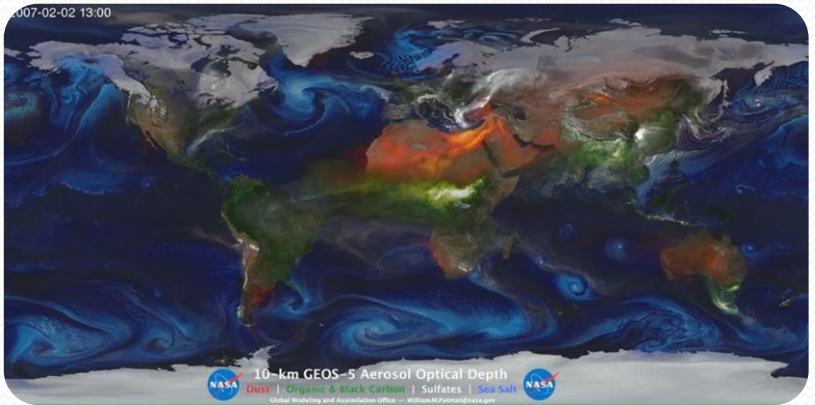
The GLOBE Program

GLOBE France

'The survey on air quality is open !'

Spring campaign : 01 March to 31 May





The Aerosols

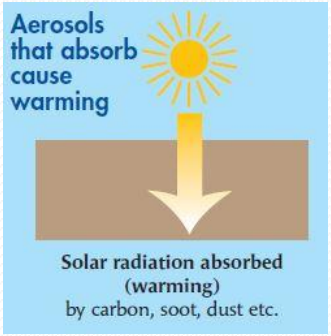
Three billion tonnes of aerosols produced each year

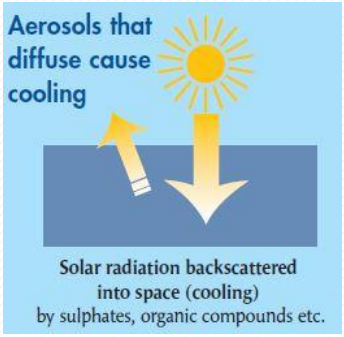
The atmosphere contains tiny liquid or solid particles in suspension, called **aerosols**. They may be volcanic ash, desert dust, sea spray, industrial dust and so on. Their size can vary from a few nanometres to almost 100 microns, the thickness of a hair. They have a much shorter lifetime than greenhouse gases and both this and their situation in the atmosphere vary according to the emission source and the size of their particles.

Why study aerosols ?

➢ Impact on the radiation budget

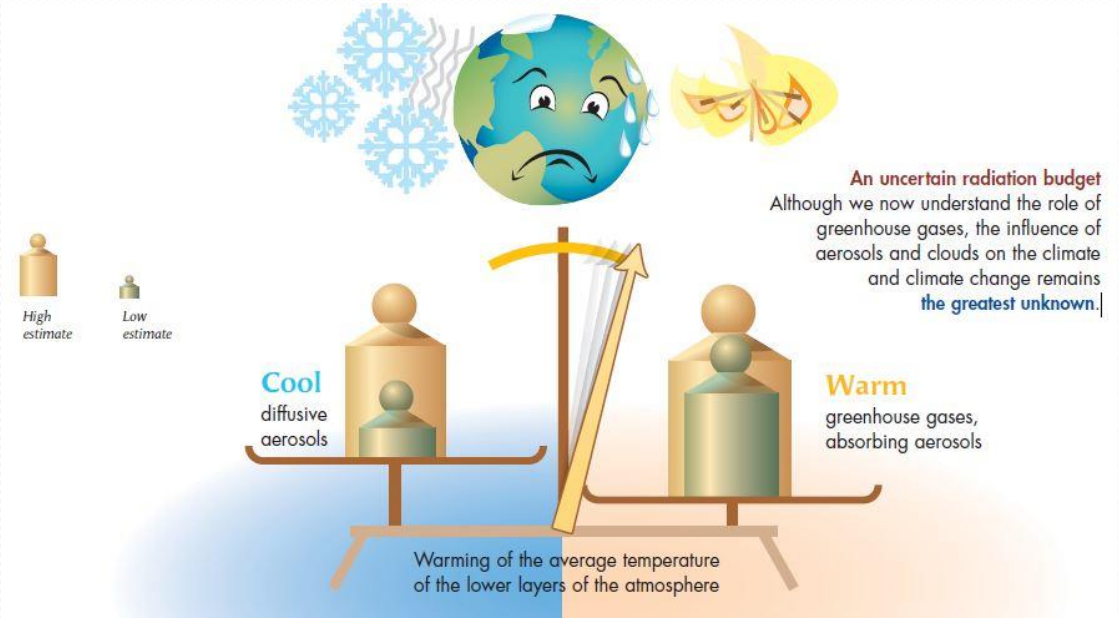
Aerosols diffuse and absorb sunlight and also modify thee reflective power of clouds, so they can affect climate in several ways





➢ Short time period

It varies quickly usually in less than one week



➢ Danger for human health

48 000 deaths each year just in France

How do we measure ?

