SOFOG3D Data and Science Meeting : Agenda

- 9h00 : Intro and 2019-2020 campaign overwiew - F. Burnet

- 9h20 : MWR network – assimilation Task5 - P. Martinet / A. Kremer

- 9h40 : Radar measurements – Task2 – J. Delanoë / S. Jorquera / A. Bell

- 10h00 : UKMO contribution – J. Price

- 10h15 : Turbulence and flux measurements - G. Canut

- 10h30 : Aerosol measurements and closure - C. Denjean

- 10h45 : UAV measurements - J. Viviand

- 11h00 : 3D LES and heterogeneities – Task 3 – C. Lac / Q. Rodier

- 11h15 : Advanced process studies – Task 4 – M. Haeffelin / C. Lac

- 11h30 : St to fog transition – Task 4.2 – M. Fathalli

- 11h45 : Evaluation of AROME model – S. Antoine

- 12h00 : AERIS database website – W. Maurel

- 12h15 : Discussion :

    data analysis, CDD/postdoc/Intership, papers, etc...

https://bluejeans.com/217558095/8583

Context

- High **economical impact** of **fog** on **transport** :

  a specific research action started at Météo France for 5 years (2017-2021)

  => Development of a high resolution version of the NWP model AROME-500m

- **SOFOG3D field experiment & ANR project**
  - Evaluation/validation of AROME-500m
  - improve our understanding of fog **processes to derive refined parameterizations** :

    => 3D high resolution LES simulations & **experimental studies**
  - new data assimilation tests

- **Collaborations :**
  - Météo France :
    - CNRM : GMEI & GMME & GMAP
    - ENM (forecast), DSO (lidar, RS)
  - ANR :
    - IPSL/LMD (M. Haeffelin) et LATMOS (J. Delanoë)
    - UKMO (J. Price)
    - MWR network (TOPROF) : Univ Cologne, MeteoSwiss, RPG & Attex
  - ONERA, IRSN, LA

ANR Main scientific questions

- **Provide a 3D caracterization of fog layer properties** with detailed observations of **dynamics, radiation, microphysics and surface fluxes**

- Processes study using **synergy between 3D high-resolution LES and unprecedented detailed observations**
  - Dynamics :
    - **Impact of surface heterogeneities** : what are the impacts of turbulent eddies near the ground induced by surface heterogeneities on the spatio-temporal variability of the fog ?
    - Impact of entrainment and turbulent mixing at the top of the fog layer
  - Microphysics **:**
    - **Is transition between thin and thick fog mainly driven by microphysics ?**
    - Impact of aerosols, evaluate improvement of the two-moment scheme LIMA
  - **Stratus to fog transition :** do microphysics and local processes induced by orography and surface type influences St lowering or is it mainly driven by large scale conditions ?

- **Data assimilation of new local observations :**
  - MWR network and synergy with radar 95 GHz

ANR SOFOG3D – 4 years (01/10/2018 ~~2022~~ 04/2023)

Kick-off   6 months campaign   **Data and Science meeting (today)**

Timetable of the project:

	18	2019				2020				2021				2022		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Task 1 : Field campaign and in situ data analysis																
1.1 Preparation																
1.2 Field campaign																
1.3 In situ data analysis (CDD)																
Task 2 : Fog retrievals based on remote sensing measurements																
2.1 Radar retrievals (CDD)							S. Jorquera									
2.2 Attenuation and closure study																
2.3 Improved MWR retrieval																
2.4 SEVIRI/MSG retrievals																
Task 3 : 3D high resolution LES																
3.1 : LES and validation (CDD)																
3.2 : Impact of heterogeneities																
3.3 : Impact of orography																
Task 4 : Advanced process studies based on highly documented cases																
4.1: Transition thin/thick																
4.3 : Ph D on St lowering																
4.2: Fog dissipation phase (CDD)																
Task 5 : Data assimilation and forecast																
5.1 Observations preparation																
5.1 Assimilation trial (CDD)																
Final report																

4 Ph D :

A. Bell

M. Fathalli

S. Antoine

T. Costabloz

+ High resolution AROME NWP model

+ 3D fog microphysics properties T1 & T3

SOFOG3D

SOuth west FOGs 3D experiment for processes study

Overview of the 2019-2020 campaign

F. Burnet et al.
Météo-France, DESR/CNRM/GMEI

Data and Science meeting – 09/11/2020
Visioconference

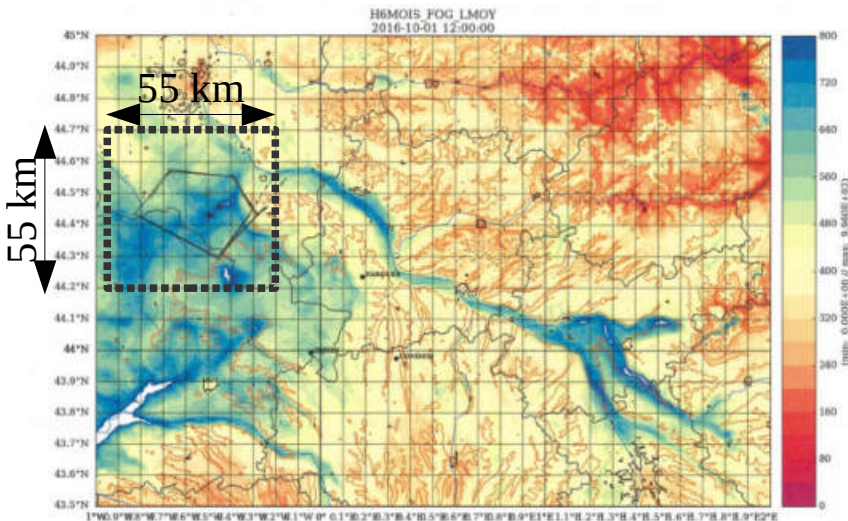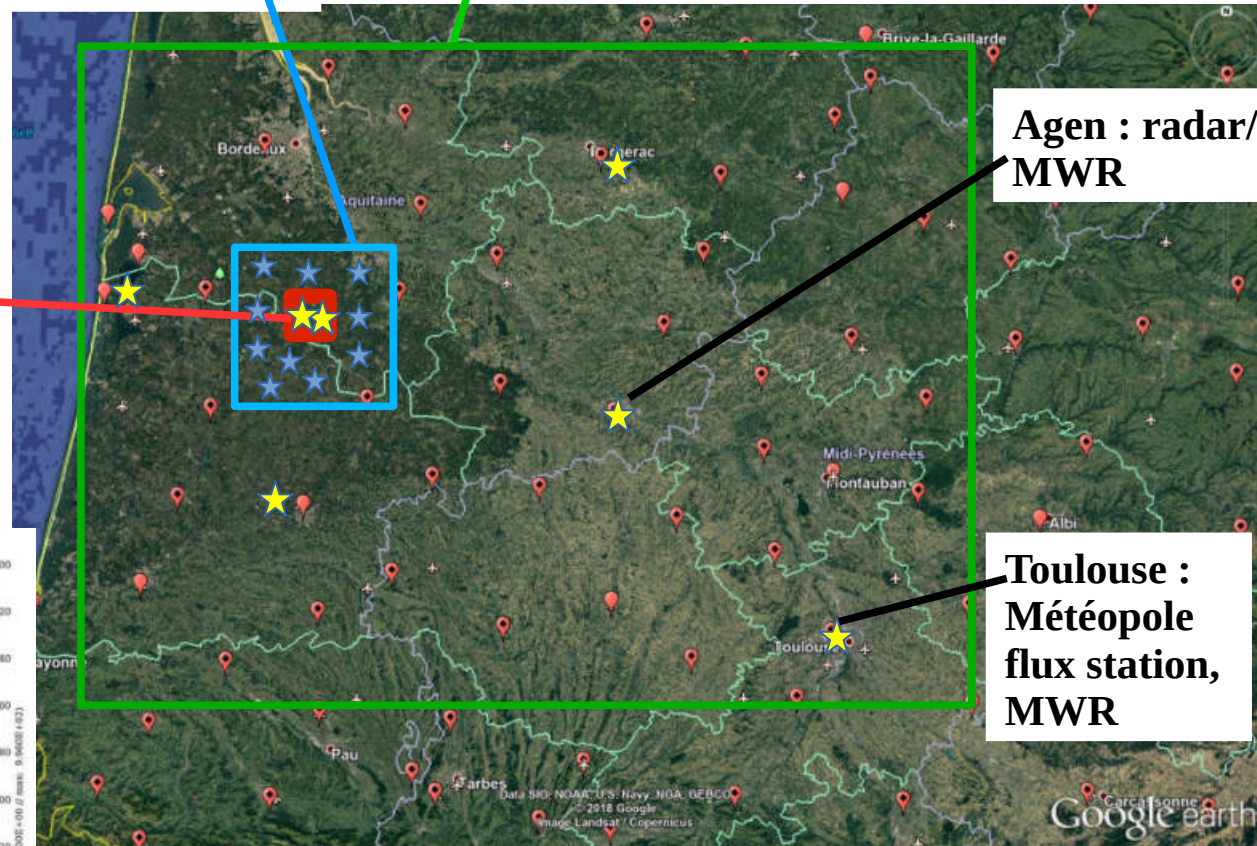# SOFOG3D Experimental strategy : **winter 2019-2020**

Surrounding domain 50 x 50 km
with increased density in-situ
sensors network (+7 surface met.
stations, visibility, +2 ceilometers)

Larger domain 300 x 200 km (AROME-500m
model) with in-situ sensors (~ 50 surface meteor.
stations) and MWR (6 sites) networks

Super-site 10 x 10 km:
- **radar/MWR/lidars**
- **tethered balloon ; UAVs fleet**
- 10 met. stations ; **50 m mast (2)**
- sites with **different vegetation types**:
heat and turbulent fluxes, radiation
budget, aerosol and fog microphysics,
water deposition, visibility, 3 ceilometers

**Agen : radar/
MWR**

**Toulouse :
Météopole
flux station,
MWR**

55 km

55 km

Hours of fog occurrence AROME
winter 2016-17 (Y. Seity)
et et al.

