IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Faire avancer la sûreté nucléaire

COSMIC ON AIR

A citizen science project for cosmic radiation monitoring in airplane

MUSÉUM
NATIONAL D'HISTOIRE NATURELLE

Planete Sciences
une aventure pour les jeunes

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Context

Legal obligation to monitor occupatIonal exposure for aircrew: both for GCR and **in case of SEP events**

Monitoring of exposure doses in most European countries is performed by calculations

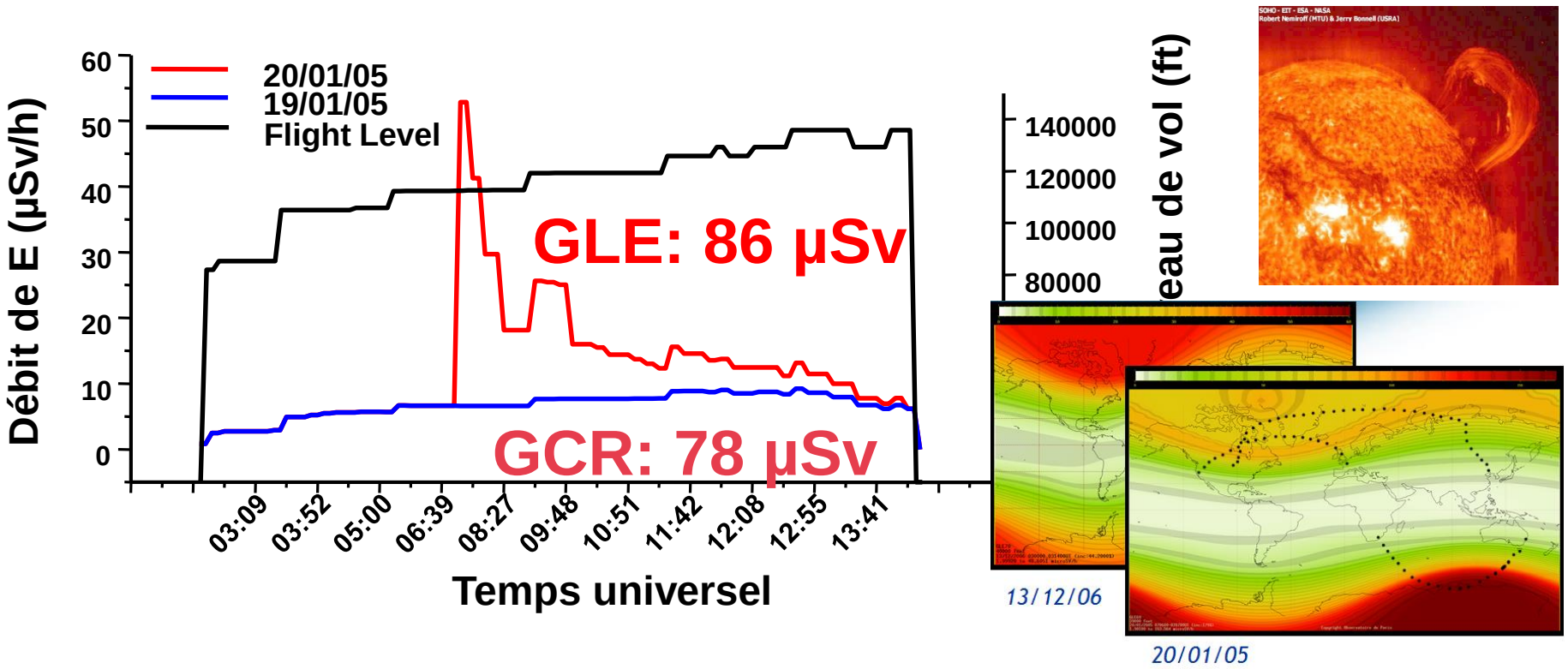
Article 42, directive 96/29/EURATOM may 13th, 1996

Arrangements for undertakings operating aircraft to take account of exposure to who are liable to be subject to exposure to **more than 1 mSv per year**. The undertakings measures, in particular:

- *to assess the exposure of the crew concerned,*
- *to take into account the assessed exposure when organizing working schedules with a view to reducing the doses of highly exposed aircrew,*
- *to inform the workers concerned of the health risks their work involves,*
- *to apply Article 10 to female air crew.* » (Article 10: the dose to the fœtus should not be higher than 1 mSv during pregnancy)

Motivations of the project

Improvment of aircrew dosimetry (in case of GLE)



Large discreapencies between models for GLE, no references!
Very few data measurements available during GLE: not sufficient for validation

Monitoring with airlines

- GLE are rare and sporadic events: permanent monitoring is required
- One large monitoring experiments in cooperation with Air France since 2013
- About 35 airplanes supplied with electronic dosimeters on long-haul airplanes
- **Limited flight routes (no polar route) with AF**
- Depend on airlines motivation

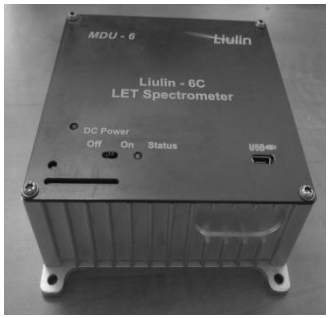
EPDN2
gamma and neutron dose, data stored every for every dose increment, scanning rate 1 min

LIULIN
energy deposited spectra in Si and D(Si) rate

HaWK TEPC
“Gamma” dose is calibrated vs low LET component from TEPC and “Neutron” dose vs high LET

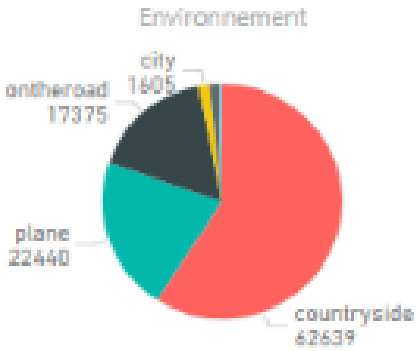
Project genesis and aims

- Needs for more inflight measurements during a GLE to verify model
- Limited possibilities of monitoring with airlines
- **Numerous citizen meas. But not reported and finally lost**
- Others phenomena to be studied in the atmospher (cf TGF…)
- Necessity to extend the actual network of in flight meas.: why not using data from citizen?



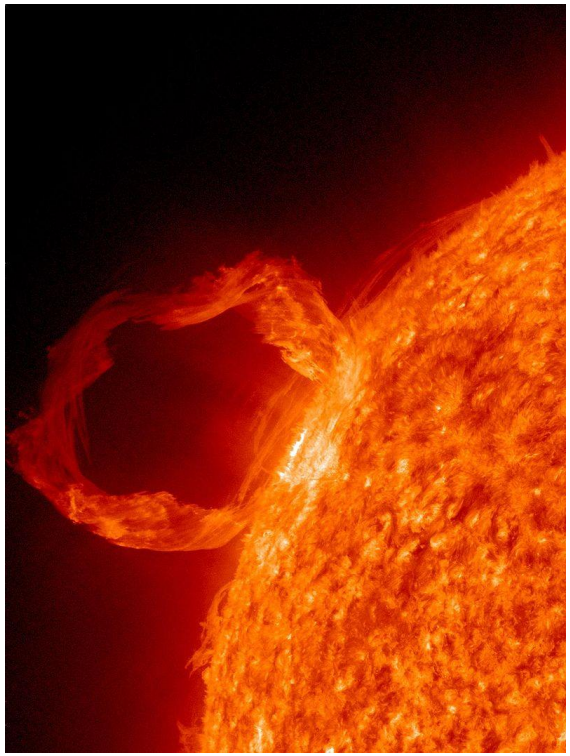
Mains problems with public meas

- Variety of devices types and model (GM, photodiode,..), not ideal for CR meas. but better than nothing
- **Needs for characterization to CR (in flight)**
- **Data collection from different devices**
- **Sharing the data collected with scientiific communauty**