Satellite Data

Measures from school

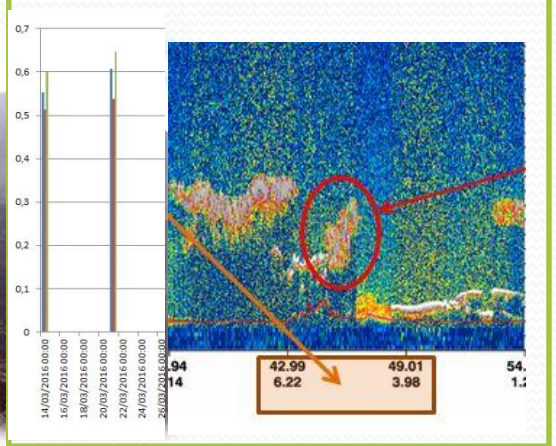
Satellite Calipso

- Active teledection (Lidar)
- Integration of aerosol concentration in the atmospheric column
- View from Space

Sunphotometer Calitoo

- Attenuation of light by aerosols (Aerosol Optical Thickness =AOT)
- Overall distribution of aerosols
- Type of particles: average size of the aerosols distribution
- Air Quality Study

Examples (school and satellite)



GLOBE France Campaign

Calisph'Air campaigns are organized on a European scale in spring and autumn. Measures obtained by schools are posted on the GLOBE database to be shared and used in classroom projects.

➢ Activities and measures

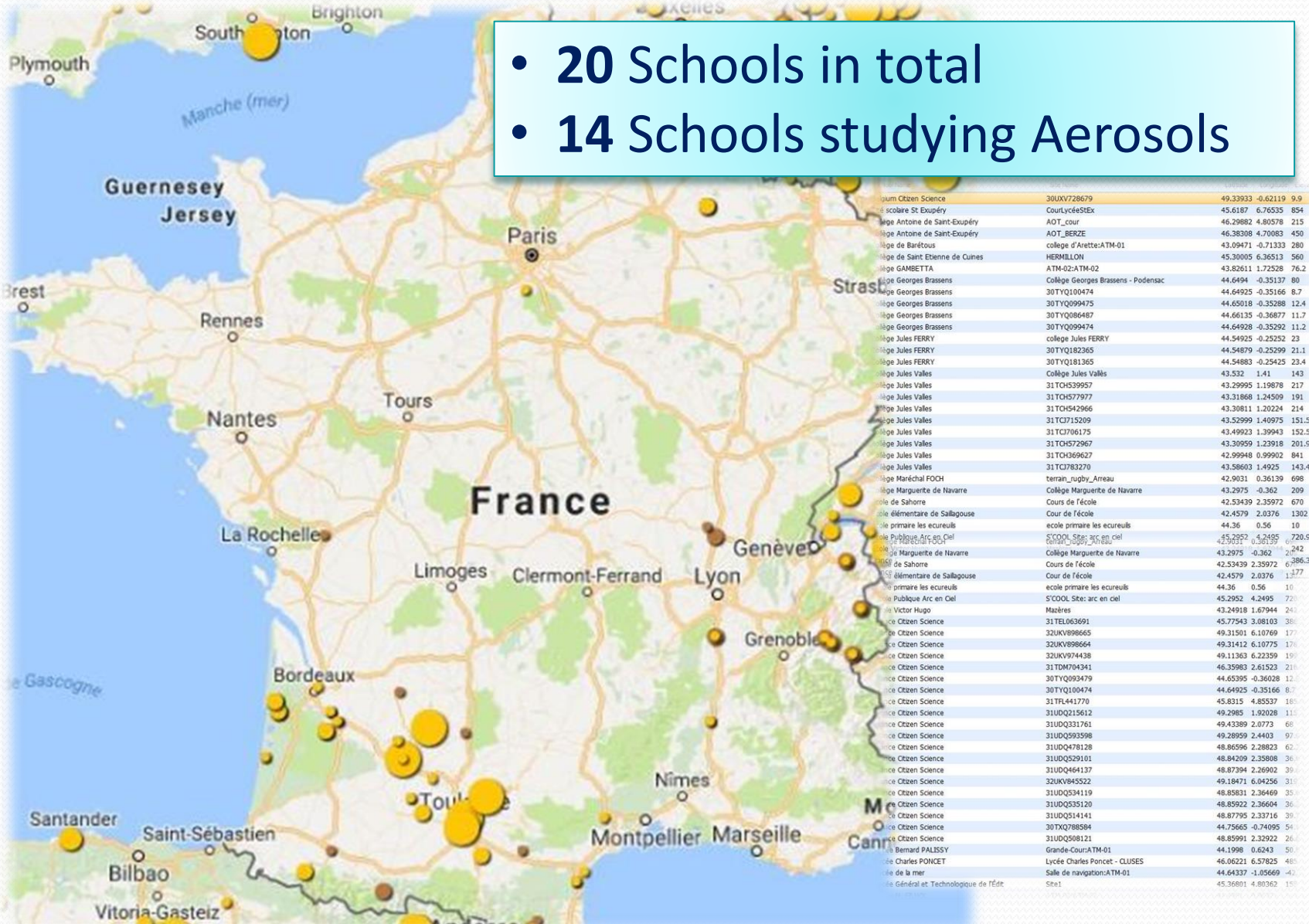
Ask questions and explore
Observe atmosphere (kind of clouds, colors of the sky ...)
Collect data (atmospheric pressure, temperature ...)
Measure optical thickness
Share the data on the GLOBE database
Correlate measurements with satellite data **Analyze** the results
Think about the solutions and **be part** of the change