SOFOG3D surrounding domain : 7 sites (+ 10 super-site)

=> Met. stations: 2 UMKO + 5 SAMHA 4M + NIZAN 40-m watchtower ; 2 ceilometers
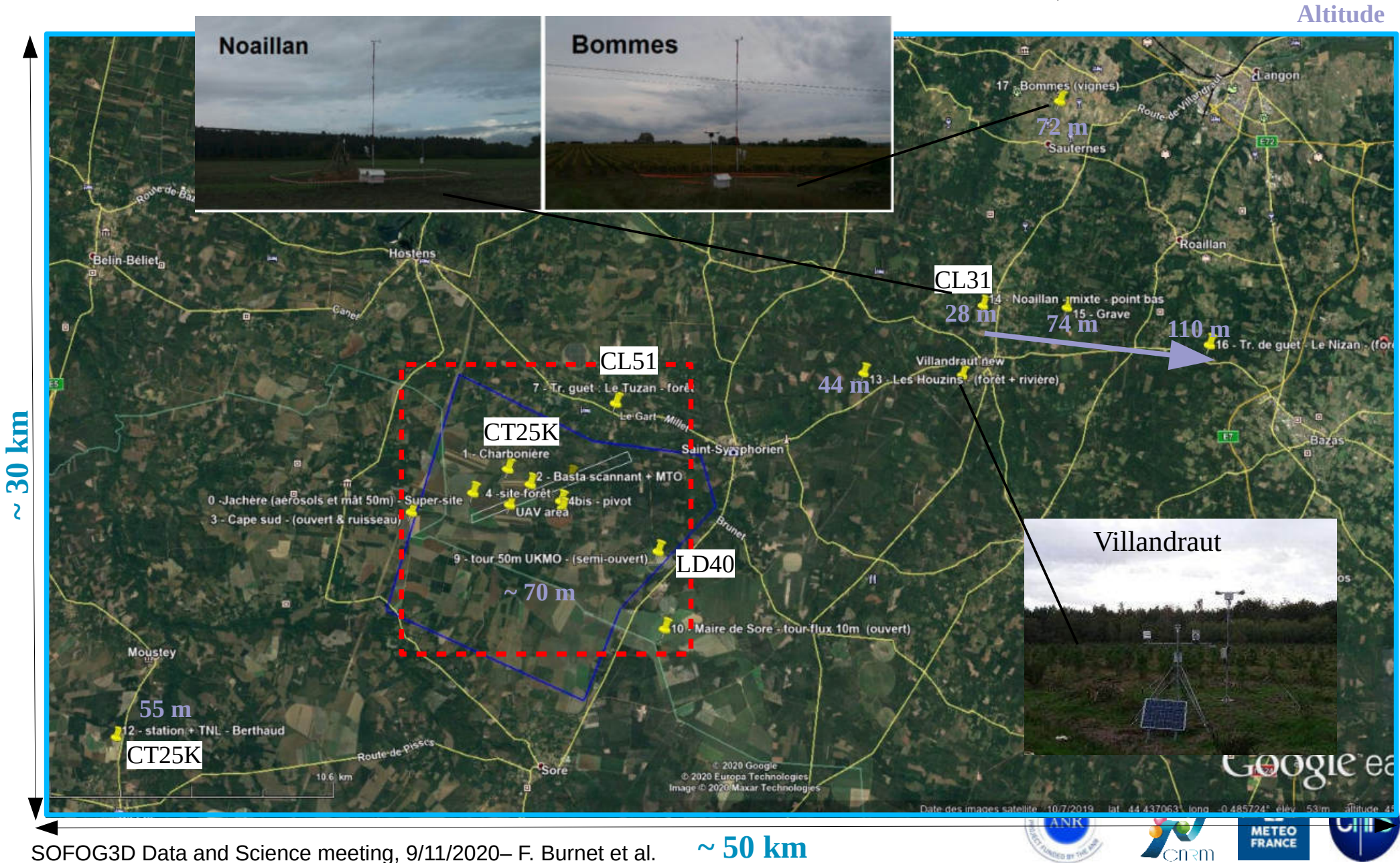
SOFOG3D Super-site experimental strategy :

Open fields
- 50m mast CNRM (flux, visi+CDP), μφ
- Aerosol shelter, μφ, lidar LB100
- Radars 95 GHz, MWRs, CT25, lidar V2
- Tethered balloon, RS

UAVs fleet sampling

Forest area (3 sites)
- 40m watchtower, CL51
- 10m mast (flux, visi), μφ

11 km
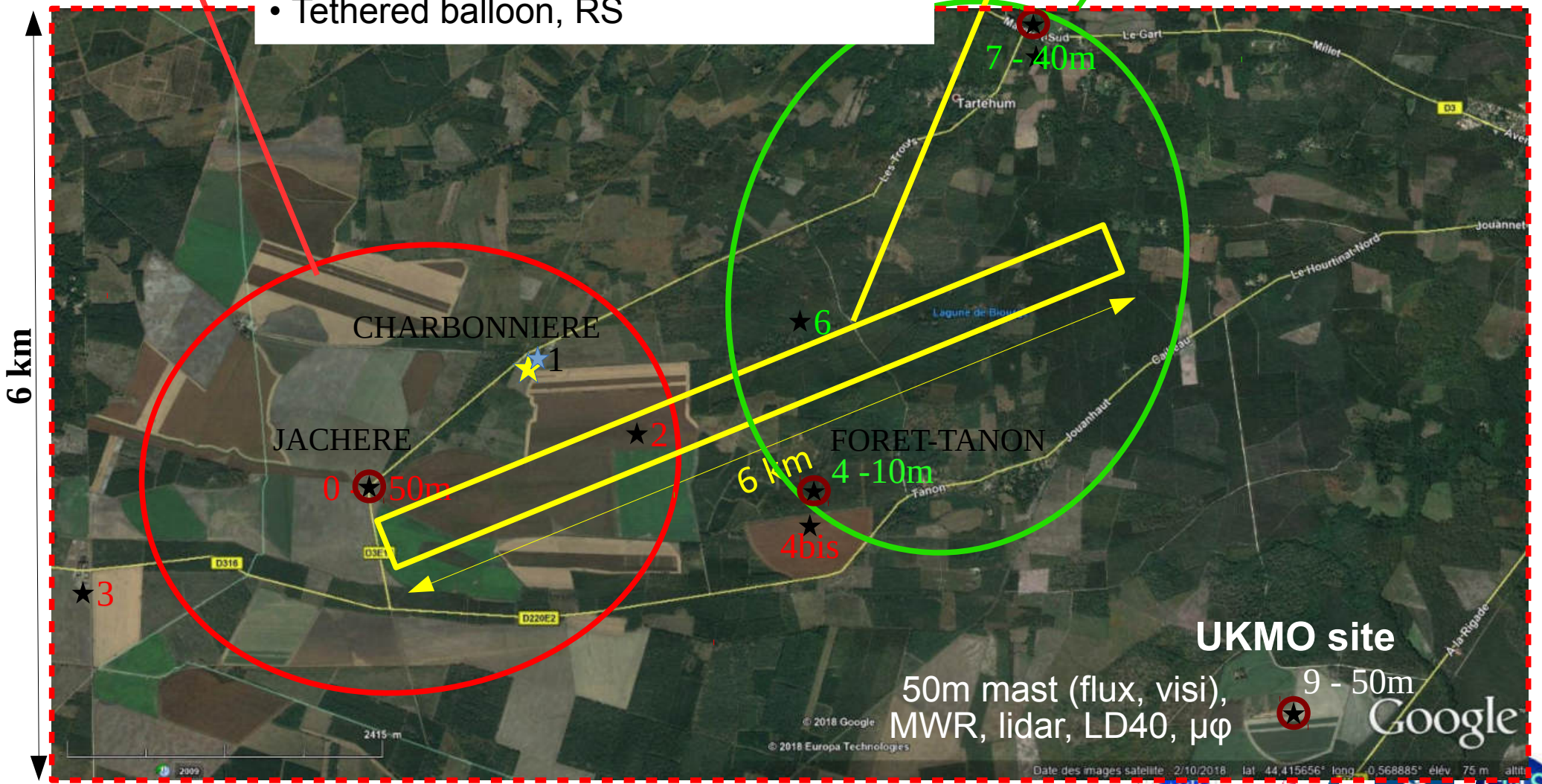
SOFOG3D super-site JACHERE

- Turbulent fluxes and microphysics profiles :
  - 50 m mast (=> 03/11/2019 Amélie storm)
  - 10 m and 2 m masts
  - surface and ground
- In situ aerosol (SMPS, OPC, CCN, CAPS) and microphysics (FM120, welas, MPS)
- Lidar LB100

