Meteorological Data in the Open Glider Network (OGN)

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MOTIVATION

- **Demand on Aviation Meteorology**
  - GA, UAV ops require next generation avi.met

- **NWP trends**
  - $dx \to \sim 1\text{km}$, adequate params (mp, ism, sfc, pbl, cu)
  - Community models (with proper setup and DA)
  - Software container technology
  - suitable data from the PBL is required

- **UAS trends**
  - sUAVs: feasible platform
  - Big Data PBL characteristics

- **Data flow**
  - Special sensors
  - equipments
  - infrastructure for
    - data transmission
    - data processing

- **Utilize meteor obs as a “side effect”**
  - Most gliders: FLARM use OGN for tracking
• **WRF v3.9.1**
  - 9-3-1km resolution nests
  - Increased vertical resolution near surface (dz1=4m)
  - Physics setup selected from 30 setups testing at 20 different “interesting” situations
  - CORINE landuse database
  - DKSIS soil database
  - Modified (MARTHA, HUNSODA) soil hydraulic data tables

- Input: 0.25deg GFS, 4 times a day + local (SFC, sodar, TWR) meas.
- 3DVAR data assimilation
  - ready for the reception of UAV profile measurements
Model output

of model output meteorological product in support of aviation: icing characteristics.
Further examples:
- Visibility
- Low ceiling
- Turbulence
- Severe convection (CB, TS, SQ…)
- Wind, wave, thermal data (bal, gld)
UAS instrumentation

- Standard GRAW radiosonde
  - DFM-09 rawinsonde and GND receiver
- Sparvio UAV sensors from Windsond
  - SKH1 (Hub+logger+P+ext.GPS)
  - SKS2 (T+Rh@10Hz)
  - SKC1/RR1 (radio)
- OGN_Met-racker
  - BME280 PTH
  - SD log
  - Console output
GND receivers

rPi+SDR – OGN
RR1 – Sparvio
GS-U – GRAW
Simple Wind measurement

Ground Speed and Flight Path

Orange: cruising against wind
Blue: drifting with wind
Yields WS & WD
Red: exponential acceleration
Green: constant drifting (+turb)
Open Glider Network (OGN)

Built on FLARM anti-collision system
Utilizing as a tracking solution as a side-effect
Met. Data in the OGN

Built on OGN Tracking system (existing network with wide coverage)
Utilizing as a meteorological data relay solution as a side-effect
Continuously increasing receivers network
Coverage – HUN
GND receiver antenna
SBC (rPi)
Software radio (SDR)
The OGN_Met-Tracker

- BME280: PTH
- Console SD log
- Mobile OGN receiver

- weight <40g
- P ~mA
- Range >100km
- Cost <100EUR
Közelmúltban kutatócsoportunk - a lengyel core fejelesztő csapattal együttműködésben - megvalósította a meteor adatok lesugárzását, és a földi vevő hálózatba (APRS szervereken keresztül) történő implementálását.
OGN+SparvIO+GRAW
IoT solutions

- **LoRa, etc. based IoT device development (independent of OGN)**
  - Special met drones equipped by special atmospheric sensors and flying regular or targeted patterns from a network of drone stations in order to collect environmental data as input for environmental models (soil moisture, air quality characteristics, turbulence and lightning detection, visibility sensors, microphysics characteristics, etc);

- **4-5G solutions for data transmission**
  - Drones and GA airframes provide data as an input for NWP modeling being run as a driver of avi.met support systems – similar organic behaviour to the traffic information of navigation/mapping apps (e.g.: waze, gmaps, etc.).
Nodes

HPE Edgeline EL300 and EL1000 nodes serving as IoT Gateway for local preprocessing and NWP integration (4DVAR)

Local nodes serving as local meteorological/drone control hubs and data servers (data communication to airframes serving wx/as/etc info for trajectory optimization.)
The (near) future

- LoRa, etc. based IoT device development (independent of OGN);

- 4-5G solutions for data transmission;

- HPE Edgeline EL300 and EL1000 nodes serving as IoT Gateway for local preprocessing and NWP integration (4DVAR)

- Drones will NOT substitute weather balloons at high altitudes and marginal weather (icing, heavy precip., storm, severe WS, SQ, etc...)
Thank you for your attention!

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