➢ Analyse the data and synthesis

Every schools do a resume of the local and global data at the end of the campaign to truly understand the meaning of the campaign. Then, the results are exposed at the meeting of Calisph'Air and a synthesis at the Europe scale is done with the help of the scientists.

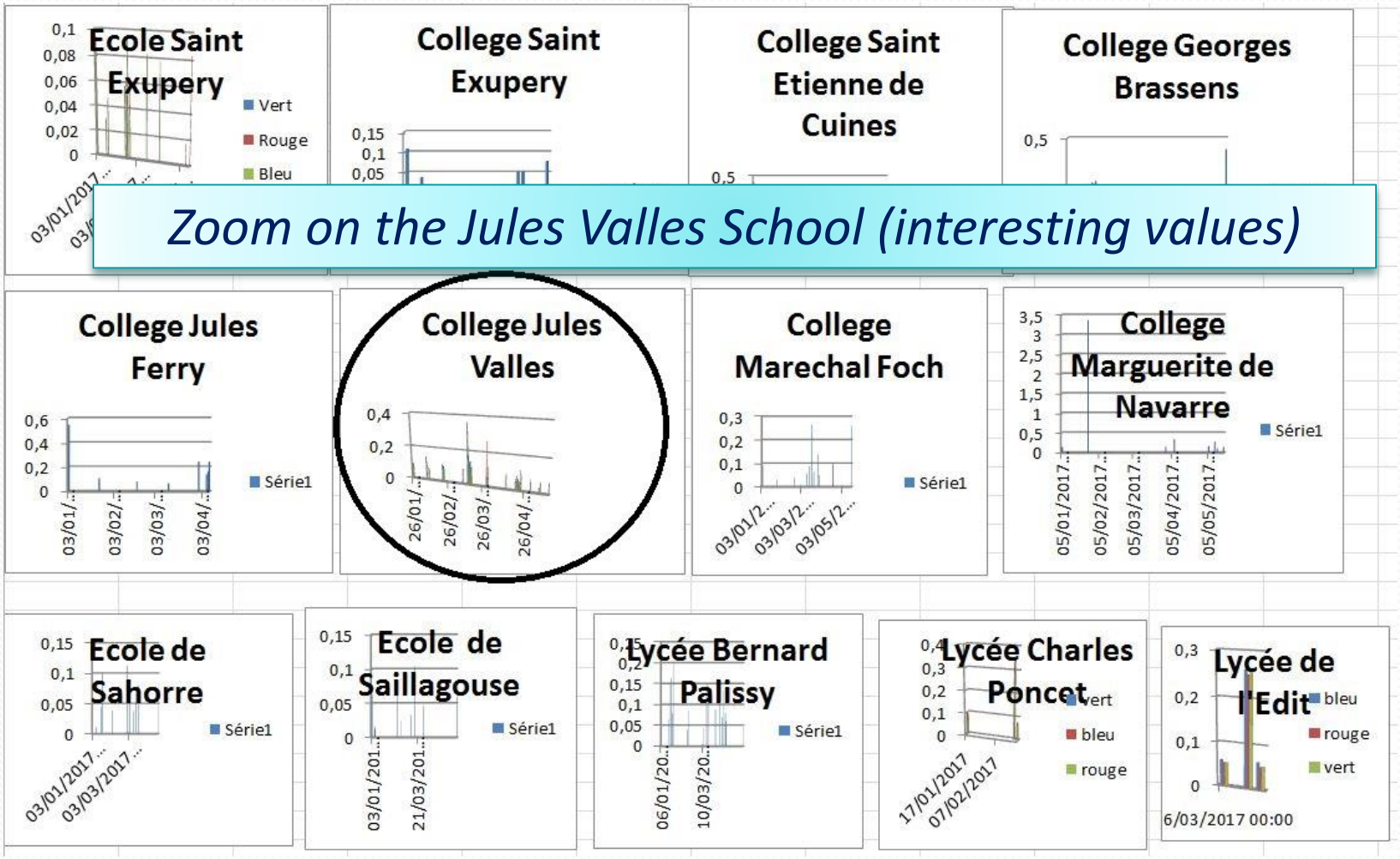
Who participated during this spring 2017 ?