SOFOG3D super-site CHARBONNIERE

- Weather station since Oct 2018

- Remote sensing: 2 MWR (G5 + MTP5), BASTA radar, 2 lidars (wind V2 and aerosol mini-MPL), CT25K, MRR, disdro (Cologne trailer)

- Tethered balloon : CDP, turbulence, OPC, CCNc

- RS

SOFOG3D super-site : scanning BASTA (BASTA-CHAMP)

- Scanning Basta
- Microphysics : FM120 + visi
- UKMO met station
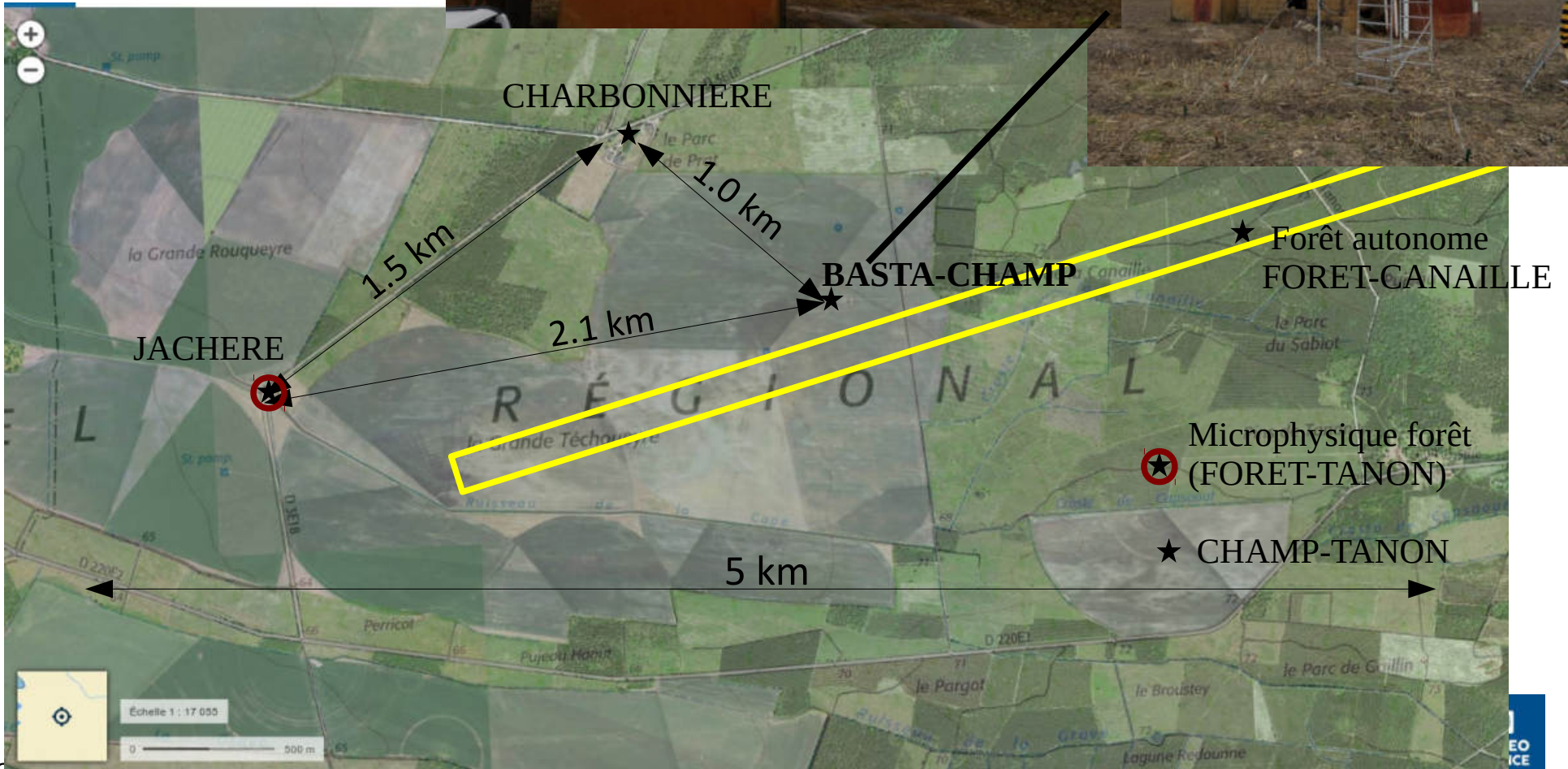
SOFOG3D super-site : 3 forest sites

FORET-TANON

- visi 3 and 10 m
- FM100 + welas
- weather complete

LE-TUZAN watch-tower
- visi 3, 24 and 40 m
- T & Hu 2, 8, 24 and 40m
- wind + radiation 40m
- ground
- CL51

FORET-CANAILLE (visi only)

40 m

24 m

8m
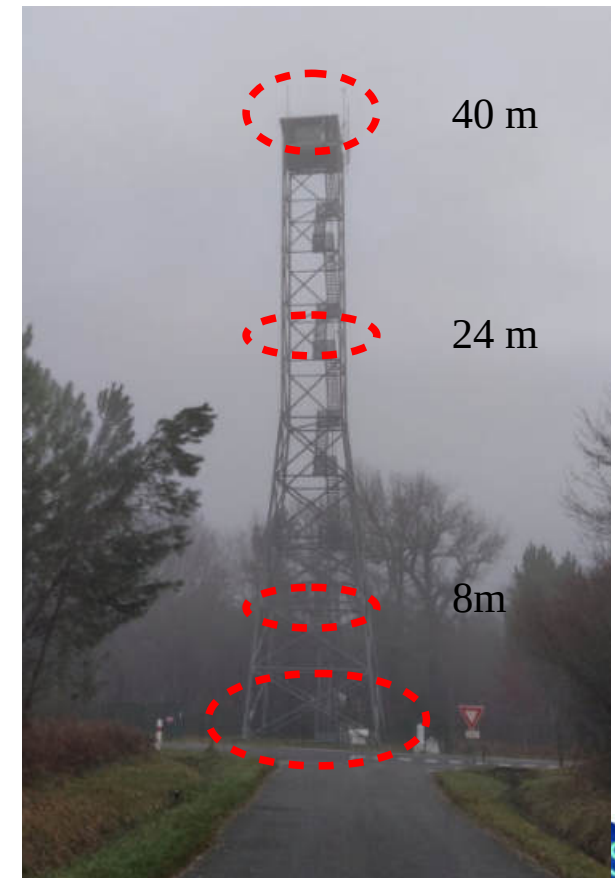
Visibility sensors network

- 17 sites with visibility measurements at 3 m high
  - FORET-TANON : + 10 m
  - LE-TUZAN : + 25 & 40 m
  - JACHERE : + 25 & 50 m
  - UKMO : + 25 & 50 m

- 24 sensors :
  - 5 PWD on 5 sites + 1 PWD mobile
  - 18 Young on 15 sites :
    - 9 autonomous (5 analogic + 4 num.)
    - 9 analogic on SAMHA met. stations

Instrument	Visibilité minimale	Visibilité maximale
CHAMP-TANON	30m	12081m
FORET-CANAILLE	30m	6804m
LES-GRAVES	30m	13085m
VILLANDRAUT	30m	12508m
TUZAN (25m)	30m	6518m

- plenty of failures... rain, electronic noise, time drift, loss of sensitivity, etc...
  but some nice data to study spatial heterogenities

Corrélation de la visibilité entre le pwd et le young (villandraut)
Corrélation (sans précipitation ou sédimentation)
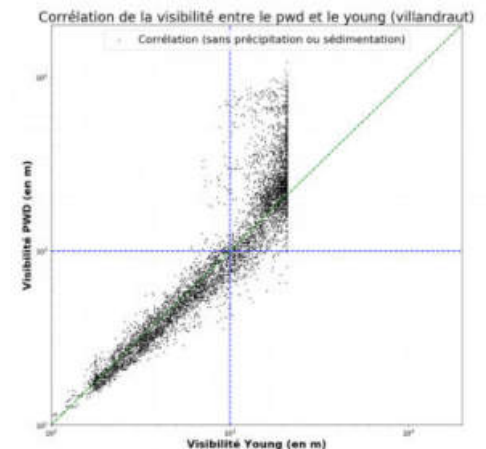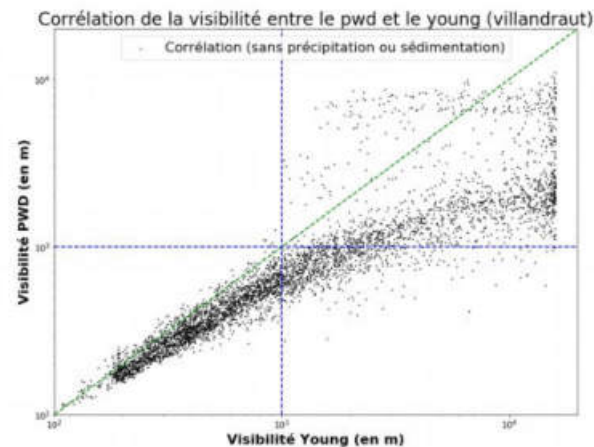
IOP overview : 01/12/2019 => 12/03/2020