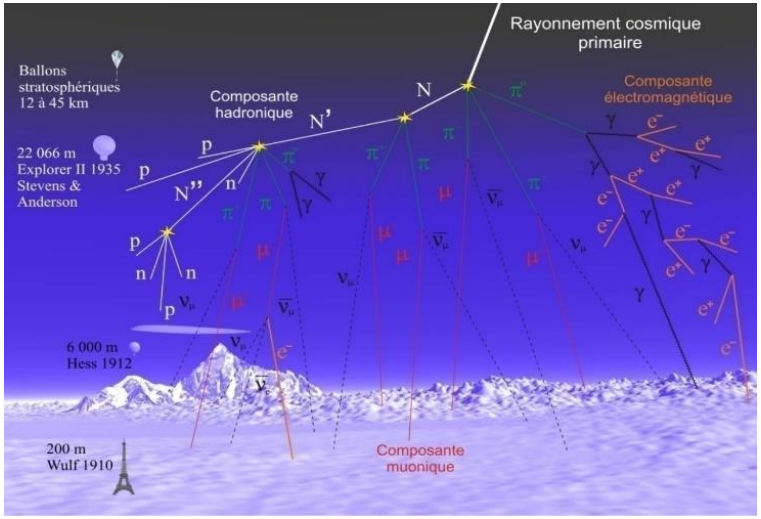
Project's aims

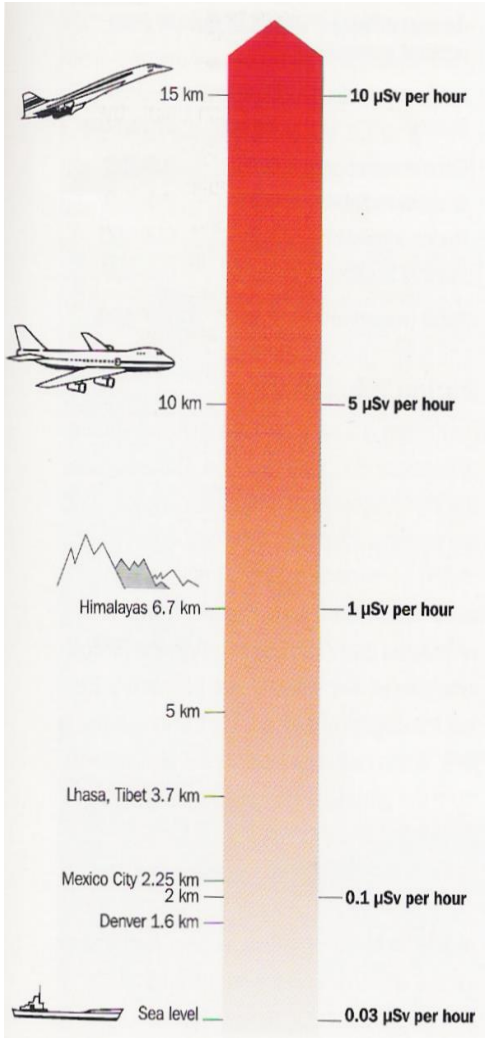
- **To collect** and organize the measured data to make them available to the scientific community
- **To consolidate** and structure the data collected in an open data frame
- **To develop** educational visualization tools for the general public and more technical tools for experts
- **To develop** our analysis tools to enhance the value of the data collected



Citizen motivation

- Participate in citizen science project on the theme **"Chase away solar flares“**
- Take ownership of the measurement of radioactivity, dose concepts and in particular in-flight dose levels





Functionalities of the project

- Use of structure of an already existing project (openradiation)

