National Transportation Safety Board
Office of Aviation Safety
Washington, DC 20594

RRD24LR012

METEOROLOGY

Specialist's Factual Report

August 8, 2024

TABLE OF CONTENTS

A. ACCIDENT

Location: Bordulac, North Dakota
Date: 5 July 2024
Time: 0336 Central Daylight Time (0836 UTC[1])
Event: Train Derailment

B. METEOROLOGY INVESTIGATOR

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Office of Aviation Safety
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C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in central daylight time for 5 July 2024 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl). The accident site was located at about: 47.387052° north latitude; 98.957681° west longitude at an elevation of about 1,525 feet.

This report provides information on precipitation applicable to the accident region.

D. WEATHER INFORMATION

1.0 Weather Radar

WSR-88D[2] Level-II base reflectivity weather radar imagery from the Grand Forks, North Dakota, site (KMVX) is presented in Figures 1-4. KMVX was located approximately 67 miles east of the accident location with an antenna elevation of about 1,080 feet. Assuming standard refraction and considering the 0.95° beam width[3] for the WSR-88D radar beam, the KMVX 0.53° tilt would have "seen" altitudes above the accident

[1] UTC – abbreviation for Coordinated Universal Time
[2] Weather Surveillance Radar 88 Doppler (WSR-88D)
[3] Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward from the radar antenna.

location of between about 4,400 and 11,200 feet. Imagery from various times that collectively established a pattern of light to extreme values of reflectivity moving through the accident region during the 24-hour period leading to the accident time are presented in Figures 1-4.

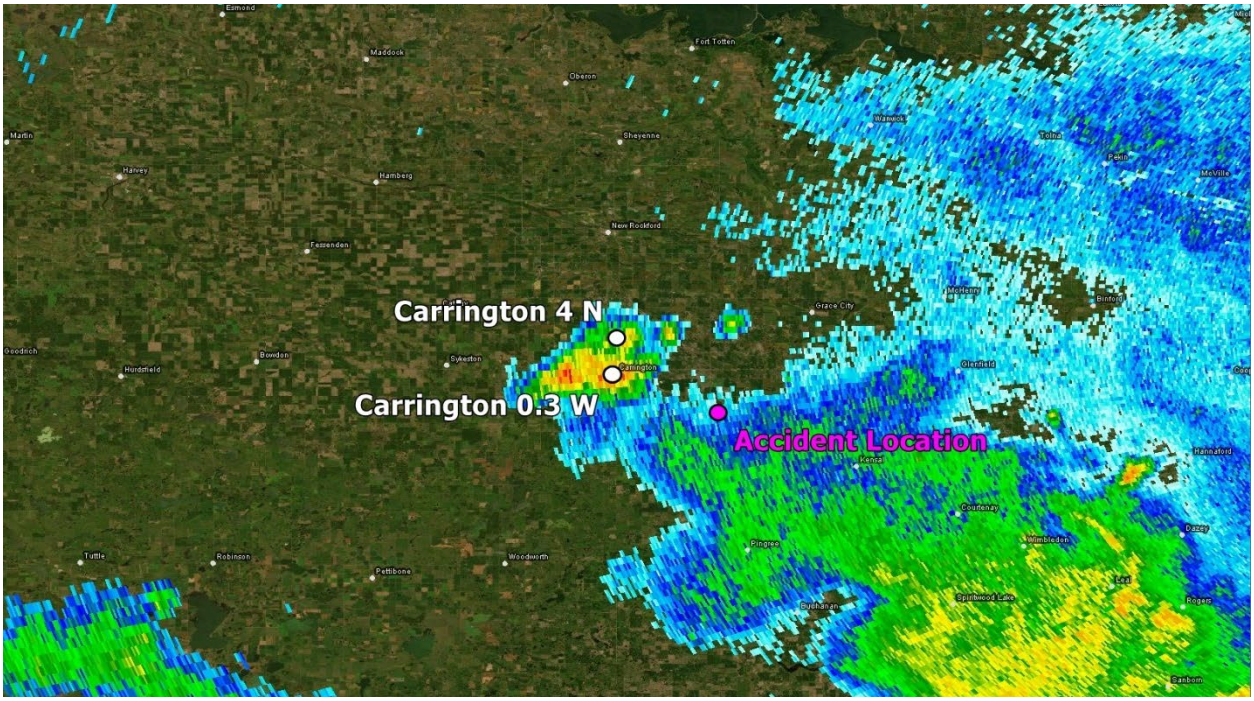

Figure 1 – KMVX 0.53° Level-II base reflectivity product from a sweep initiated about 0646 on 4 July 2024.