- **15 IOP => 20 nights of balloon operations + RS:**

  — 5 without fog (or just mist)

  — 8 thin fog with width H ≤ 50 m

  — 4 with 80 ≤ H ≤ 180 m

  — 3 H ≥ 200 m : **IOP-6, 11 and 14**

  15 fog events

  5-6 Jan. (250m), 8-9 Feb. (250m) and 8-9 March (200m)

- 7 IOP with UAV flights

- 3 + 1 IOP failed due to balloon => 7 missed fog events

  — 2 with H ~120m (26/10 – 01/11)

  — 2 with H ~ 200m (28-31/12)

- Coronavirus => 5 missed fogs after March 15, 2020

  — 1 Stratus to fog : 16-17

  — 2 thin : H ≤ 50 m 17-18 (3h) and 18-19 (8h)

  — 2 thick : ~250m 22-23 (3h) ~80m 30-31 (8h)

Les lapins de Pâques de cette année
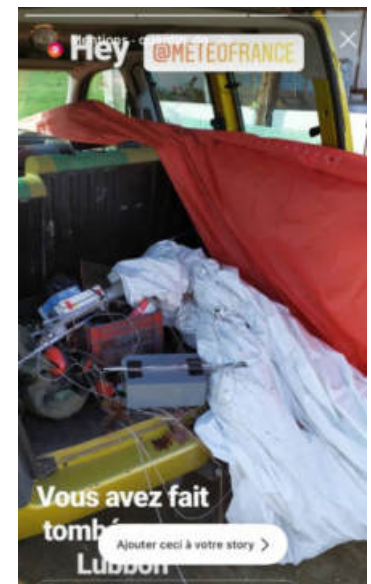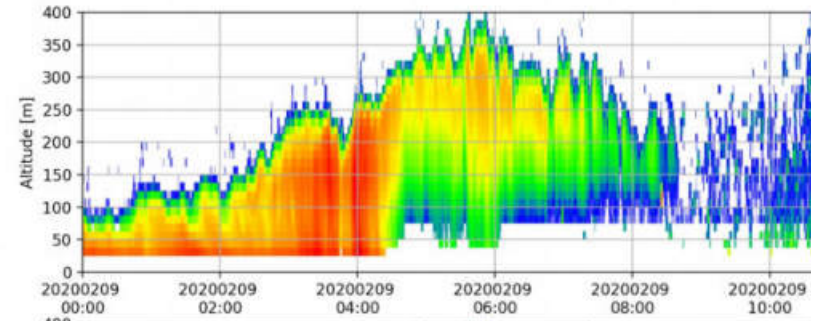
Bilan des radiosondages - SOFOG3D

(A. Roy)

Lieu	Toulouse	Agen	St-Symhorien	Bordeaux
Nombre de lâchers	37	52	62	33 (en plus de ceux du réseau)

Agen: 52
St-Symphorien: 62
Toulouse: 37
Bordeaux :33
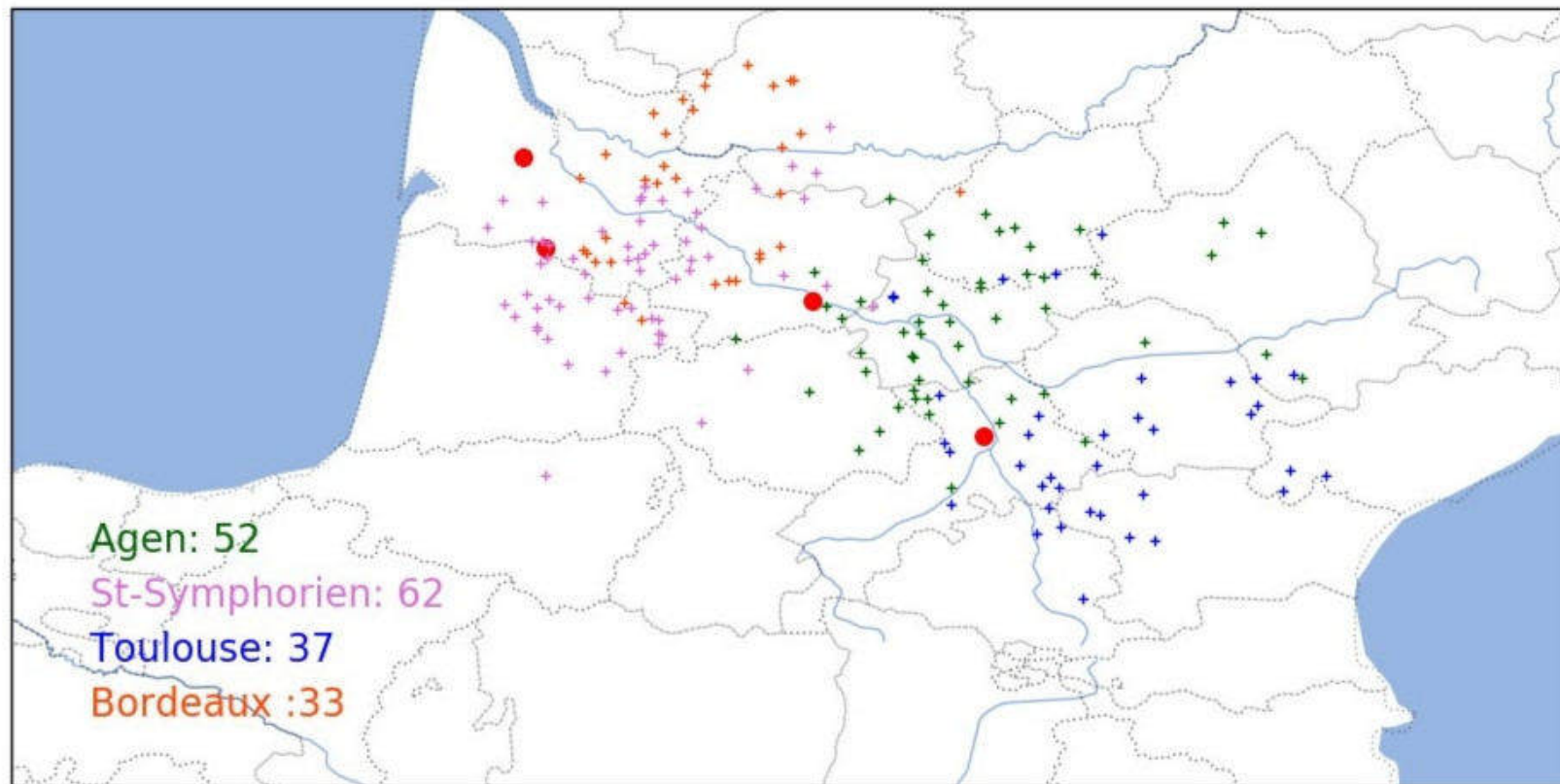
IOP-6 : from January 4 to 7, 2020

- 3 days of tethered balloon operations (no turbulence probe) + RS

- large differences Noaillan / Super-site
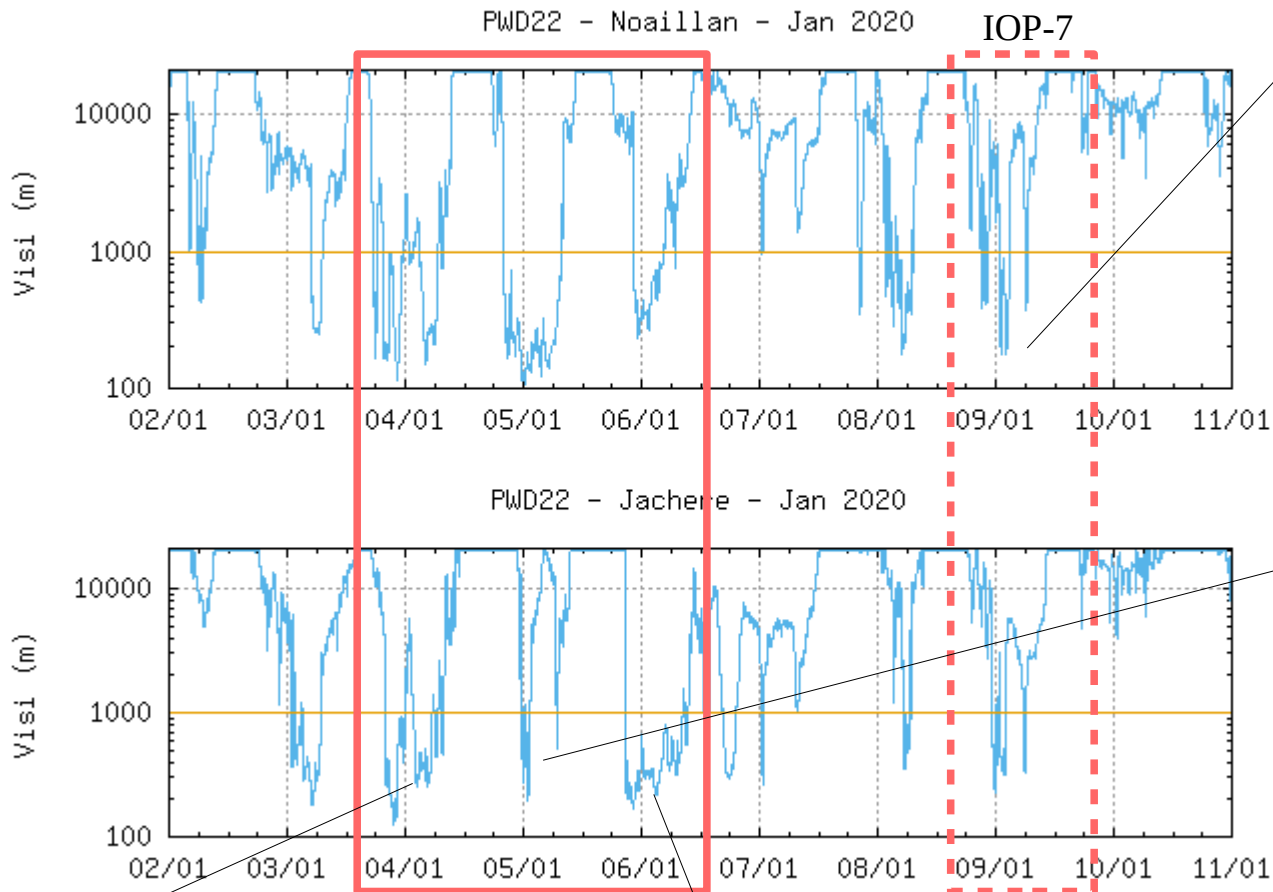
Sc stops the fog developpement :