OpenRadiation devices

others detectors

Bluetooth/USB

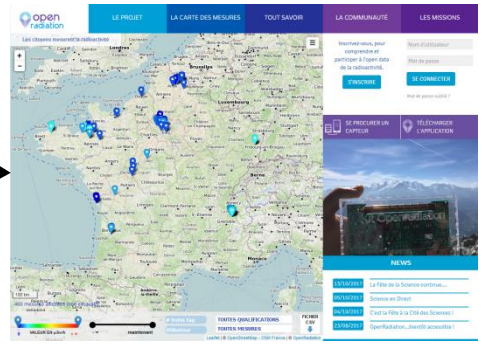
OpenRadiation Apps

Open API openradiation.net

Data access

Raw data files

OpenRadiation database



www.openradiation.org

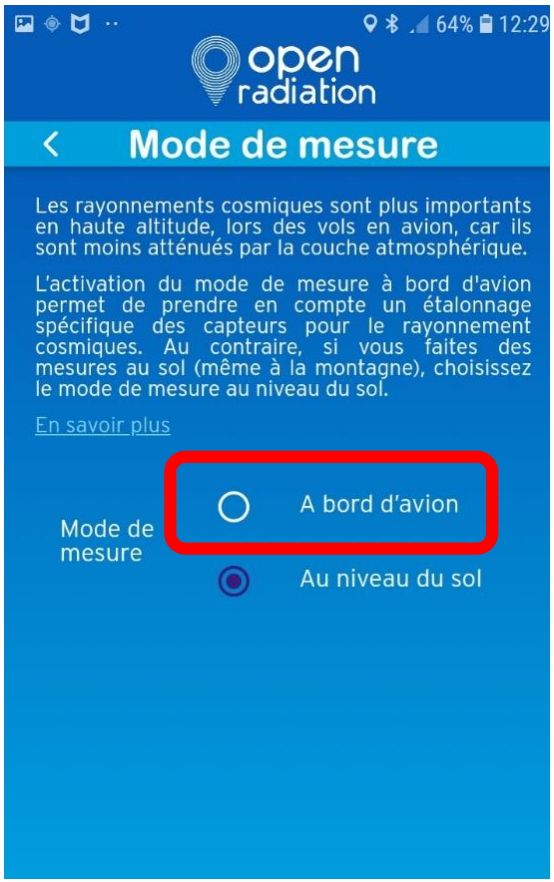
A free mobile app to collect data

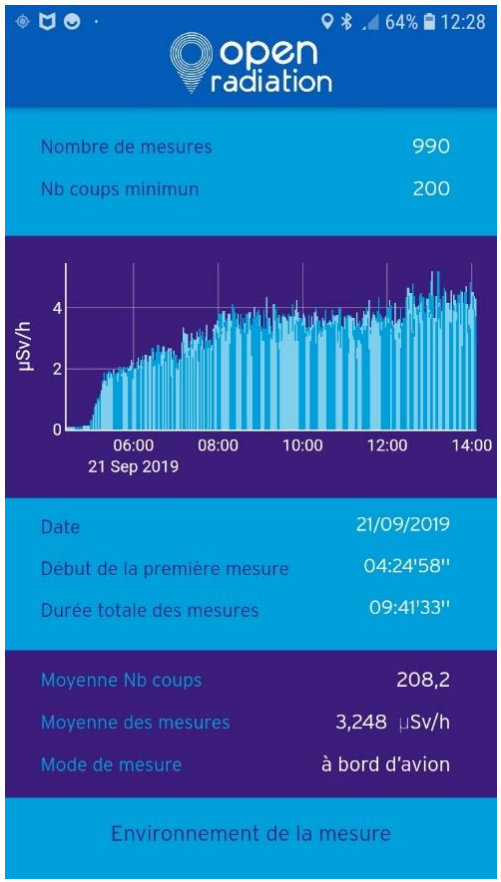
↗ OpenRadiation mobile application

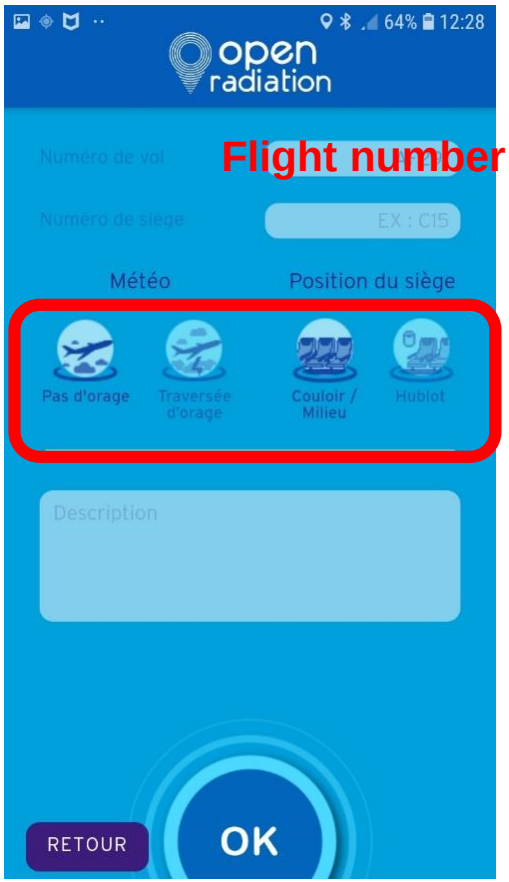
- Connected devices (BT or USB) to collect and share data (Safecast, Rium GM, Atomtage, pocketgeiger, openradiation kit, Polimaster)
- Possibility to connect more types in future and detectors from others projects
- **Calibration factors in the apps for each detector u**sed with openradiation app
- Two meas. modes: ground and in flight
  - Specific calibration to CR
  - Possibility to provide information as Flight number, seat, meteo (thunderstroms or not)..