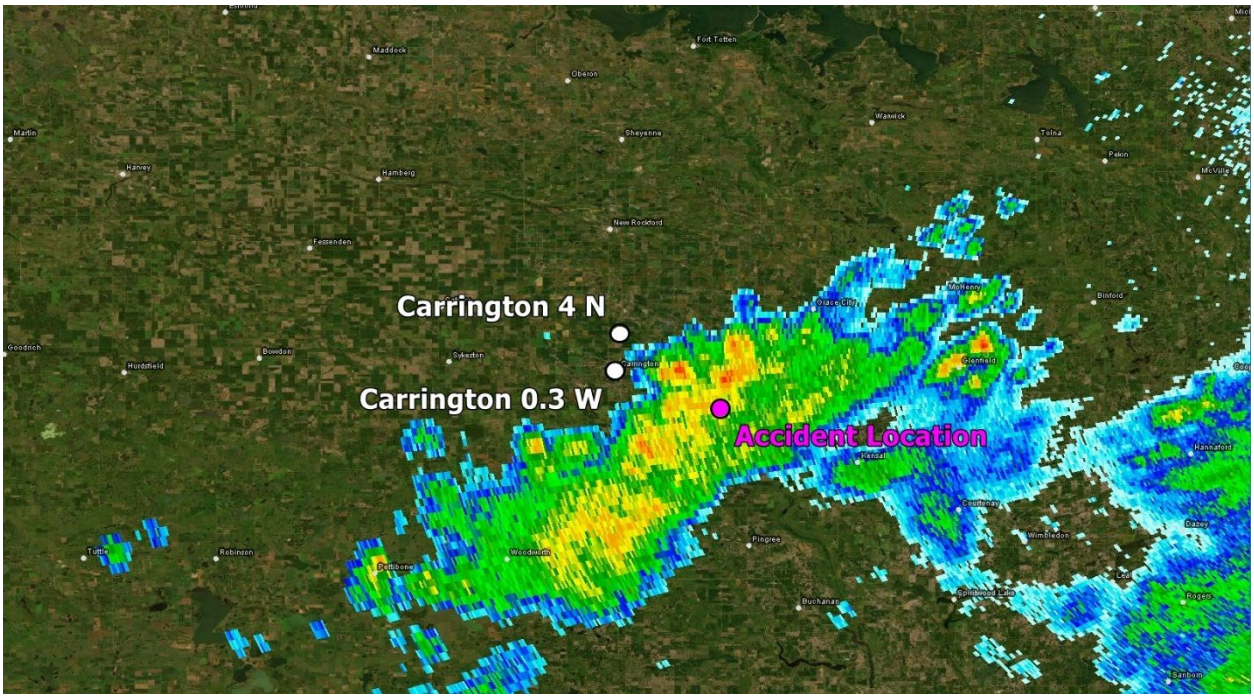

Figure 2 – KMVX 0.53° Level-II base reflectivity product from a sweep initiated about 1028 on 4 July 2024.

