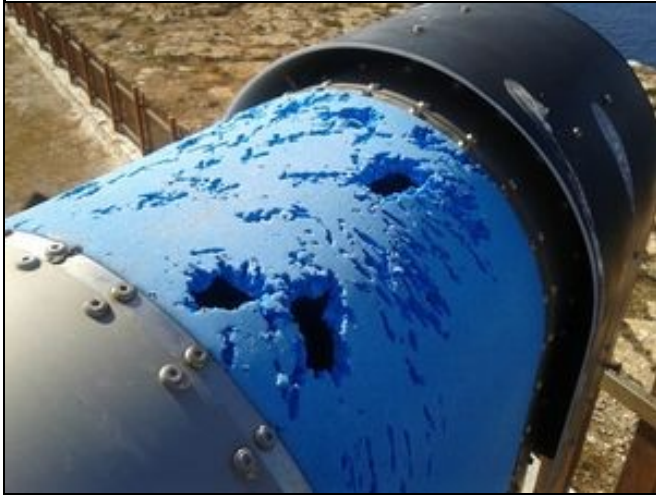


# 1 Technical implementation

## Instrument set up



Seagul damages on the radome

- Continuous monitoring of MWR via remote access as well as a webcam (particularly the microwave transparent radome) are strongly suggested.
- Operational MWR are mostly provided with an heated blower system to avoid/reduce the accumulation of water/ice on the radome. It is suggested to switch on the heater, when the relative humidity exceed the 70%.
- Even though the commercial MWRs can are quite heavy, it is recommended to fix the radiometer on the ground or add further weights to the stand for preventing damage due to very strong wind.
- Birds show the terrible habit to damage the radome. Although visual inspection can reduce the impact of this problem, very good results (at least with seagulls) have been obtained by using nylon strings and nails above and near the radome (see picture).

## Maintenance recommendations

- Pure water should be use to periodically clean the radome window of MWR to prevent the reduction of the radome hydrophobic behavior; if a IR camera is used, also the lens and the gold mirror should be cleaned. Care should be used when using a camera in a marine environment, due to possible damages of the IR camera lens coating.

## Data processing and quality control

- To allow a complete reanalysis of data, the storing of uncalibrated data, including the types of operational mode and the automatic calibrations of MWR, and of all the possible ancillary data (meteorological parameter, rain detection, ...) is necessary.

- Although most commercial MWR are equipped with rain sensors warning for the presence of rain, it is advisable to compare these data with other measurements such as webcam, IR camera or rain gauge to avoid of eliminating a too few or, more a too great probably, number of data.
- Non-physical values of brightness temperature (i.e. lower than 2.7 K or greater of 330 K) as well as of IWV and LWP can be also used to detect possibly malfunctioning.
- In spite of using different automatic quality controls, a ?by eye? inspection of quick look brightness temperature is recommended in order to assure a complete quality control of data that can evidences also not meteorological disturbances such as humans, bird, sun, moon, aircraft...

## 2 Tips and recommendations

### For HATPRO users

#### *Sky tipping calibration on the water vapour line*

Due to the declared high stability of the RPG's instrument the manufacturer suggests to not use sky tipping calibration, but only nitrogen calibration to be repeated each 6-8 months. The user that decides to perform sky tipping calibrations is suggested to perform bilateral sky tipping calibrations using the default thresholds as suggested by the manufacturer. To observe eventually bias or derivation of the measurements between different calibrations (especially in case of nitrogen calibration) it is suggested to compare the brightness temperature measured immediately after the nitrogen calibration.

#### *Nitrogen calibration*

The standard nitrogen calibration frequency is around 6 months or whenever the instrument it is moved from a location to another. The RPG manufacturer suggests to perform the nitrogen calibration without cover the radiometer with plastic foil or similar differently as reported in previous versions of the user manual (i.e. it is recommended to wrap a plastic foil around the load+radiometer (wind protection) during absolute calibration to avoid the formation of condensed water above the liquid surface (caused by wind etc.) ). After filling the liquid nitrogen container it is suggested to check that the black absorber does not float and it is completely immersed in liquid nitrogen. After the nitrogen calibration the polystyrene container should be emptied from the nitrogen and put in vertical position in a way that nitrogen residuum could run out; this helps the maintaining of the black absorber.

