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Going with the floe

Article

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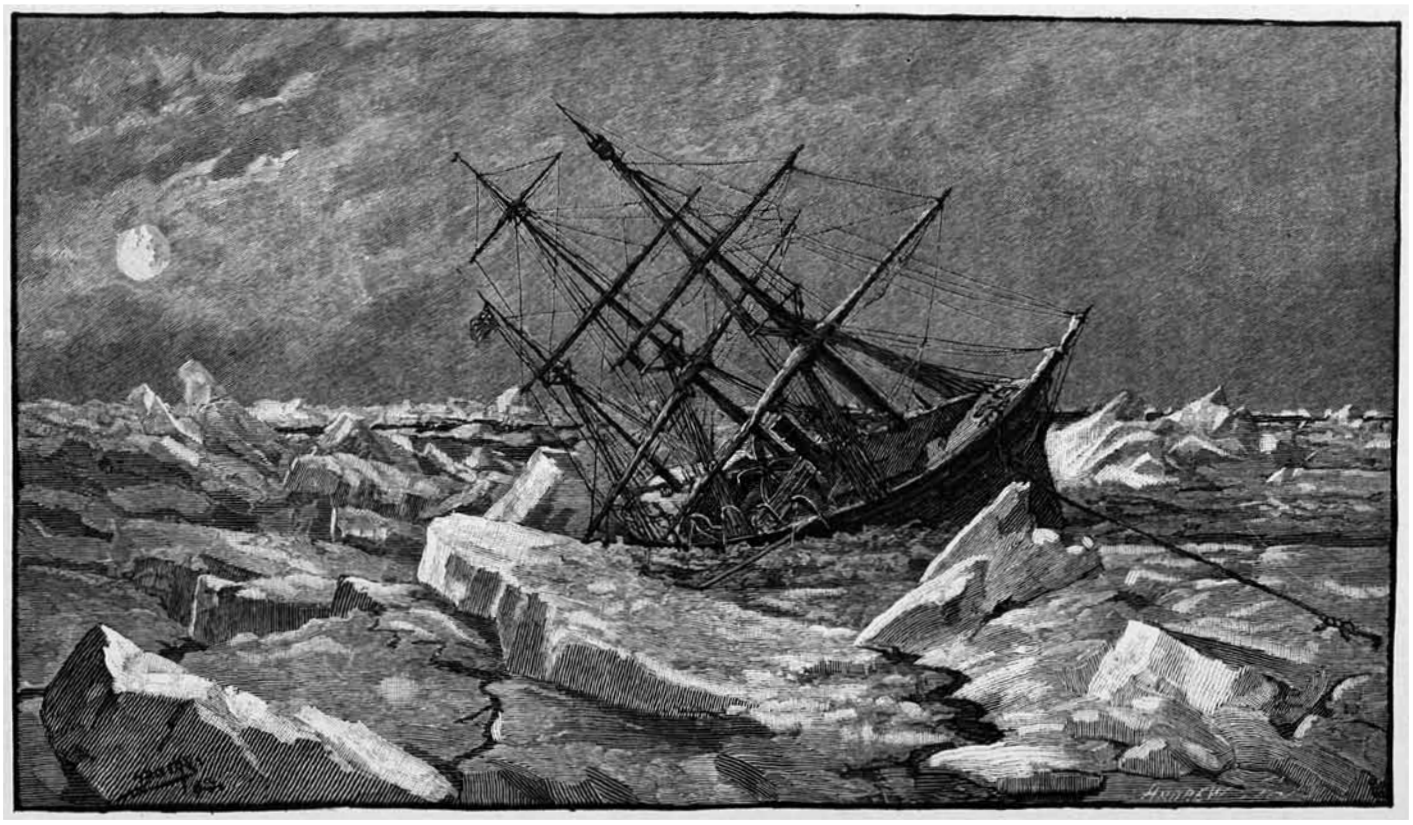

1 The sinking of the *Jeannette* in 1881, after almost two years trapped in the ice between 65° and 70° north. (US Naval History and Heritage Command)

Going with the floe

Julia Wilkinson and a Zooniverse citizen-science team examine Arctic auroral data, using observations from the ill-fated 19th-century Arctic exploration ship USS *Jeannette*.

Nineteenth-century Arctic explorers sailed into unknown, uncharted waters knowing that they followed in the wake of others who never returned. Over-wintering in the grip of Arctic pack ice, waiting for the spring thaw, was often an expected part of the journey. Remaining imprisoned for a second winter was something to be avoided; supplies and morale would run low. This is what happened to the USS *Jeannette* between 1879 and 1881 (figure 1). In freezing, unpleasant and often dangerous conditions the crew embraced its role aboard what was effectively the first ice station and diligently observed and recorded auroral displays over a two-year period in the ship's logs. Citizen-science volunteers taking part in the Zooniverse Old Weather project (http://www.oldweather.org) recently digitized the logbooks of the USS *Jeannette*, thereby releasing this hitherto hidden resource for study. Included within the logs were detailed descriptions of the Arctic aurora. By examining these records we were able to piece together a surprisingly detailed picture of Arctic auroral activity, evaluating their frequency, strength and direction. We also examined the reported colours of the aurora and used this information to compare the relative strengths of auroral displays, noting the effect of the lunar phase on the visibility of aurorae. We also found instances of the auroral oval expanding equatorwards, as would be expected during periods dominated by dayside magnetic reconnection. Finally, we looked for evidence of solar active regions with lifetimes longer than a single synodic solar rotation (approximately 27 days) by looking for recurrent patterns in auroral activity. At a time when little was known about the cause of auroral activity, the crew of the *Jeannette* was gathering valuable information. We were curious to see whether these 135-year-old Arctic auroral observations could contribute to our understanding of the Sun–Earth connection.