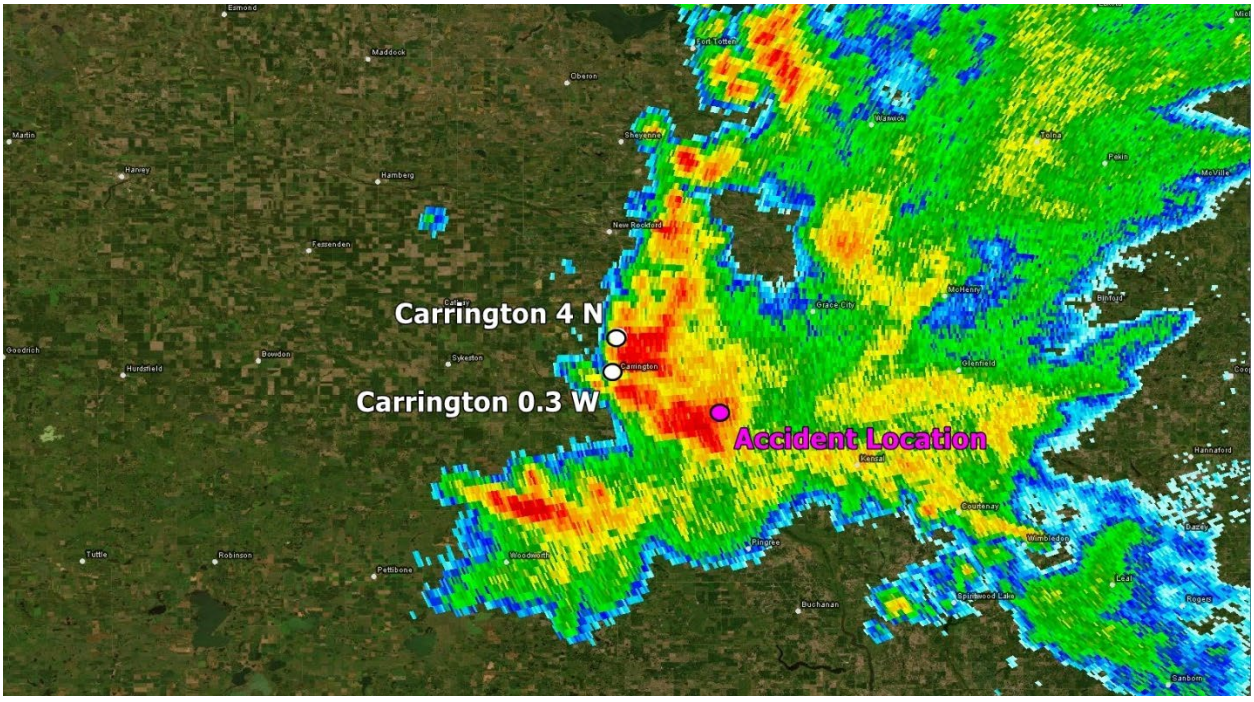

Figure 3 – KMVX 0.53° Level-II base reflectivity product from a sweep initiated about 1710 on 4 July 2024.