- **20** Schools in total
- **14** Schools studying Aerosols

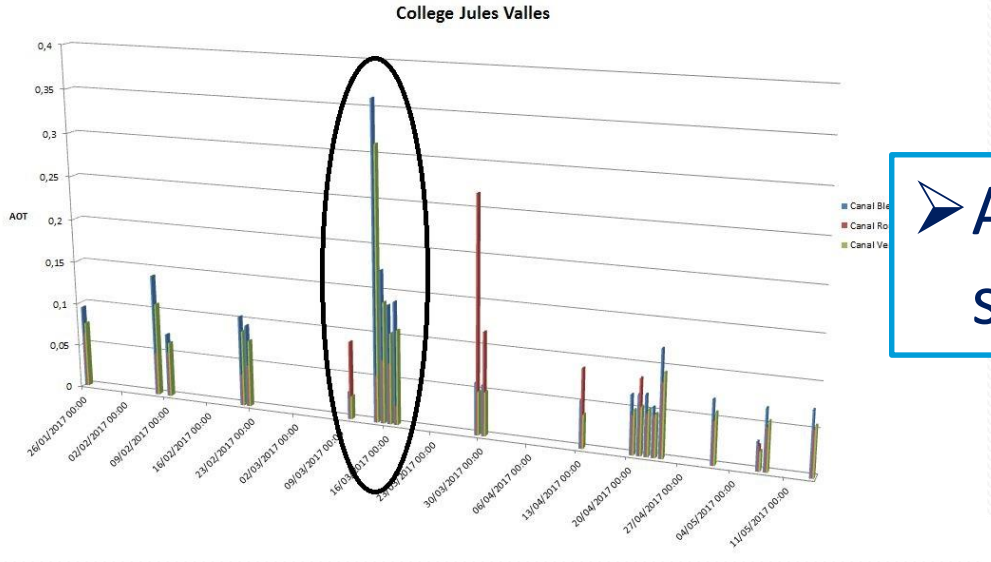


gium Citizen Science	30UXV728679	49.33933	-0.62119	9.9
é scolaire St Exupéry	CourLycéeStEx	45.6187	6.76535	854
lège Antoine de Saint-Exupéry	AOT_cour	46.29882	4.80578	215
lège Antoine de Saint-Exupéry	AOT_BERZE	46.38308	4.70083	450
lège de Barétous	college d'Arette:ATM-01	43.09471	-0.71333	280
lège de Saint Etienne de Cuines	HERMILLON	45.30005	6.36513	560
lège GAMBETTA	ATM-02:ATM-02	43.82611	1.72528	76.2
lège Georges Brassens	Collège Georges Brassens - Podensac	44.6494	-0.35137	80
lège Georges Brassens	30TYQ100474	44.64925	-0.35166	8.7
lège Georges Brassens	30TYQ099475	44.65018	-0.35288	12.4
lège Georges Brassens	30TYQ086487	44.66135	-0.36877	11.7
lège Georges Brassens	30TYQ099474	44.64928	-0.35292	11.2
lège Jules FERRY	college Jules FERRY	44.54925	-0.25252	23
lège Jules FERRY	30TYQ182365	44.54879	-0.25299	21.1
lège Jules FERRY	30TYQ181365	44.54883	-0.25425	23.4
lège Jules Valles	Collège Jules Vallès	43.532	1.41	143
lège Jules Valles	31TCH539957	43.29995	1.19878	217
lège Jules Valles	31TCH577977	43.31868	1.24509	191
lège Jules Valles	31TCH542966	43.30811	1.20224	214
lège Jules Valles	31TCJ715209	43.52999	1.40975	151.5
lège Jules Valles	31TCJ706175	43.49923	1.39943	152.5
lège Jules Valles	31TCH572967	43.30959	1.23918	201.9
lège Jules Valles	31TCH369627	42.99948	0.99902	841
lège Jules Valles	31TCJ783270	43.58603	1.4925	143.4
lège Maréchal FOCH	terrain_rugby_Arreau	42.9031	0.36139	698
lège Marguerite de Navarre	Collège Marguerite de Navarre	43.2975	-0.362	209
ole de Sahorre	Cours de l'école	42.53439	2.35972	670
ole élémentaire de Saillagouse	Cour de l'école	42.4579	2.0376	1302
le primaire les ecureuils	ecole primaire les ecureuils	44.36	0.56	10
le Publique Arc en Ciel	S'COOL Site: arc en ciel	45.2952	4.2495	720.9
lège Maréchal FOCH	terrain_rugby_Arreau	42.9031	0.36139	698
lège Marguerite de Navarre	Collège Marguerite de Navarre	43.2975	-0.362	242
ole de Sahorre	Cours de l'école	42.53439	2.35972	386.3
ole élémentaire de Saillagouse	Cour de l'école	42.4579	2.0376	177
le primaire les ecureuils	ecole primaire les ecureuils	44.36	0.56	10
le Publique Arc en Ciel	S'COOL Site: arc en ciel	45.2952	4.2495	720
le Victor Hugo	Mazères	43.24918	1.67944	240
ce Citizen Science	31TEL063691	45.77543	3.08103	380
ce Citizen Science	32UKV898665	49.31501	6.10769	177
ce Citizen Science	32UKV898664	49.31412	6.10775	176
ce Citizen Science	32UKV974438	49.11363	6.22359	190
ce Citizen Science	31TDM704341	46.35983	2.61523	210
ce Citizen Science	30TYQ093479	44.65395	-0.36028	12
ce Citizen Science	30TYQ100474	44.64925	-0.35166	8.7
ce Citizen Science	31TFL441770	45.8315	4.85537	180
ce Citizen Science	31UDQ215612	49.2985	1.92028	110
ce Citizen Science	31UDQ331761	49.43389	2.0773	68
ce Citizen Science	31UDQ593598	49.28959	2.4403	97
ce Citizen Science	31UDQ478128	48.86596	2.28823	62
ce Citizen Science	31UDQ529101	48.84209	2.35808	36
ce Citizen Science	31UDQ464137	48.87394	2.26902	39
ce Citizen Science	32UKV845522	49.18471	6.04256	310
ce Citizen Science	31UDQ534119	48.85831	2.36469	35
ce Citizen Science	31UDQ535120	48.85922	2.36604	36
ce Citizen Science	31UDQ514141	48.87795	2.33716	39
ce Citizen Science	30TXQ788584	44.75665	-0.74095	54
ce Citizen Science	31UDQ508121	48.85991	2.32922	26
le Bernard PALISSY	Grande-Cour:ATM-01	44.1998	0.6243	50
le Charles PONCET	Lycée Charles Poncet - CLUSES	46.06221	6.57825	480
le de la mer	Salle de navigation:ATM-01	44.64337	-1.05669	-42
le Général et Technologique de l'Édit	Site1	45.36801	4.80362	150

