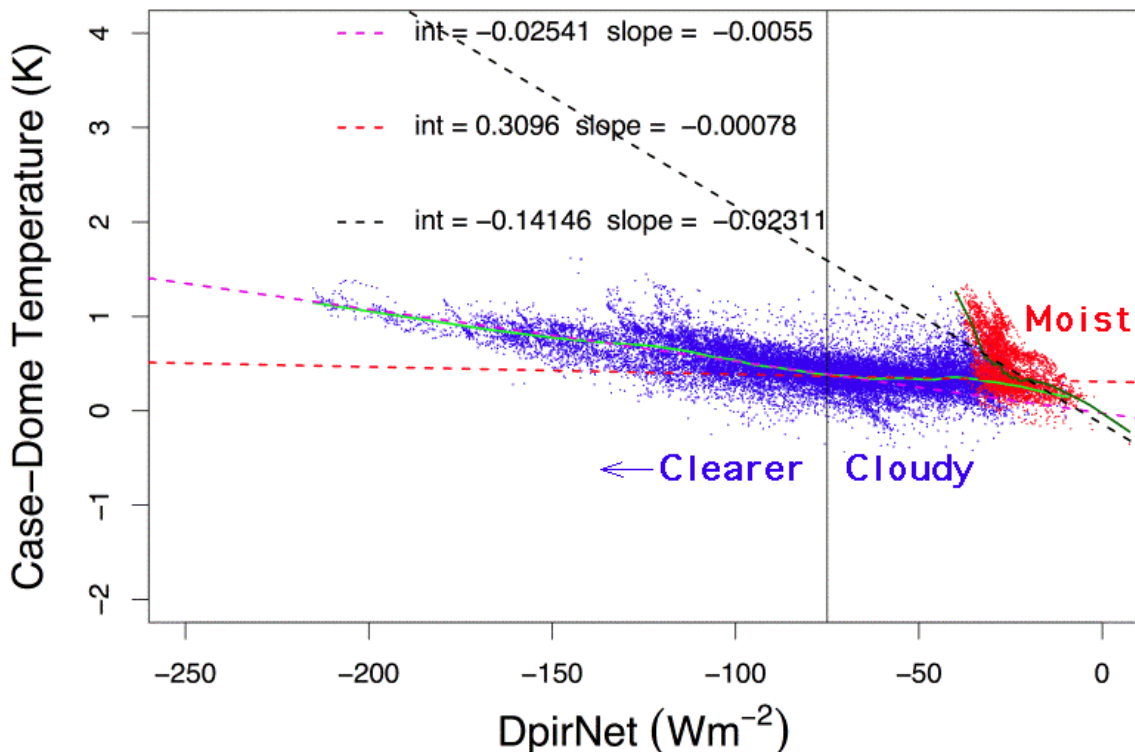


# A Method to Correct Longwave Radiation Measurements Corrupted by a Bad Thermistor

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The ESRL/GMD SURFACE RADIATION (SURFRAD) network has been operational for over 20 years and has the longest tenure of any previous national surface radiation network. Measurements of upwelling and downwelling LongWave (LW) radiation are integral components of the Surface Radiation Budget (SRB) -- the focus of SURFRAD. Missing any of the four components of the SRB nullifies the primary product of the network until the bad instrument is replaced or repaired, leaving a gap in the SRB time series. Retrieval of the LW signal requires three measurements by the pyrgeometer: the thermopile signal under the filtered dome, the temperature of the instrument body (case temperature), and the temperature of the instrument's dome. The case and dome temperature measurements are made by thermistors and account for over 80% of the LW signal. Because those temperatures are raised to the 4<sup>th</sup> power in the LW retrieval, small measurement errors can make for large LW errors (~20 Wm<sup>-2</sup> per 1°C error). A method has been developed to correct a bad thermistor measurement that adds only 1-2% extra error to the LW retrieval. It is based on the relationship between the case-dome temperature difference and the thermopile signal. If one thermistor temperature is good, the other can be recovered using the linear relationships shown in the figure below, which are based on a period of good data from the affected instrument. Thermistor errors of < 1°C are difficult to perceive in data quality control and can persist for months. These situations have occurred several times in the SURFRAD network and many months of SRB data have been saved owing to this correction method.



**Figure 1.** Case – dome temperature difference versus the thermopile voltage of a normal operating upward-looking pyrgeometer at the Fort Peck SURFRAD surface radiation budget station. The three linear relationships shown can be used to recover longwave data if one of the instrument's thermistors goes bad.