

Report on test flights

1. Adapting UAV platform for atmospheric measurements

The following steps were necessary to adapt the UAV platform for research equipments

- Reinforcement UAV structural strength; Reinforcement junction wing - fuselage
- Structural Stiffener UAV;
- Making covers for access points;
- Installation jack actuators;
- Test planning and installing equipment;
- Testing UAV at ground level (engine running).

The adaptation of the airborne platform requires a series of flight tests and the following steps were performed:

- Programming autopilot;
- Connecting UAV in manual mode and autopilot mode;
- Connecting UAV in manual mode and autopilot mode with machete devices;
- Autopilot flights with devices installed in UAV during April-June 2014.



Fig. 1 ATMOSLAB

2. Organizing test flights for intercomparison of ground and airborne instruments

Under CAPESA project in 2014 were performed some research flights to determine the microphysical parameters of aerosols and clouds. The flights were performed with ATMOSLAB aircraft (Property of INCAS) equipped with two sensor systems, CAPS (Cloud, Aerosol, Precipitation Spectrometer) and HAWKEYE probe particles.

- CAPS (Cloud, Aerosol, Precipitation Spectrometer) is composed of five sensors: aerosols and clouds spectrometer (CAS: 0.51 - 50 μm) clouds imaging probe (CIP: 25-1550 μm resolution 25 μm or 15 μm 15-930 μm resolution) detector of liquid water content (LWC: 0.01 - 3 gm^{-3}), a wind speed and a temperature sensor.

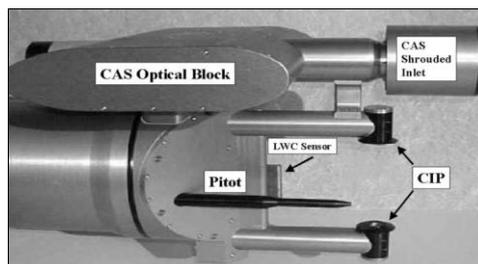


Fig. 2 CAPS

- Hawkeye test combines three detection systems and imaging of atmospheric aerosol and hydrometeors: a module which measures scattering determining size particles (1-50 μm), a CCD camera and two channels for particle images.

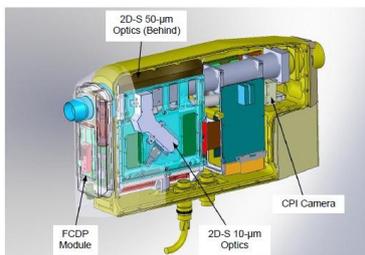


Fig. 3 Hawkeye System

3. Results

In the south part of Romania a flight was performed to sound a low cloud formations associated with severe rainfall. In the Craiova city area, were made four horizontal lines inside the cell cloud, between 1100 and 650m altitude. In Figure below, is shown the entire flight path corresponding to the four trajectories and associated sounding lines.



Fig. 4 Craiova atmospheric sounding

Correlating information on temperature and pressure variation during sounding with information obtained from CAPS and Hawkeye sensors can easily confirm the presence of large ice crystals, 500 μm and small droplets. This ice crystals in high concentrations associated with moderate icing phenomenon process on ATMOSLAB aircraft was confirmed both from measurements made with CIP sensor - Cloud Imaging Probe and the 3D images acquired with the camera inside the Hawkeye system. In the first stage of data analysis, acquired images are analyzed using dedicated tools software. After the processing steps, images were sorted according to the form of ice crystals being statistically analyzed the distribution of certain types of crystals inside the cloud.

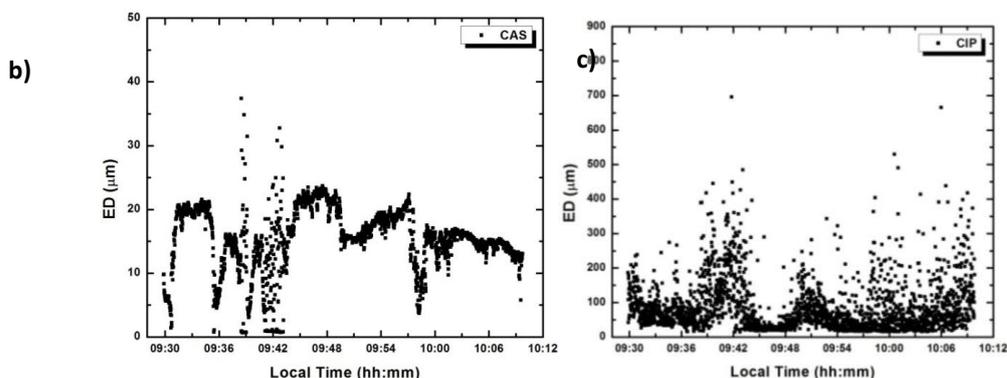


Fig. 5 Effective radius for small particles Caps (left) and for big particles (right)