H~35 m ; 0h15 to 2h TU
Nocturnal jet stops the fog
developpement :
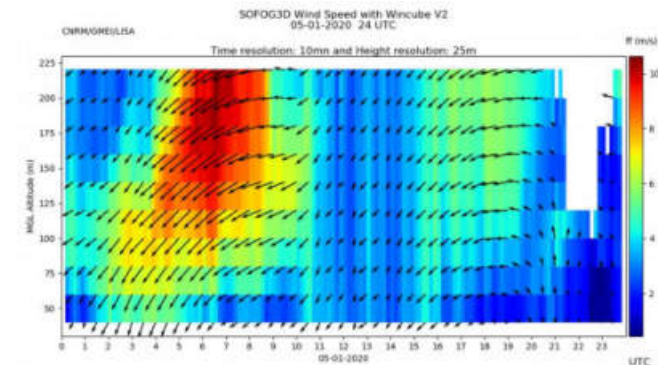
H~100m then St :
 (21h30)- 3h30 to 9h TU
Clouds above 0.5-2 km

H~200 m - frozen
 21H50 to 4h40 TU

IOP-6 : night of January 5-6, 2020

- ~250 m lifting into a St cloud – freezing fog

- 7 CDP flights + tethersonde (no turbulence probe) 21h50 to 12h45 UTC

  => ~40 profiles + 12 legs (from 40 to 180m)

- 3 UAV flights 22h15 to 1h45 : circles below 120m – frozen propeller

Fog

Stratus
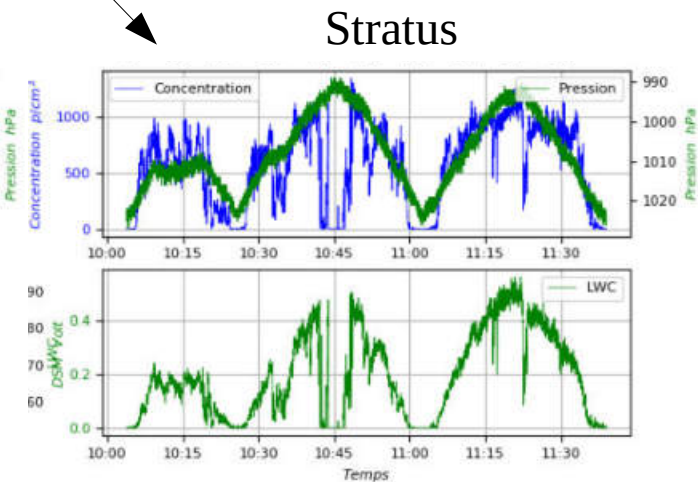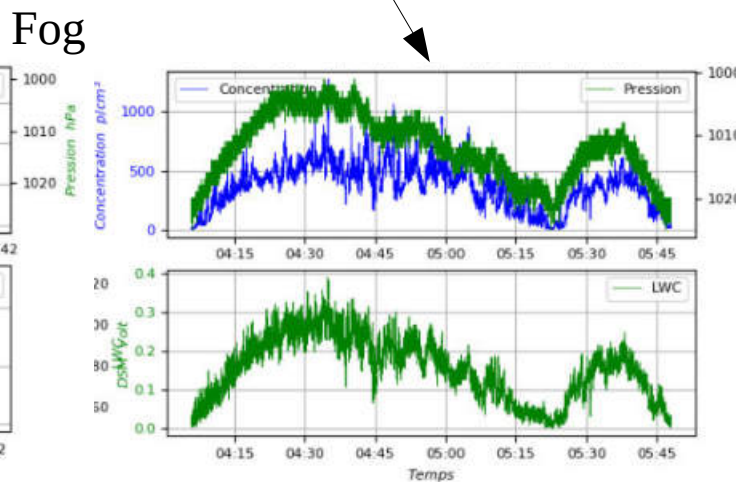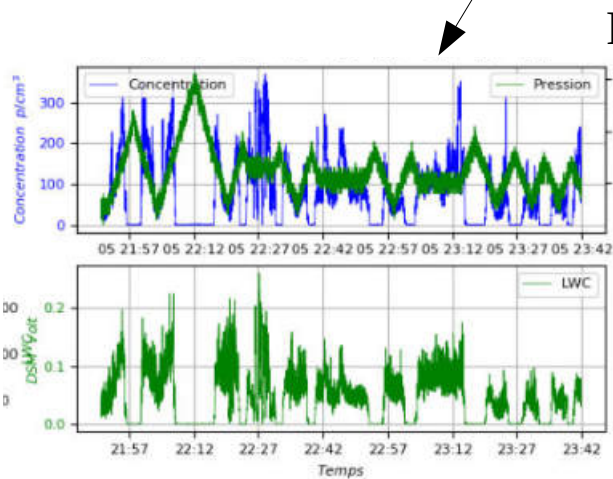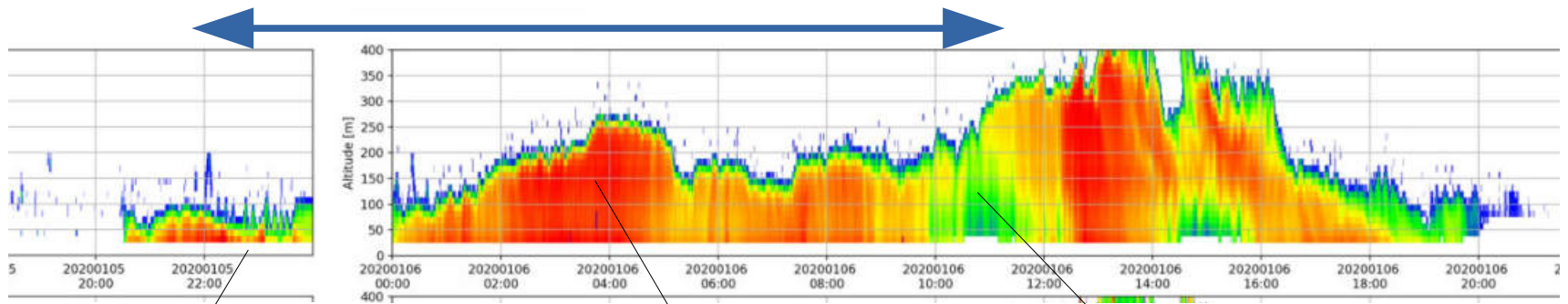
IOP-11 : night of February 8-9, 2020

