MetSim: A Tool for the Simulation of Meteorological Sensors and Verification of New AWOS

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ABSTRACT

The German Meteorological Service (DWD) will replace all automatic weather observing systems (AWOS) at the 16 international German airports. All existing sensors as well as the communication infrastructure of the present installation have to be reused for the new system called “ASDUV_E”, which is presently being finalized by the company Telvent Netherlands. For acceptance tests – and later routine testing – a sensor simulator was commissioned to facilitate the testing of the communication between all sensors and the data acquisition systems and the correctness of the AWOS data processing.

The simulator – called ‘MetSim’ – is capable to simulate all sensors of a fully equipped airport (at least 130 instruments) including static values, predefined runs with added statistical variation as well as the replay of recorded weather data of real sensors from the field.

Sensor telegrams can be modified and new sensor types can be defined by configuration without changing the program code.

An essential feature is the ability to compare all parameters in real-time to the values determined by the AWOS under test including derived values, METARs, SPECIs, data telegrams to air traffic control (ATC) etc. The structure and the scope of the sensor simulation tool are presented.
Simulation Module
The test tool MetSim includes a simulation module to generate the data messages of all sensors types presently used at the different airports (e.g. MOR, wind speed and direction, pressure, temperature, humidity, clouds). The sensor data created in the simulation module is arbitrarily adjustable. The simulated values can be changed via keyboard or mouse. The test tool also allows the users to set the different possible states of a sensor such as 'defective', 'heater failure', 'power fault' or 'windows contaminated'. The simulator is capable to simulate all sensors of a fully equipped airport including static values, predefined runs with added statistical variation as well as the replay of pre-recorded weather data of real sensors from the field. The time characteristics of each sensor is selectable from different presets (linear, step, curved). Sensor telegrams can be modified and new sensor types can be defined by configuration without changing the program code. Also generated by MetSim is the information from the ATC tower such as runway direction or information on runway illumination, transmitted as XML telegrams. The sensor data telegrams are finally sent to the AWOS under test, and internally to the algorithm module where the data is processed by the algorithms as defined by DWD.

Algorithm Module
This module uses the algorithms as defined in appropriate regulations to calculate all corresponding meteorological parameters (e.g. RVR, QNH, tail and cross wind, cloud layers) and statistical values such as averages, min., max. values from simulated sensor inputs.

Comparison Module & Logging
The comparison module of the test tool compares processed sensor data with data from the AWOS server (meteorological data and data telegrams to the ATC provider via proprietary back channel). Differences of the target/actual comparison are highlighted and displayed instantly. All inputs, outputs as well as relevant internal parameters are logged into a protocol file for later reference.
Fig. 2: Ruler mode of sensor simulator to adjust sensor data and statistical noise ranges.
Fig. 3: Telegram mode to display data telegrams as transmitted by the sensor interfaces.
Fig. 4: Timeline to specify time response of a simulated sensor in an easy and intuitive way.
Fig. 5: Variables view for target/actual comparison (comparison module).