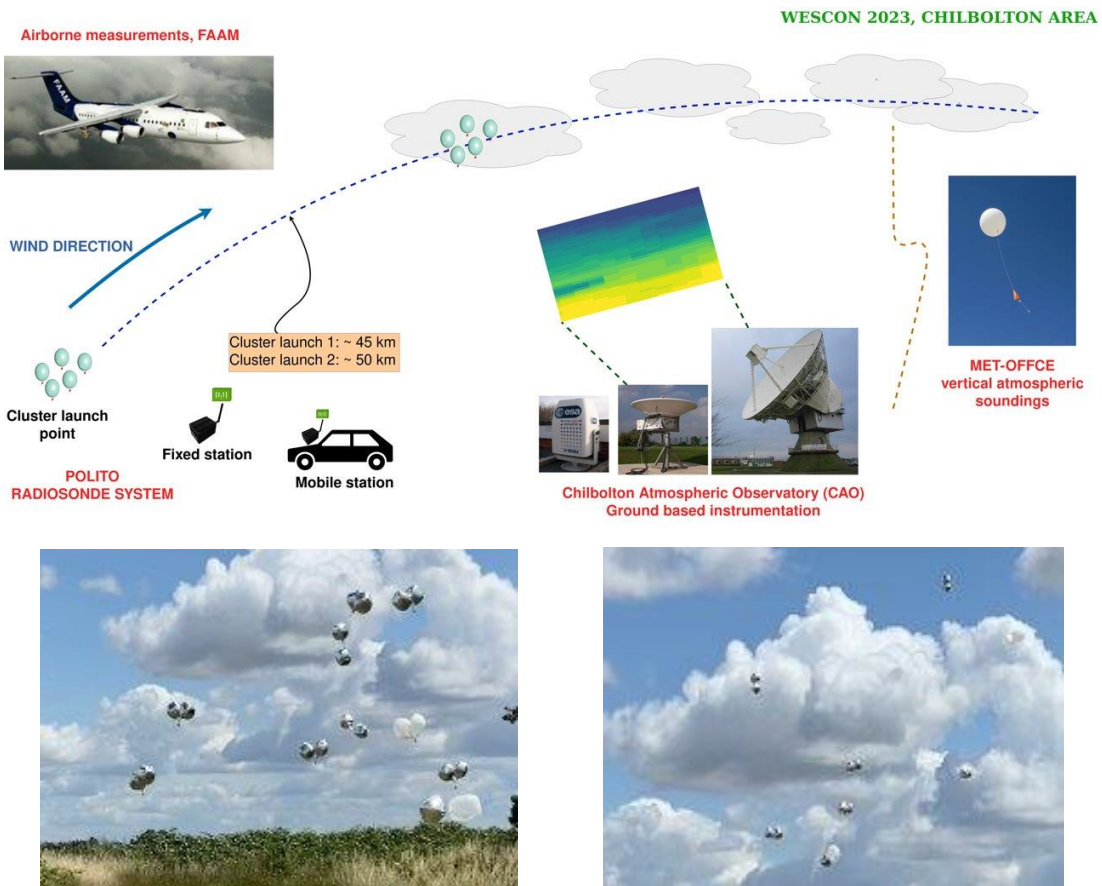# Dataset description of POLITO Radiosonde Cluster

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1. Raw dataset

Current version of the radioprobe comprises a set of components, such as:

- Radio transmission module
- GNSS (Global Navigation Satellite System) sensor
- IMU (Inertial Measurement Unit) including accelerometer, gyroscope and magenometer sensors
- PHT (Pressure, Humidity, Temperature) sensor.

Each radioprobe transmits a data packet to the receiver station with proprietary LoRa based transmission protocol. The data packet is uniquely identified with the **pair of radioprobe id and data packet counter** values. In the following table we can see the detailed description of the raw data packet.

#	Quantity	Comments	Format and range
1	`tx_time`	Timestamp of the radiosonde	Date HH:mm:ss
2	`micro_time`	Board timer	second
3	`count`	`Data packet counter`	Integer number
4	`lon`	Longitude	Decimal degrees
5	`lat`	Latitude	Decimal degrees
6	`alt`	Altitude	meters

7-9	vn ve vd	North, east and down direction velocity	[0, 500] m/s
10	pres	Pressure	[300, 1100] mbar
11	hum	Humidity	[0, 100] %
12	temp	Temperature	[−40, +85] °C
13-15	ax ay az	3D acceleration measurements in radioprobe body frame	[−16, +16] g
16-18	mx my mz	3D magnetic field measurements in radioprobe body frame (if avaliable)	[−4, +4] Gauss
19-22	q0 q1 q2 q3	4D quaternion vector from IMU sensor data. It is used for post-processing to obtain acceleration readings in NED (north, east, down) reference frame (not transmitted during Chilbolton launches)	Unit quaternions

2. Post-processed dataset

In addition to data packet quantities, we can provide the following quantities as a result of quick post-processing.

#	Quantity	Format and range	Comments
1	Pressure, humidity and temperature profiles with respect to Altitude	Pa, %, °C	PHT sensor readings are aligned with GNSS sensor readings to obtain profiles

2	North, east and down position	meters	Radioprobe positions with respect to local tangent plane in NED (north, east, down) reference frame. GNSS LLA (Longitude, Latitude and Altitude) coordinates are converted to NED coordinates. Reference observation point is set as origin of the NED frame during the conversion process.
3	3D accelerations in north, east and down directions	[-16, +16] g	Accelerometer readings are represented in NED (north, east, down) reference frame. Raw accelerations readings from the body frame of the radioprobes are converted to NED reference frame by using quaternion values.
4	Relative positions in NED frame	-	Relative distances among all radioprobes computed from their NED coordinates.
5	Distance-neighbor graph	-	Distance neighbor graph function (L.F. Richardson, 1926).
6	Fluctuations	-	Velocity, temperature, pressure, acceleration, humidity and magnetic field readings
7	Spectral profiles	-	-
8	Volumetric dispersion and concentration of radiosondes	-	-
9	Turbulent characeristics	-	Dissipation rate, anisotropy, ...