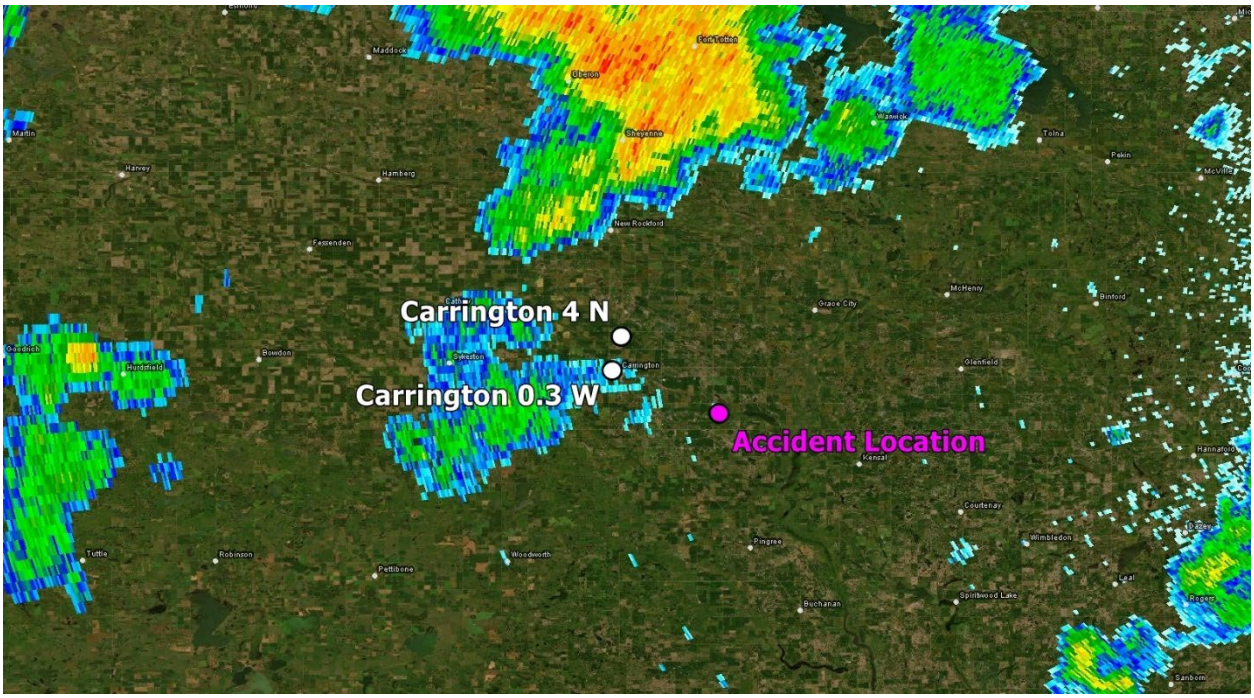

Figure 4 – KMVX 0.53° Level-II base reflectivity product from a sweep initiated about 2150 on 4 July 2024.

2.0 Automated Surface Observing System

The closest station to the accident location with a precipitation discriminator was Jamestown Regional Airport (JMS[4]) in Jamestown, North Dakota, which was located about 30 miles south-southeast of the accident site at an elevation of about 1,500 feet. Automated longline[5] reports[6] from the JMS Automated Surface Observing System (ASOS) during the 24-hour period leading to the accident time indicated a minimum

[4] This report uses the 3-digit International Air Transport Association format for airport identification, which does not use the geographic designating digit (e.g., "K" for stations in the continental U.S. and "P" for U.S. stations in Alaska and the Pacific region) as found in the 4-digit International Civil Aviation Organization (ICAO) identifier format. Weather observations from airports in this report are referenced by their reporting station's identifier (using ICAO format that includes the geographic designating digit), not by the airport at which the reporting station is located.

[5] "Longline" refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station's Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

[6] https://mesonet.agron.iastate.edu/cgi-bin/request/asos.py?station=JMS&data=metar&year1=2024&month1=7&day1=4&year2=2024&month2=7&day2=6&tz=Etc%2FUTC&format=onlytdf&latlon=no&elev=no&missing=M&trace=T&direct=no&report_type=3&report_type=4

ambient air temperature of 13.3°C and present weather precipitation types of light rain and moderate rain.

3.0 Precipitation Accumulation

"Q3 Multi-Sensor" precipitation accumulation (Pass 2) imagery from the National Oceanic and Atmospheric Administration's National Severe Storms Laboratory Multi-Radar/Mutli-Sensor (MRMS) system[7] is presented in Figures 5 and 6. These figures present liquid-equivalent precipitation[8] accumulations for the 12- and 24-hour periods ending on 0300 on 5 July 2024. MRMS indicated that there was no liquid-equivalent precipitation accumulation for the period between 0300 and the accident time. For the 12-hour period ending at 0300 (Figure 5), the liquid-equivalent precipitation accumulation at the accident location was 1.47 inches. About 4 miles north of the accident location, a local maximum of about 3 inches was depicted. For the 24-hour period ending at 0300 (Figure 6), the liquid equivalent precipitation accumulation at the accident location was 2.1 inches.

