

# THE RECORD COLD TEMPERATURE AT PHOENIX AIRFIELD, ROSS ISLAND, ANTARCTICA

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## 1. OVERVIEW

A cold temperature of  $-55^{\circ}\text{C}$  was observed and recorded by the FMQ-19 Automatic Meteorological Station (AMS) at Phoenix Airfield on 25 August 2018 that likely broke the previous regional record of  $-53.9^{\circ}\text{C}$  observed at Pegasus North Airfield on 19 July 2010. Weather observers at Phoenix Airfield recorded a temperature of  $-54^{\circ}\text{C}$  as reported in the METAR observations in support of on-going aviation operations. There was a medical evacuation (medevac) that occurred on 25 August when the temperatures were observed to be exceptionally cold. METAR, satellite, FMQ-19 AMS, and Automatic Weather Station (AWS) data were collected to determine the causes of this extreme cold. This event is important because of the impacts the cold can have on aircraft. Aviation operations can be at risk when limits are reached on the ground at  $-50^{\circ}\text{C}$ ,  $-55^{\circ}\text{C}$  in the air,  $-58^{\circ}\text{C}$  for jet fuel, and  $-54^{\circ}\text{C}$  for the hydraulics (Courtesy Doll, M, 2012; Lazzara et al., 2012). Reports from the medevac indicated that the aircraft was impacted by the extreme cold temperatures, so the patients had to be loaded via the side door (Davis, B., 2018). The main causes for this event are likely stagnant air, clear skies with no incoming radiation, and high pressure lasting for several days leading up to the recorded extreme.



*Figure 1: Image of a C-17 aircraft on Phoenix Runway on 25 August 2018 during a medevac (Photo courtesy of 304<sup>th</sup> Expeditionary Air Unit).*

## 2. 48 HOURS BEFORE: 23 AUGUST 2018

At the beginning of this cold temperature period, temperatures oscillated during the day on 23 August between  $-35^{\circ}\text{C}$  and  $-50^{\circ}\text{C}$  according to the FMQ-19 AMS. There was hardly any cloud coverage over the airfield, however there was often times of freezing fog, mist or haze throughout the day. The winds were low or non-existent on the 23rd which didn't allow for much mixing of the atmosphere. This period allowed for the continuous atmospheric cooling while the atmosphere remained near saturation.

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Evaporation and sublimation would enhance cooling.

### **3. 24 HOURS BEFORE: 24 AUGUST 2018**

On 24 August, the FMQ-19 AMS indicated that the temperature was generally decreasing throughout the day from -35°C to -54°C. The first observation of -54°C occurred at 19:50 UTC. The METAR report indicates that at 23:55 UTC the recorded temperature was -54°C. There was a gap in manual METAR observations during times where no flights were scheduled to arrive/depart. In that gap, temperatures decreased from -48°C to -53°C. Wind speeds during the 24th ranged from 0 to 3 kts.

### **4. MEDEVAC: 25 AUGUST 2018**

On the day of the medevac, the temperature observations from the METAR reports indicated that there were temperatures of -54°C from 04:25 UTC to 06:55 UTC. The FMQ-19 AMS observations indicated that after the METAR reports stopped, the temperature dropped down to -55°C, a potential record-breaking temperature observation for the region, at 09:20 UTC until 09:40 UTC. After this, the temperature

increased dramatically within a couple of hours due to a low pressure system moving in from the north. This storm increased wind speeds up to 20 knots, mixing the atmosphere.

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