Results of the campaign

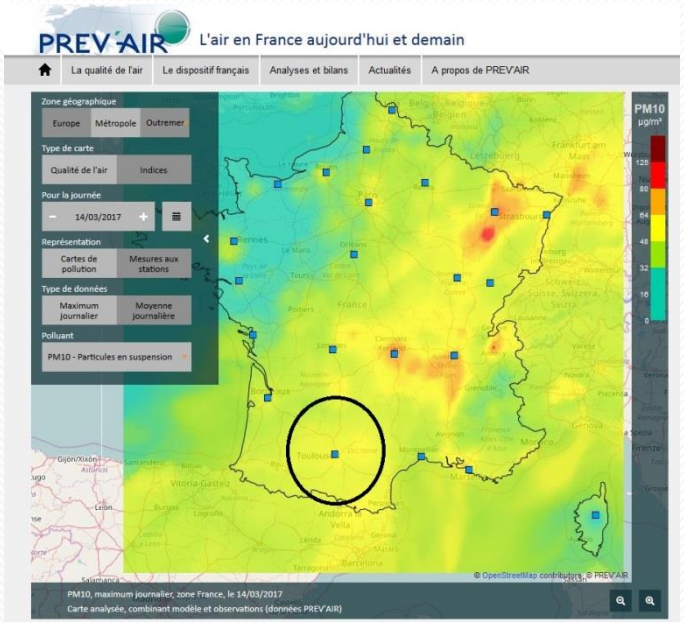


Case study of Jules Vallès : Relatively high AOT



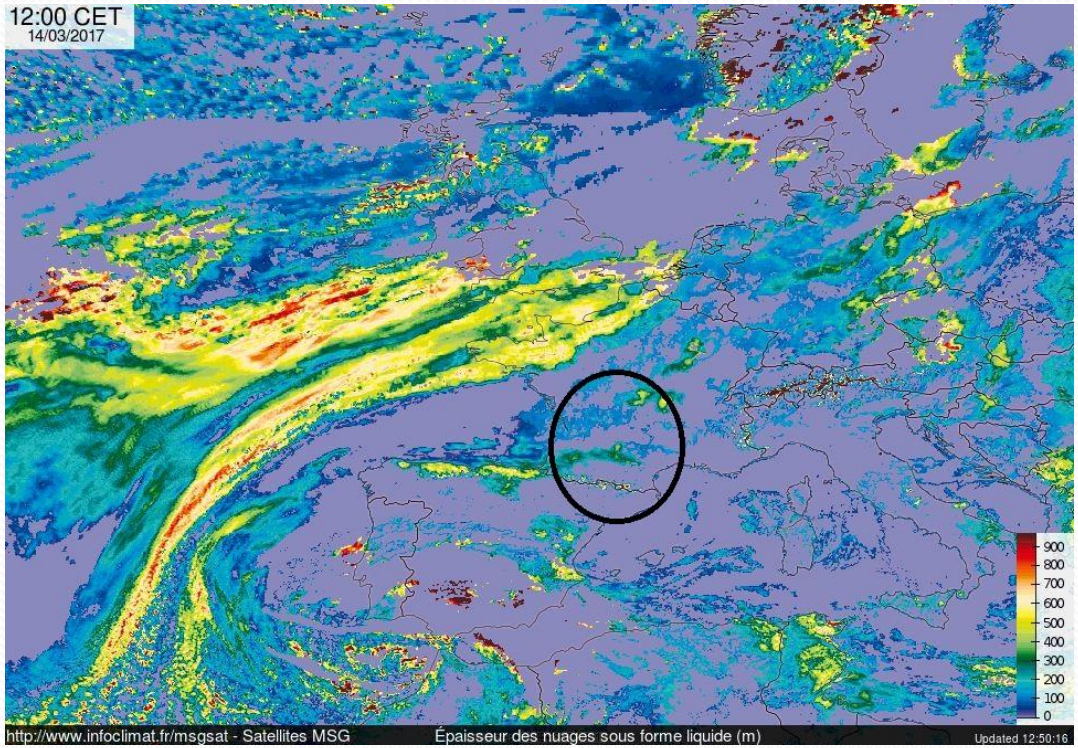
➢AOT measured from school : ~ 0,4 max

PM 10 measured by professionals this day >



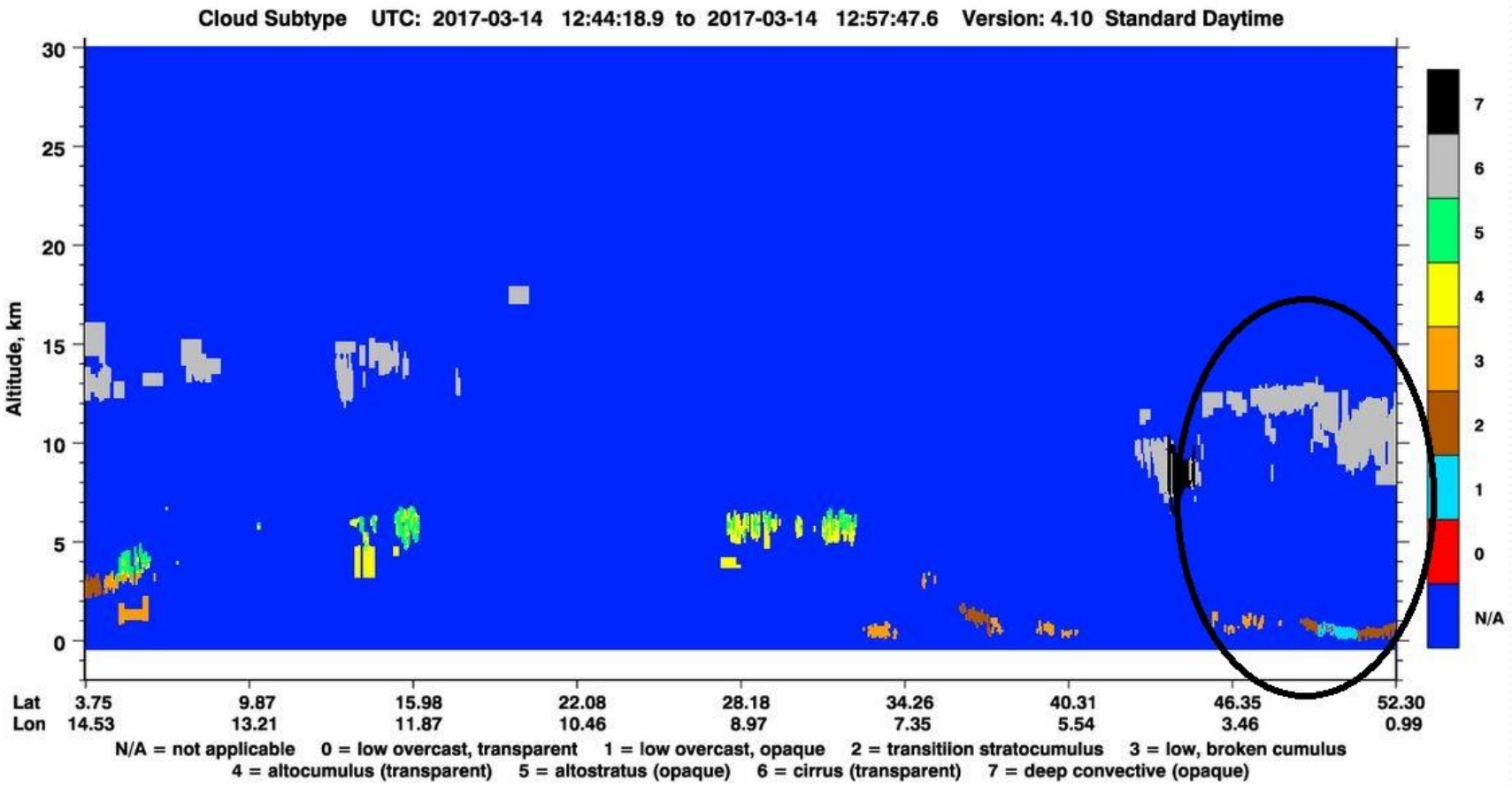
Results of Jules Vallès : Cloudsat

Did the ‘high’ AOT was cause by a cloud between observer and the sun, or by a pollution of the lower layer ?