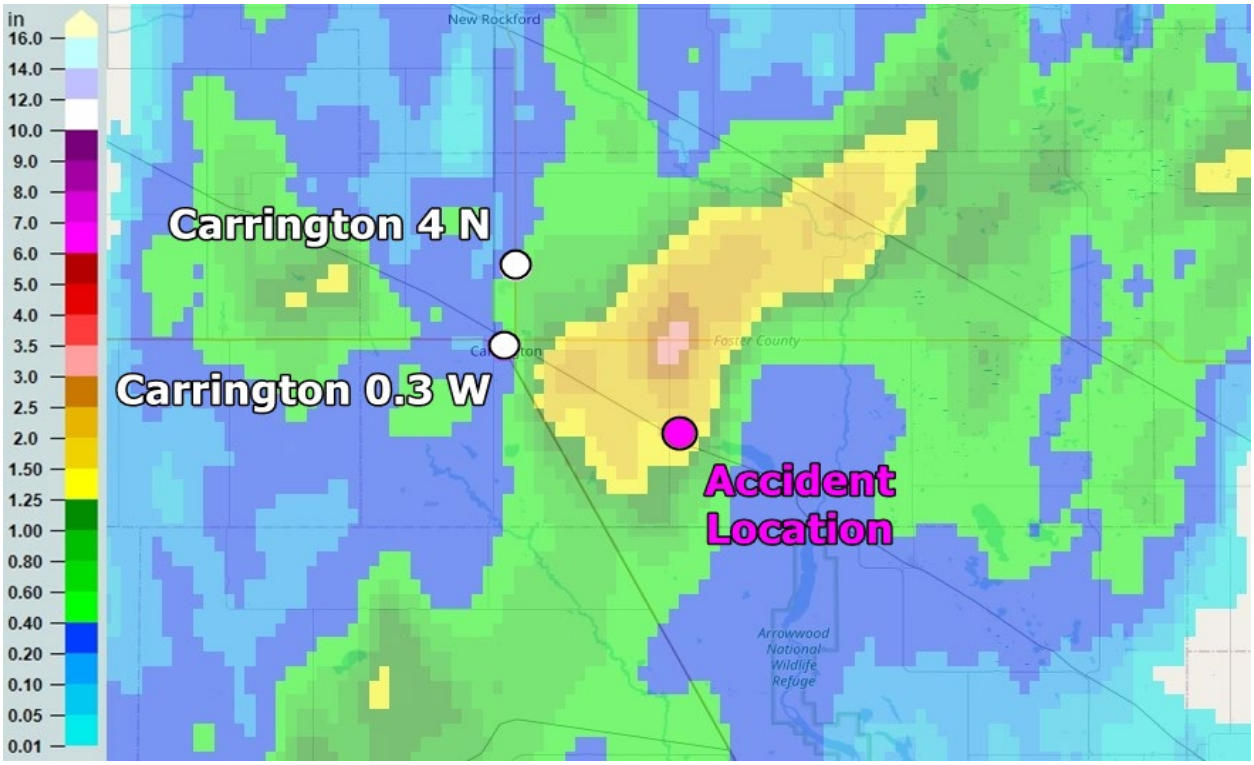

Figure 5 – MRMS Q3 Multi-Sensor 12-hour liquid-equivalent precipitation accumulation (Pass 2) imagery valid at 0300.

[7] The MRMS is a system with fully-automated algorithms that quickly and intelligently integrate data streams from multiple radars, surface and upper air observations, lightning detection systems, satellite observations, and forecast models. See: https://www.nssl.noaa.gov/projects/mrms/

[8] The amount of liquid-equivalent precipitation is how much precipitation fell if it was entirely in the form of rain (liquid; no ice/snow).