#### *Gain calibration*

In standard case the RPG manufacturer suggests to perform the gain calibration every 5 minutes for 8-10 seconds.

#### *Interference (RFI)*

Depending on the type of RFI interferences they should appear as spikes or increase in the row signals generally not affecting all channels.

### *Instrument setup (obstructions, location, etc.)*

Microwave profilers should have a free field of view for performing sky tipping calibration and retrieve profiles of humidity and temperature. Although a completely free field of view is desirable, the first obstacles on the line of sight of the radiometer should be generally distant at least 10 km for sky tipping/humidity profiler and 1 km for boundary layer temperature retrieval.

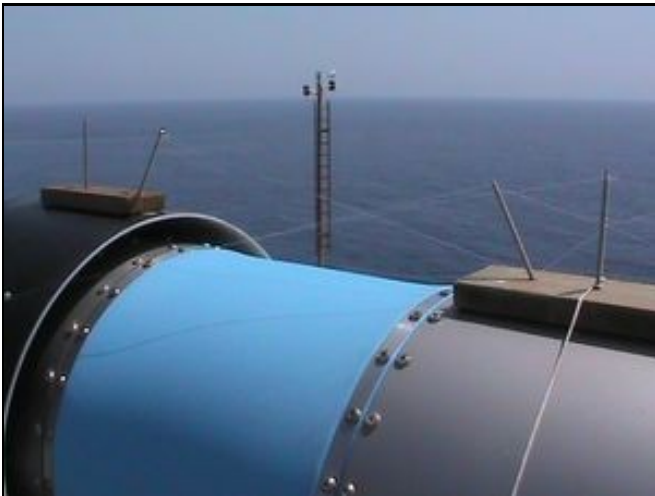
### *Water/ice/dirt detection over the radome*

The microwave window sheet (rubber foam highly transparent to microwave frequencies) must be clean of water/ice/dirt at all times. Environmental conditions deteriorate the rubber foam of the microwave window, reducing its hydrophobic characteristics; therefore it is recommended to replace it every other year.

### *Water detection over the radome*

The marker of condensation occurring over the radome it is characterized by a steadily and regular increase and decrease of the signals of channels in the water vapour line (K band). Such behaviour it is also generally visible on the retrieved LWP values.

### *Cleaning of dirt*



### *Seagull damages on the radome*

Depending on the operational environment it could be useful to wash the radome window (and the optics, the lens and particularly the gold mirror of the IR radiometers if installed on the microwave radiometer) with ?pure water? (when necessary a soft sponge and mild soap may also be used). In demanding environment presenting phenomena as elevated concentrations of sea spray or intense events of aerosol depositions (example desert dust environment or ?yellow? rain), the accumulation of aerosols above the radome window could reduce the hydrophobic feature of

it, while the deposition of aerosol layer on the gold mirror can influence the IR measurements. This behaviour is more prominent in humid environments. This problem could also occurs in highly polluted sites.

### *Rain flag*

Especially in humid environment (for example coastal environment) the rain sensor often can indicate false rain event. It is advisable to compare the indication of rain flag with independent measurements such as IR camera measurement or brightness temperature of the radiometer in the water vapour line.

### *Radome integrity (birds)*

Birds can damage or perforate the radome window by mean of their beak or claws. It is difficult to avoid this problem although visual inspection (maybe also by webcam) can reduce the effect of radome breaking. Aluminium nails could also be fixed close to the radome window to prevent birds standing on the radiometer.

### *Adverse atmospheric conditions*

To avoid problems in case of very strong wind it is suggested to fix the radiometer on the ground or (in case of RPG radiometers) or ballast the stand with some weights.