

Supplementary material

Suppl. Table 1: Technical specifications of the data logger installed in the Veyre River and in middle point of Aydat lake

HOBO Pendant® MX Temperature/Light Data Logger	Parameter specification
Manufacturer	ONSET
Temperature Sensor range	-20° to 50°C (-4° to 122°F) in water
Temperature Sensor accuracy	±0.5°C from -20° to 70°C (-4° to 158°F)
Temperature Sensor resolution	0.04°C (0.072°F)
Temperature Sensor drift	<0.1°C (0.18°F) per year
Light Sensor (MX2202) Range	0 to 167,731 lux (15,582 lum/ft2)

Suppl. Table 2: Technical specifications of YSI ProDSS Multiparameter Water Quality Meter

ProDSS Multiparameter Digital Water Quality Meter	Parameter specification
Manufacturer	YSI
ProDSS Conductivity, Temperature, Dissolved Oxygen sensors range	Temperature -5 to 70 °C (temperature compensation range for DO mg/L measurement: -5 to 50 °C); Conductivity - 0 to 200 mS/cm; , Dissolved Oxygen 0 to 500%, 0 to 50 mg/L
ProDSS Conductivity, Temperature, Dissolved Oxygen sensors accuracy	Temperature - ±0.2 °C; Conductivity - 0.001, 0.01 or 0.1 µS/cm (range dependent); Dissolved Oxygen 0 to 200%: ±1% of reading or 1% saturation, whichever is greater 200 to 500%: ±8% of reading 0 to 20 mg/L: ±0.1 mg/L or 1% of reading, whichever is greater 20 to 50 mg/L: ±8% of reading
ProDSS Conductivity, Temperature, Dissolved Oxygen sensors resolution	Temperature - 0.1 °C or 0.1 °F (user selectable) ; Conductivity - 0.001, 0.01 or 0.1 µS/cm (range dependent); Specific Conductance - 0.001, 0.01, 0.1 mS/cm; Salinity - 0.01 ppt; Resistivity - 0.001, 0.01, 0.1 ohms; Sigma T- 0.1 sigma; Dissolved Oxygen 0.01 mg/L and 0.1%, or 0.1 mg/L and 1% (user selectable)

Direct outputs	Barometer (mmHg), temperature (°C), Conductivity and specific conductance ($\mu\text{S}/\text{cm}$), Salinity (psu), Dissolved Oxygen (% saturation & mg/L), pressure (pis a), depth (m)
Indirect outputs	thermal structure (stratification strength), salinity, and resistivity
Data acquisition	punctual measures during lake sampling

Suppl. Table 3: Technical specifications of the cloud radar MIRA35c installed at Aydat

Radar MIRA35c	Parameter specification
Manufacturer	METEK
Radar system	Monostatic pulsed Doppler polarimetric
Transmitter frequency [GHz]	35.00-35.15 +/- 0.1 (band Ka)
Radar core	Magnetron
Peak power [W]	2500
Antenna type	Casse grain
Antenna diameter [m]	1
Antenna gain [dB]	48.5
Antenna beam width [°]	0.6
Pulse repetition frequency [kHz]	2.5 - 10
Pulse width [ns]	100 - 400
Unambiguous velocity range [m s-1]	+/- 10.65
Uncertainty [dB]	noise : 3.4 (LNA) + 1.5 (T-R-switch) + 0.2 (couplers and flanges)
Height range [m]	300-15000
Range resolution [m]	15-60
Velocity resolution [m s-1]	0.01
Velocity unambiguity [m s-1]	11-42
Direct outputs	Profiles of: radial velocity ; RMS = Doppler spread ; ratio of the power from co- and cross-polarized signal (LDR); reflectivity factor
Indirect outputs	Rain kinetic energy and classification
Begin of operation	July 2020

Suppl. Table 4: Technical specifications of the rain radar MRR pro installed at Aydat

Radar MRR	Parameter specification
Manufacturer	METEK
Radar system	Vertical doppler Frequency Modulated Continuous Wave (FMCW) radar
Transmitter frequency [GHz]	24.23 (Band K)
Peak power [mW]	50
Antenna diameter [m]	0.60
Antenna beam width [°]	1.5
Sampling frequency [kHz]	500
Min. detectable radar reflectivity (z = 1000 m, $\Delta z = 100$ m, $\Delta t = 60$ s) [dBZ]	-8