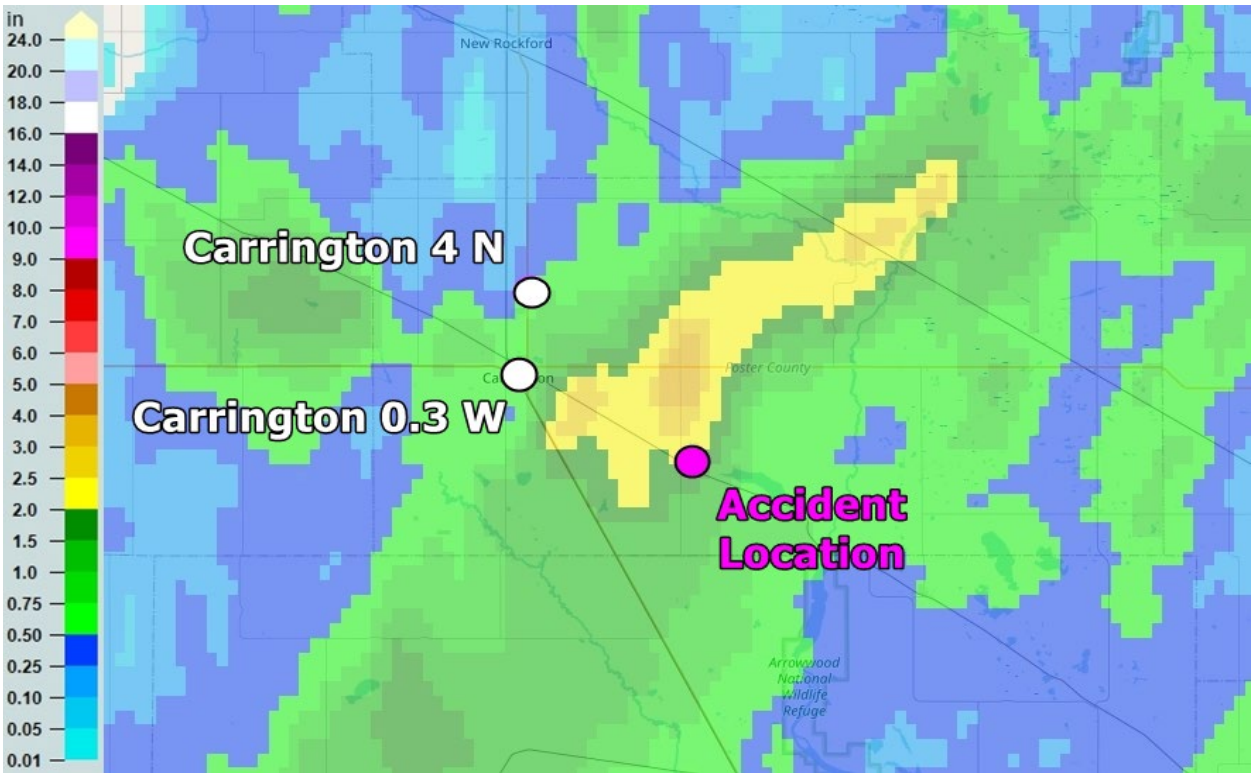

Figure 6 – MRMS Q3 Multi-Sensor 24-hour liquid-equivalent precipitation accumulation (Pass 2) imagery valid at 0300.

4.0 Precipitation Climatology

Liquid-equivalent precipitation data for two stations near the accident location were retrieved from the Applied Climate Information System (ACIS).[9] Station "Carrington 0.3 W" was located 8 miles northwest-west of the accident location and provided precipitation data from May 2018. Station "Carrington 4 N" was located about 10 miles northwest of the accident location and provided precipitation data from April 1967.

Figure 7 presents the monthly and annual 30-year[10] liquid-equivalent precipitation normals[11] from the Carrington 4 N station. According to these data, the 30-year annual normal was 20.77 inches, and the 30-year monthly normal for July was 3.60 inches. June and July had the highest values compared to all other months.

[9] ACIS is a system architecture developed, maintained, and operated by the National Oceanic and Atmospheric Administration Regional Climate Centers. Further information on ACIS can be found at http://www.rcc-acis.org/index.html

[10] The 30-year period was 1991-2020.

[11] A "normal" is the 30-year average of a particular variable's measurements, calculated for a uniform time period.

Month	Total Precipitation Normal (inches)
January	0.53
February	0.42
March	0.75
April	1.25
May	2.76
June	3.78
July	3.60
August	2.33
September	1.97
October	1.90
November	0.67
December	0.81
Annual	20.77

Figure 7 – Monthly and annual 30-year liquid-precipitation normals from the Carrington 4 N station.

According to data from the Carrington 0.3 W station, the daily[12] record for liquid-equivalent precipitation occurred on 18 July 2020 where 4.64 inches was recorded.[13]

The daily record for liquid-equivalent precipitation from the Carrington 4 N station was 4.08 inches, which occurred on 21 September 2019.[14]

Submitted by:

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[12] Daily accumulations begin at 0000 local time and end at 2359 local time.
[13] The earliest data available from the Carrington 0.3 W station were from 17 May 2018.
[14] The earliest data available from the Carrington 4 W station were from 19 April 1967.