- Pictures of clouds over Toulouse with the satelite Cloudsat

Results of Jules Vallès : Calipso



- Cirrus at the higher altitudes and a non-identified layer on the lower layer

Results of Jules Vallès : Angstrom coefficient

Smaller particles will scatter based on the wavelenght more so than larger particles
Since we have the value on the 3 wavelength we can calculate the Angstrom coefficient :
this is a good indicator of the average distribution of the aerosols concentration

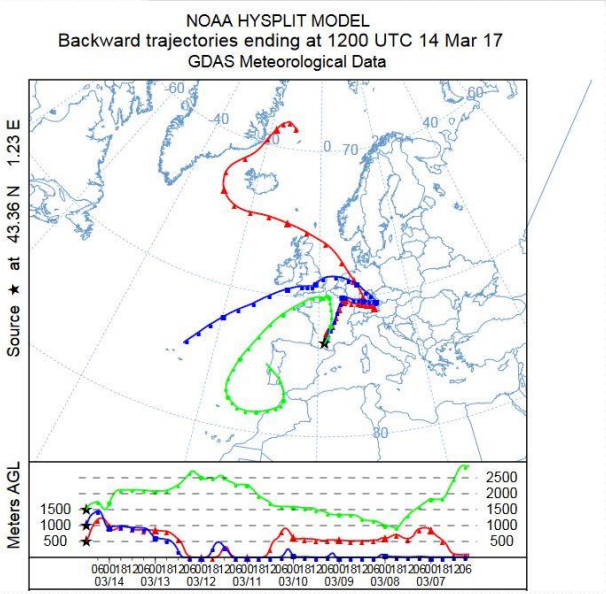
$$\alpha = -\frac{\ln(\frac{\tau_1}{\tau_2})}{\ln(\frac{\lambda_1}{\lambda_2})}$$

Angstrom coefficient : 1,05

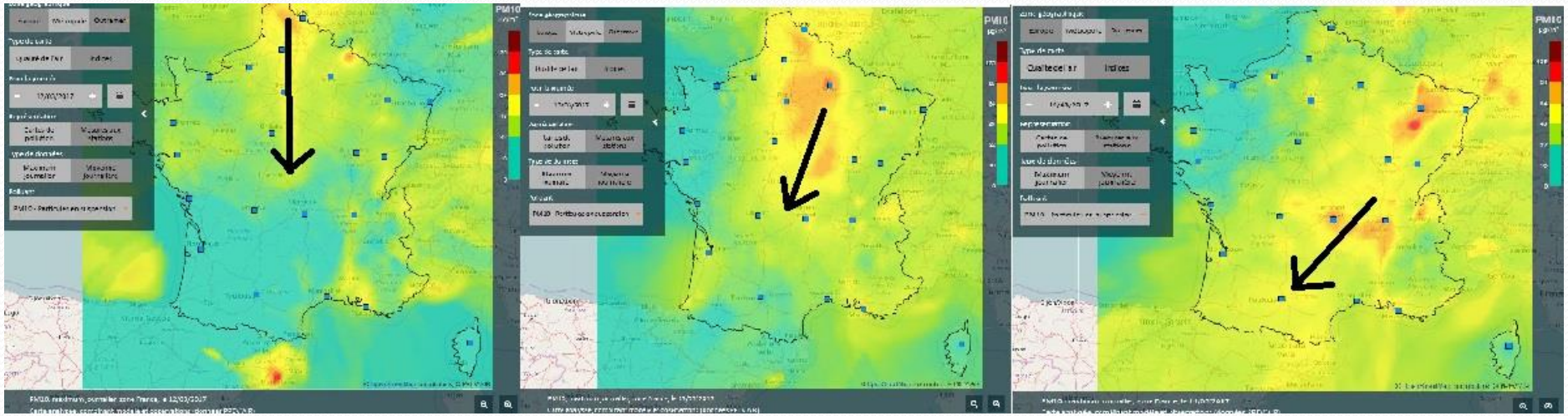
this is an indicator of thin particule matter (clouds are large PM)