- ~ 250m - lifting into a St cloud
- Aerosol profile at 18h15 UTC
- 4 CDP flights + turbulence from 21h55 to 07h20
  - 7 turb. legs at different altitude in the fog, below and above the top, St base
  - ~ 10 profiles (250m)
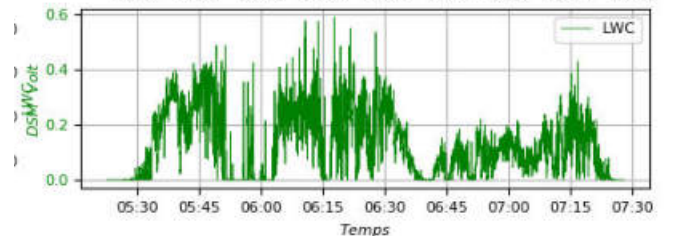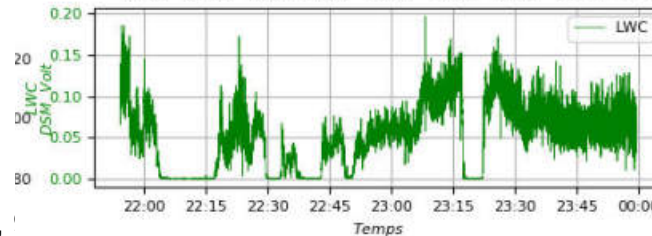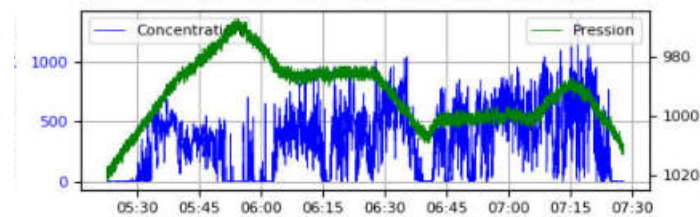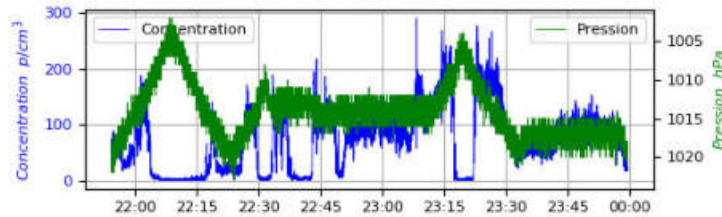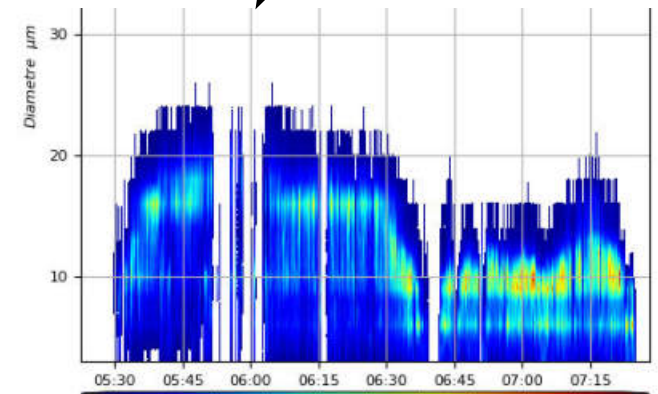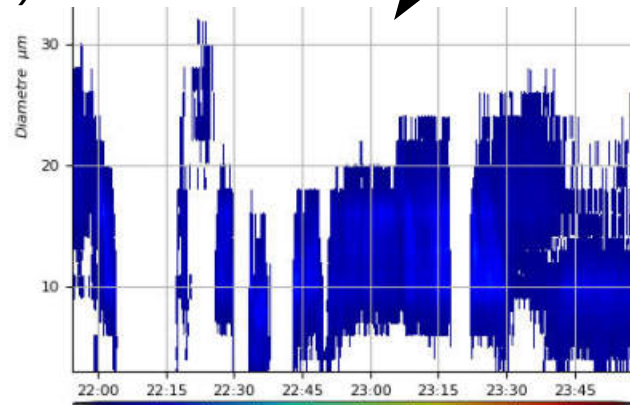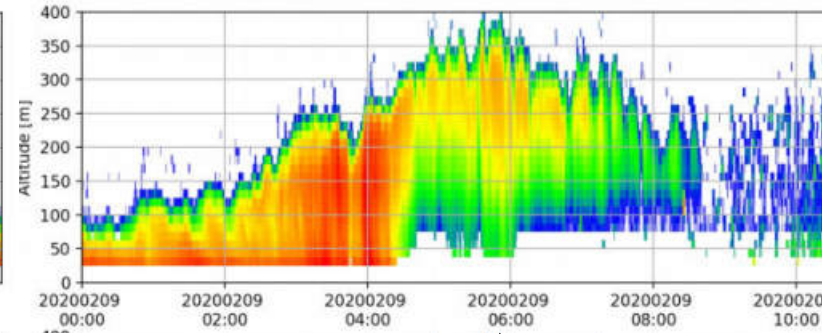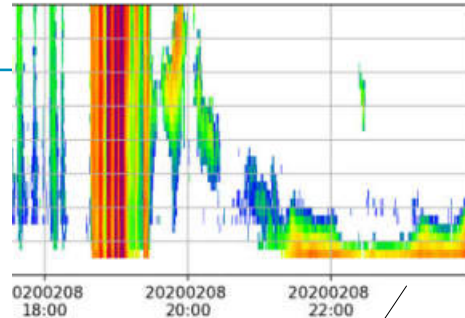
Stratus

POI11 du 8 au 9 février
Avec une visibilité moyennée toutes les 10 minutes
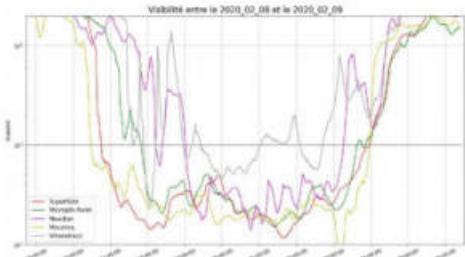
Villandraut visibilité plus élevée, durée de vie plus faible

(M.A Magnaldo)

IOP-14 : nigth of March 7-8, 2020

- 11 hours of fog from 21h to 8h UTC, Hmax ~ 200m, lifting into a Stratus cloud

- 4 CDP flights: 22h50 to 10h30 (~15 prof, 14 legs incl. 6 turbulence (St lifting)

- 4 UAV flights between 23h and 5h (2h30 of data – profiles + legs at 2 levels)