Modification of the openradiation app

↗ In Flight measurements mode is now supplied

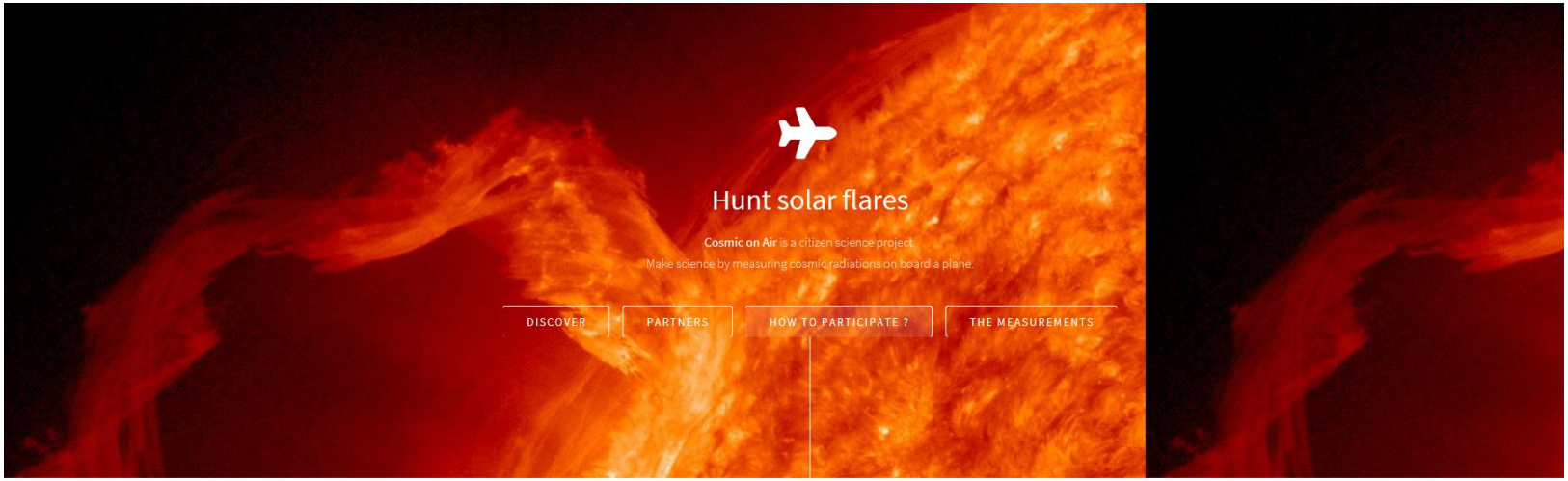






A dedicated webpage for the project

↗ Comunication with public and scientific communauty



The Cosmic on Air project

The Cosmic on Air project is a citizen science project which aims to collect measurements of dose rate carried out on board airplane by the public to organize and make them available to the scientific community, in particular those which could be carried out during solar flares. These phenomena can significantly increase dose rates at flight altitudes. Eruptions are sporadic phenomena and those with a significant effect are rare. Very few measurements made on board aircraft are available, which limits the understanding of these phenomena in the atmosphere.