The pollution must come from the lower layer

Results of Jules Vallès : Retrotrajectory



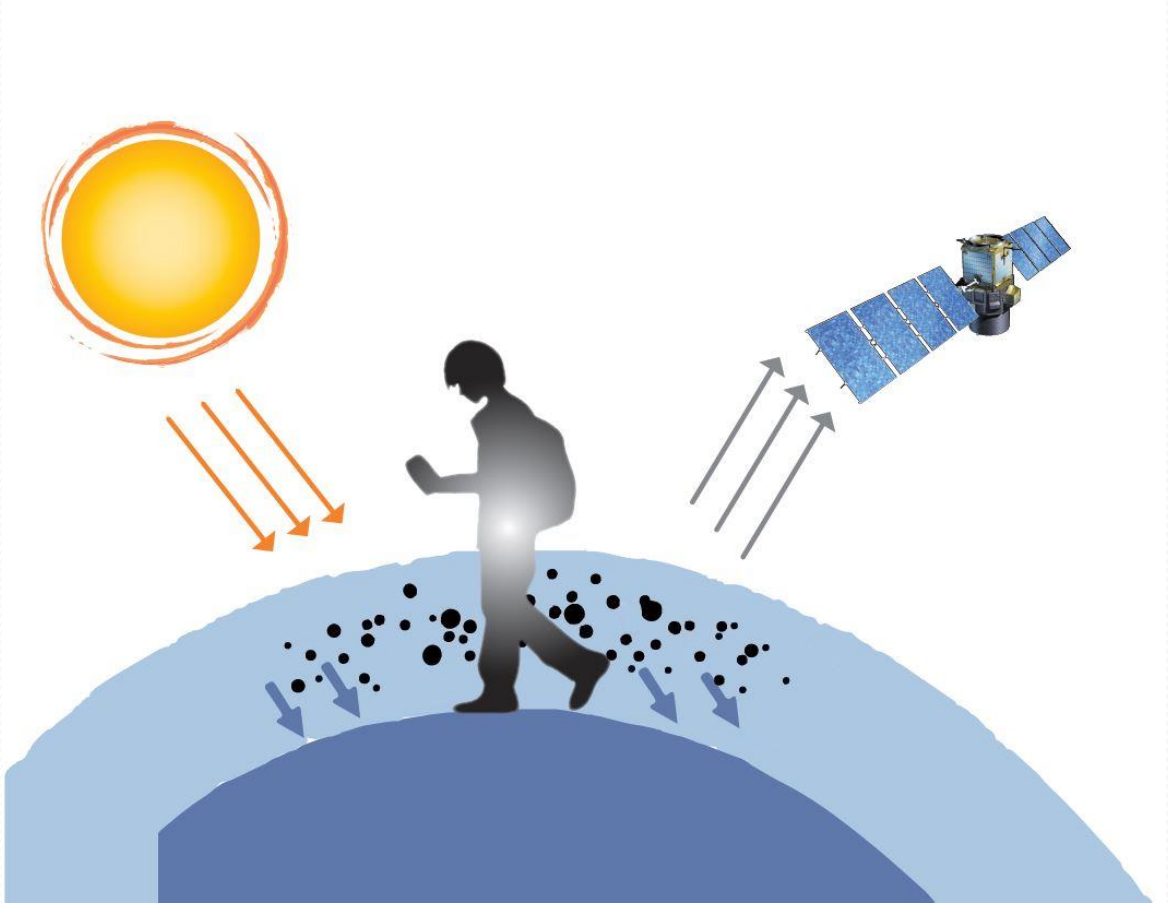
- Retrotrajectory : Aerosols coming from the north east of France ?



Results of Jules Vallès : Conclusion

- High AOT probably came from a pollution above the north east of France

- Further data are necessary to be more accurate



Conclusion

- Having a **new global view** of the earth : from the space
- Develloping a **scientific process** and an **environmental consciousness**
- Sharing with other countries with the **international cooperation**
- Learning about the world, **spreading hopes** for the world of tommorow
- Acting **locally** to observe **global impacts…**
- A new platform is on study to simplify the analysis for schools