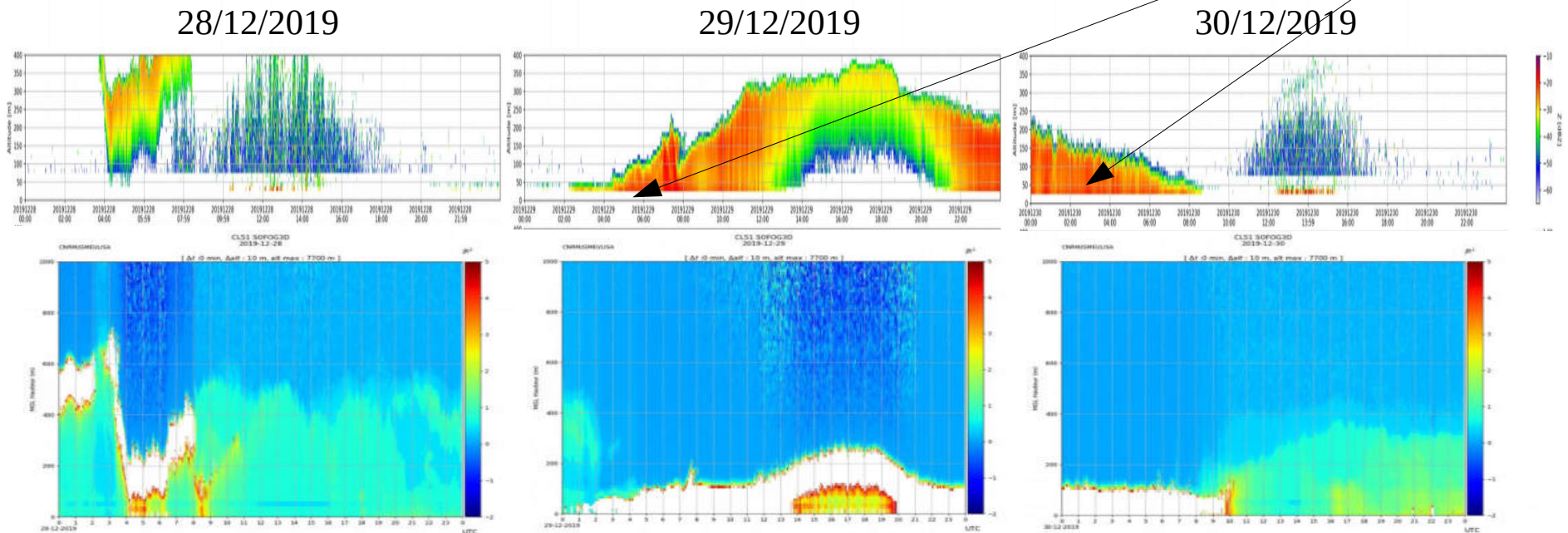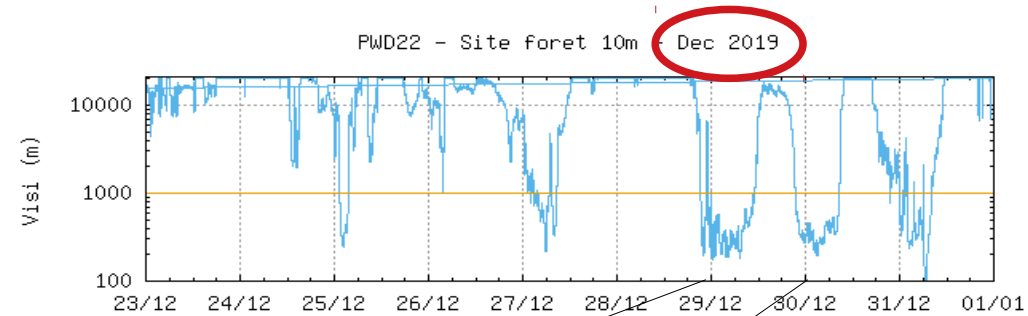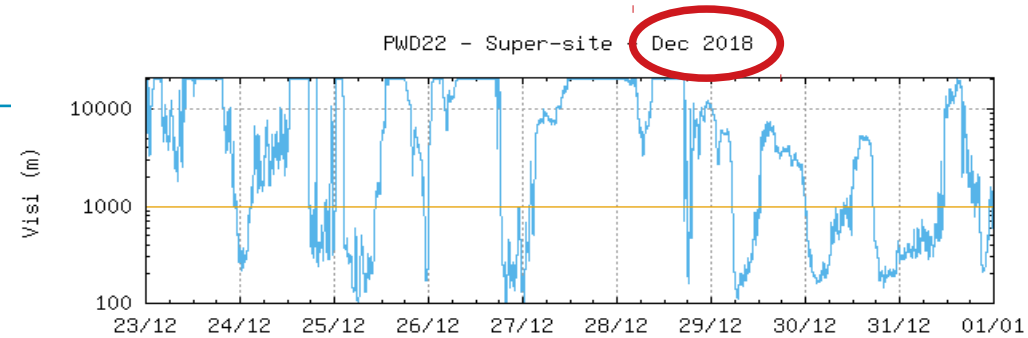UAV flight :
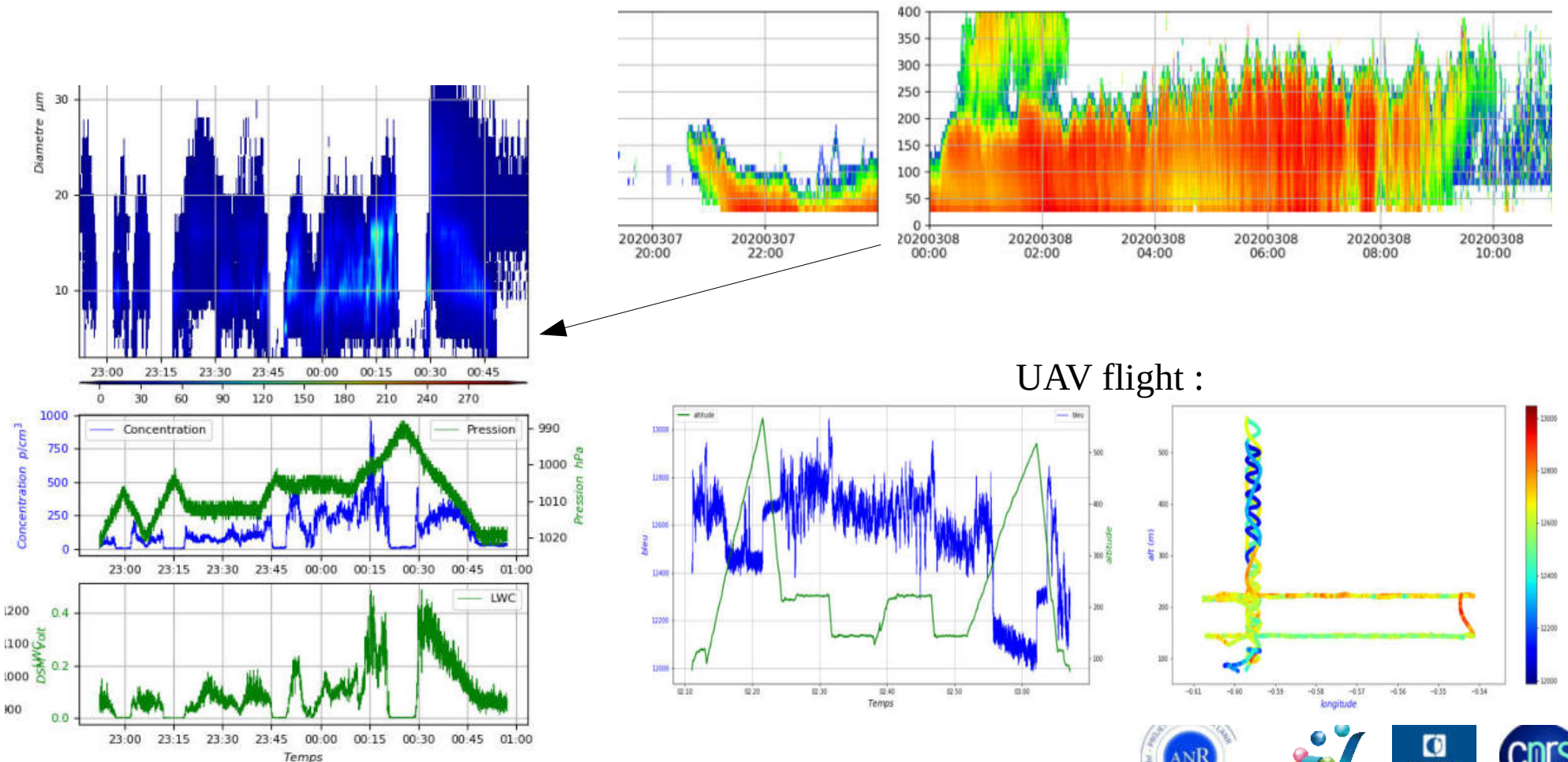
Nights of October 28 to 30, 2019

- The unique fog event sampled with the 50m mast

- missed IOP (1st fog event of the season)

- Large droplets of 30 µm (FM120)

PWD22 - Jachere - Oct-Nov 2019
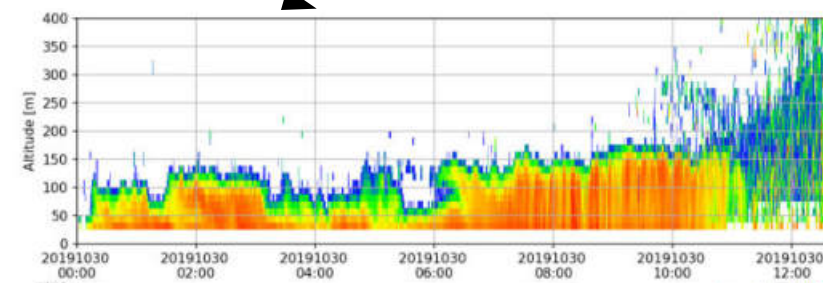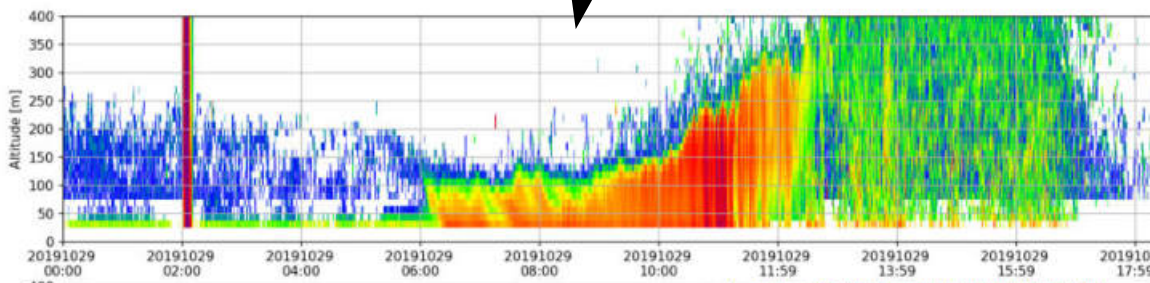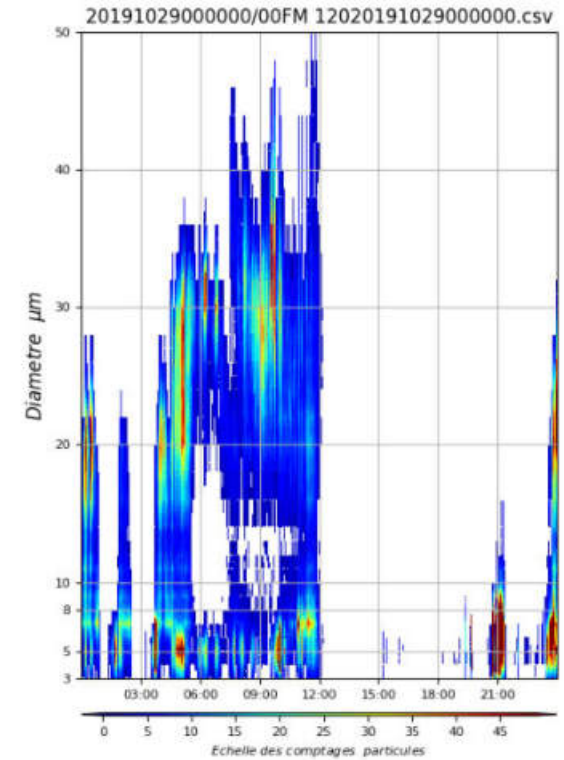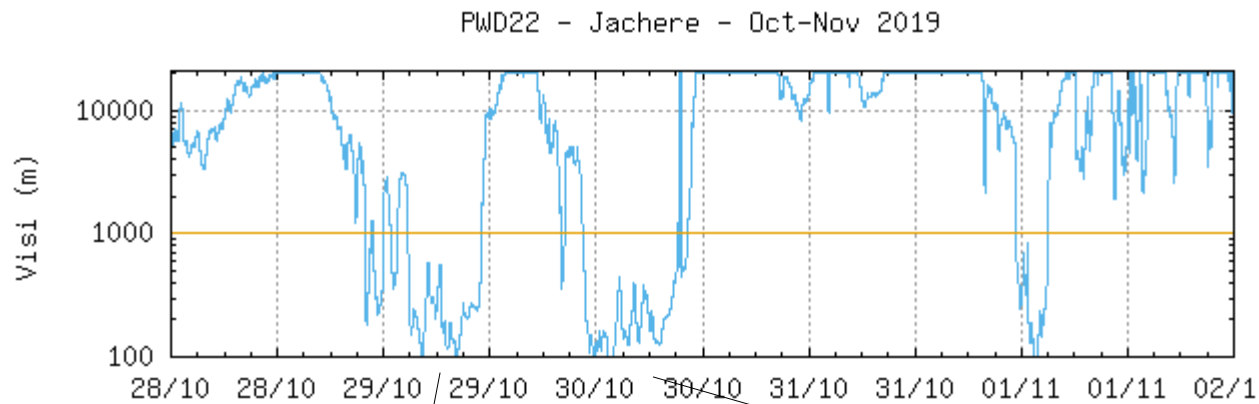
Xmas period