Understand more

www.cosmic-on-air.com

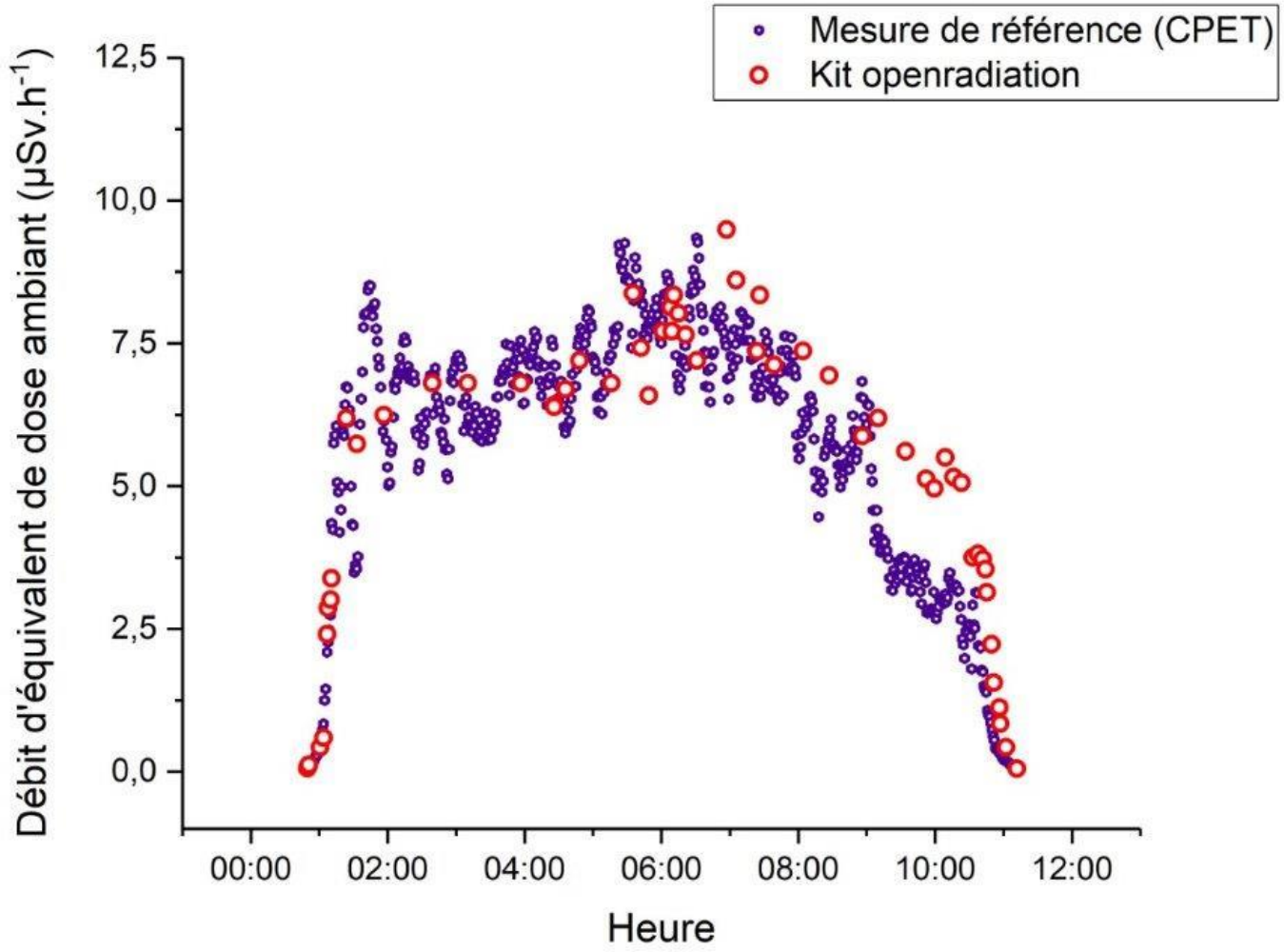
Calibration of devices

- Device calibration versus:
  - in flight measurement with TEPC (tissue equivalent propotionnal counter)
  - dose calculation

TEPC reference dosimeter

Meas with Atomtag system

Measurements comparison



How to participate

- Get a device (various devices compatibles)
- Create an account on the openradiation website
- Take a plane and make your CO_2 emission useful

How to join the project

- Propose a new measurements device
- To insure project promotion in your own country

Conclusions

- New citizen science project (opendata)
- Project complementary to airline monitoring for GLE model improvment
- Education of Public on Radiation Risk and GCR