**IR20**

The IR20 is a pyrgeometer manufactured by Hukseflux. It measures broadband infrared (longwave) radiation. A black mirror silicon dome covers a thermopile (thermocouples in series). When the top of the thermopile is a different temperature than the bottom of the thermopile, a voltage is created. This voltage is measured and is calibrated to Wm-2. A pyrgeometer is designed so that the thermopile shaded from sunlight and affected only by infrared radiation. The thermopile is either warming or cooling relative to the target. Usually, for an upward-facing instrument, the thermopile cools to space (the sky temperature is cold). This cooling is large when the sky is clear and near 0 when it is very cloudy. The thermopile voltage is measured by the logger as well as the temperature of the instrument body. These values are used to derive the longwave flux. Two IR20s are installed on each ASFS station, one facing up (measuring incoming radiation emitted by atmospheric gases and cloud, termed “downwelling longwave” LWD) and one facing down (measuring outgoing radiation emitted from the surface termed or “upwelling longwave” LWU). The IR20s have a small internal heater and are mounted inside of a ventilator. The heat and ventilation are meant to mitigate ice formation and to help maintain a homogeneous temperature across the instrument.

**Turning the system on/off:**

Connect/disconnect power source.

Sensor is unpowered but heaters and a fan are fused 12 VDC

**Communications & Settings:**

 The voltage across the thermopile is measured using a differential voltage measurement at differential channels 1 and 2 on the logger. Single-ended voltage measurements at SE 5 and 6 as part of a half-bridge circuit with an excitation voltage (0.25 volts) and reference resistor (100 kOhm, 0.01%) are used to measure temperature of the thermistor mounted in the instrument body. Both of these are precision measurements used in the calibration of flux.

**Variables:**

 Variables are reported in the “slow” data table file. The calibration coefficients are hard-coded into the logger program and so raw thermopile voltage (mV), raw thermistor resistance (Ohms) and calibrated fluxes (Wm-2) are recorded.

**Post Processing:**

* Analysis of cross validation data acquired using the MARC station.
* Long and Shi (2008) quality control + manual QC
* Examination of data and camera images for signs of icing

**Expected Values:**

* Unlike the shortwave radiation, there is a LWD and LWU signal during polar night. Generally, for LWD, 150-250 Wm-2 when it is clear and 200-350 Wm-2 when it is cloudy (lower when colder in both cases). LWU will be more like the cloudy LWD values.

**Daily Data Checks:**

* Make sure data is coming in, temperatures and fluxes are realistic.
* When overcast, LWU and LWD will be similar (with 20 Wm-2)
* Make sure fan is running

**ASFS Visit Checks:**

* (1) Inspect instrument level. Note if it is off. Maybe even take a photo.
* (2) Make sure fan is running and that the fan/ventilation assembly are not clogged with snow. If this becomes a problem, removing the screen covering the fan could help (or cause new problems).
* (3) Use ethanol to clean ice/snow/salt etc from the instrument, especially the glass dome. Ice that is not on the dome but can shade the dome is a problem. Ice on the body can be a platform for more ice to build upon. Knock the ice away from the body and clear around the instrument using a brush or glove. Use a clean microfiber cloth or a Kimwipe that has been wetted with ethanol to clean the dome. The dome is silicon – you don’t want to scratch it but it is not too sensitive. Treat it like a camera lens. It is better not to spray ethanol directly on the instrument because it can damage gaskets over time, but it is ok to do so if you need to. Always use the cloth to wipe the glass dome dry when you are done cleaning because if you leave liquid on the dome residual water will refreeze after the alcohol evaporates and/or the evaporating alcohol can cool the dome and attract frost.
* (3) Level the instrument by leveling the radiation plate. The upward facing SR30 is the reference, but note the bubble level on the IR20.

**Things to consider:**

* Level matters at lot, but there is more flexibility for the IR20 than for the SR30.
* Disturbing the snow beneath the IR20 is not a big deal, but its FOV overlaps with several instruments that are more sensitive to surface disturbance.