- Short even of Xmas night

- Loss of the balloon on the evening of 26/12 :

  — thin fog ~ 40m width the night of 26-27

  — St-lowering during the night of 27-28

  — 2 thick : ~250m 28-29 (3h) and 29-30 (8h)

  — IOP-5 during the night of 30-31: UAV only

PWD22 – Super-site   Dec 2018

PWD22 – Site foret 10m   Dec 2019

28/12/2019   29/12/2019   30/12/2019

IOP-5 : night of December 30 to 31, 2019

- Thin fog until 6h UTC : too much wind
- 3 UAV flights (1 in the Stratus) and RS
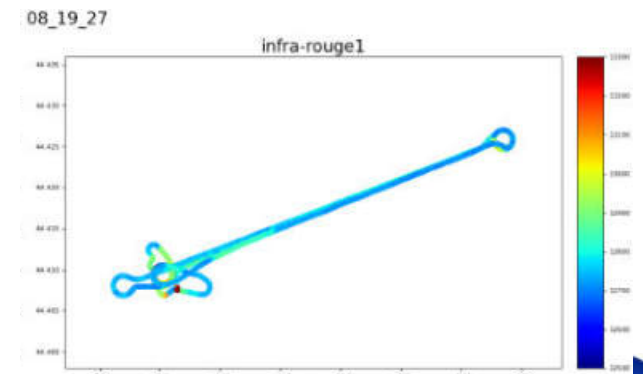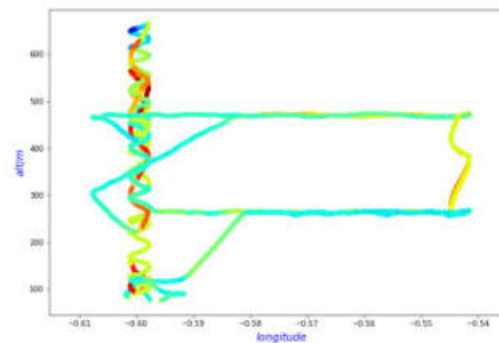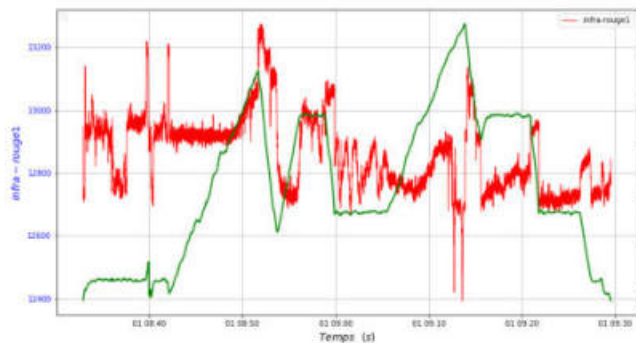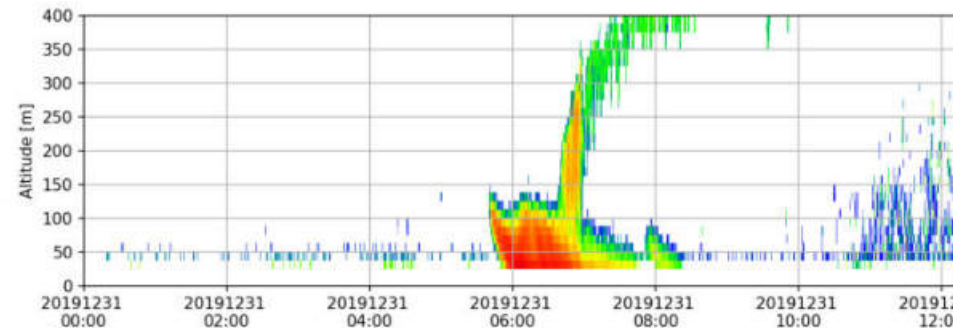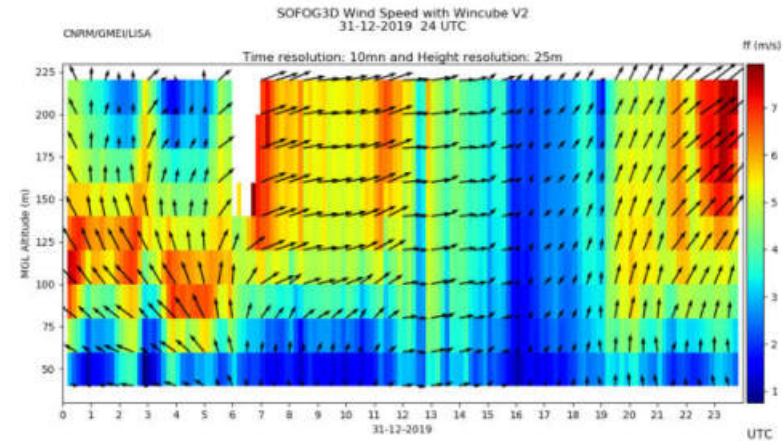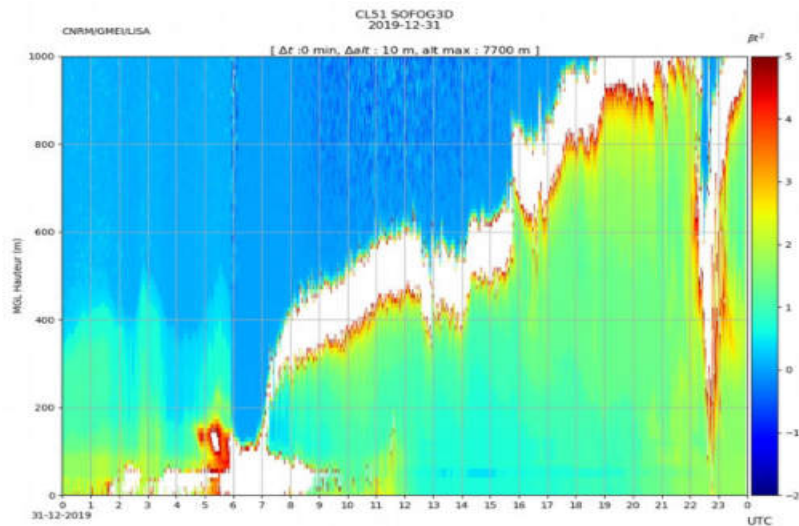
Summary

- 15 fog events sampled with the tethered balloon (20 nights of operations, 180 RS)

  => **3 main events (IOP 6, 11 and 14)** but many interesting thiner cases

- Despite technical failures and difficult weather conditions :

  — synergy 94 GHz radar, MWR and in situ profiling with microphysics and turbulence

  — volume sampling with scanning radar and UAV flights with ~5 km legs

  — MWR network (6 sites) for assimilation

  => **promising data set to document 3D heterogeneities and conduct process studies**

- large amount of data to process, validate and analyze... will take some time

- **Many thanks** to all people involved in preparation, forecasts, operations, processing....

SOFOG3D Data and Science Meeting : Agenda

- 9h00 : Intro and 2019-2020 campaign overwiew - F. Burnet
- 9h20 : MWR network – assimilation Task5 - P. Martinet / A. Kremer
- 9h40 : Radar measurements – Task2 – J. Delanoë / S. Jorquera / A. Bell
- 10h00 : UKMO contribution – J. Price
- 10h15 : Turbulence and flux measurements - G. Canut
- 10h30 : Aerosol measurements and closure - C. Denjean
- 10h45 : UAV measurements - J. Viviand
- 11h00 : 3D LES and heterogeneities – Task 3 – C. Lac / Q. Rodier
- 11h15 : Advanced process studies – Task 4 – M. Haeffelin / C. Lac
- 11h30 : St to fog transition – Task 4.2 – M. Fathalli
- 11h45 : Evaluation of AROME model – S. Antoine
- 12h00 : AERIS database website – W. Maurel
- 12h15 : Discussion :

    data analysis, CDD/postdoc/Intership, papers, etc...

https://bluejeans.com/217558095/8583