Velocity resolution [m/s]	0.05 to 6.00
Nyquist velocity range [m s ⁻¹]	12.3 to 96.3 m/s
Height range [m]	30 to 4000
Direct outputs	Vertical profiling of drop size distribution density (N) , rain rate (RR) and liquid water content (LWC); Equivalent Radar Reflectivity Factor (Ze); Fall velocity (W)
Indirect outputs	Rain kinetic energy and classification
Begin of operation	July 2020

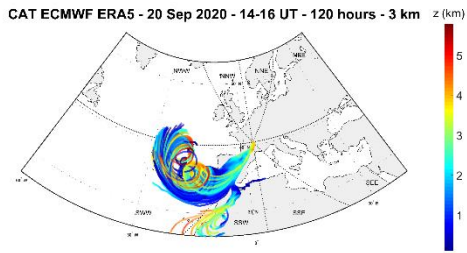
Suppl. Table 5: Technical specifications of the Parsivel² disdrometer installed at Aydat

Parsivel² Disdrometer	Parameter specification
Manufacturer	Ott
Wavelength [nm]	650
Output power [mW]	0.2
Accuracy [%]	+/- 5% (liquid) +/- 20% (ice/snow)
Particle size Detection range [mm]	0.2 - 8 (liquid) and 0.2-25 (ice/snow)
rain rate : min (drizzle rain) /max intensity [mm h ⁻¹]	0.001 / 1.2
Direct outputs	Rain rate, diameter and velocity of rain drops
Begin of operation	July 2020

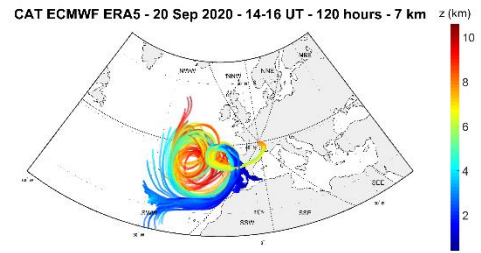
Suppl. Table 6: Technical specifications of the precipitation collector installed at Aydat

Rain collector	Parameter specification
Manufacturer	Eigenbrodt
Number/Size of bottles [~/ml]	16/250
collection area [cm ²]	500
Sensor	precipitation sensor IRSS 88
Sensor sentivity [drops/90s]	5
Delay time for new rain event [1]	1
Ambient temperature Operation [°C]	-30 to 45 (automatic ventilation above 25°C)
Direct outputs	Quantity of precipitation and number of rain events per days
Indirect outputs	viability of photosynthetic cells in rain (flow cytometry), pigment concentrations
Begin of operation	September 2020

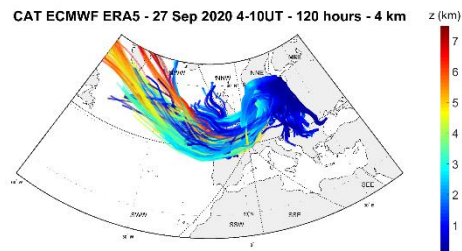
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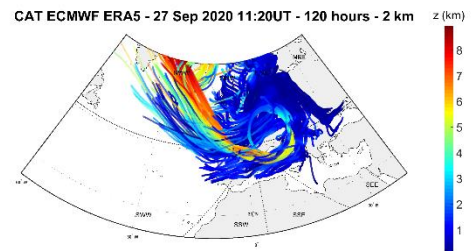
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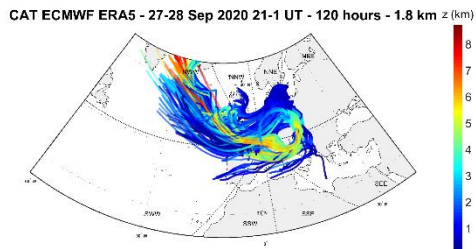
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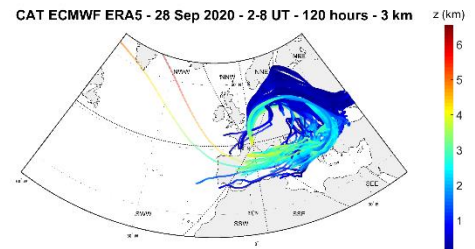
d)



e)



f)



Suppl. Fig. 1: 72-h backward trajectory plots at higher and lower cloud level, extracted from ERA5 data reanalysis, for the three rain events, (a-b) HIR, (c-d) CR1 and (e-f) CR2. The CR1's sub-events were represented.