"Little was known of aurorae: the *Jeannette* was gathering valuable information"

To boldly go…

Nineteenth-century polar exploration captured the public imagination in the way that space exploration would a century later. Polar explorers were hailed as heroes and accounts of their journeys were read widely. Major goals included sailing to the North Pole via the fabled Polar Sea and navigating the much coveted Northwest Passage. Ships from several nations set out to win honour (and prize money) by being the first to attain these goals, but the top prize of being the first to claim the North Pole remained elusive until the 20th century. During their voyages, each ship kept meticulous daily logs of latitude and longitude positions, meteorological observations and shipboard life. Many of the logs survive and they contain a wealth of historical, scientific and social data. But the task of transcribing and digitizing these logs is daunting given their number.

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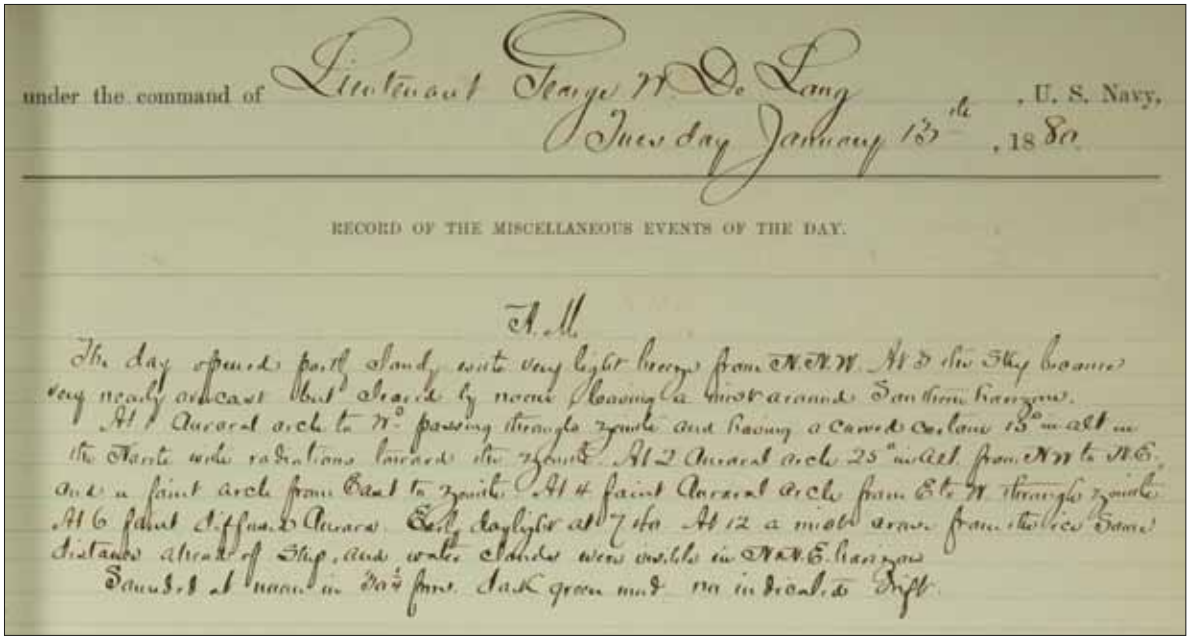
under the command of Lieutenant George W. De Long, U. S. Navy.
Tuesday January 13th, 1880.
RECORD OF THE MISCELLANEOUS EVENTS OF THE DAY.
A. M.

2 Logbook entry for the morning watch on 13 January 1880. "At 1 Auroral arch to Wd passing through zenith and having a curved curtain 15° in alt in the North with radiations toward the zenith…" (http://research.archives.gov/description/6919191)

The Old Weather project (http://classic.oldweather.org) is an online citizen-science project using the Zooniverse (http://www.zooniverse.org) platform which overcomes this problem by asking members of the public to transcribe the meteorological observations recorded in 19th and 20th-century ships' logs. These historical data are subsequently used to improve weather and climate modelling (http://www.oldweather.org/why_scientists_need_you). A recent batch of ships' logs presented for transcription included some 19th-century Arctic explorers. When some Old Weather volunteers began discussing auroral observations from the logs on the Old Weather forum, we asked them to keep a record of any further observations they found. This was in addition to the normal transcribing required by the Old Weather project and the enthusiastic volunteers readily took up the challenge. One of the ships, the USS *Jeannette*, was beset in Arctic ice for two years between 1879 and 1881, drifting with the ice floe and ideally placed to make extended observations of auroral activity. It is these observations that provide the data presented in this article.

"The *Jeannette* became stuck in pack ice off Herald Island for almost two years"

The USS *Jeannette*

The USS *Jeannette* was built in Wales and started life as a Royal Navy gunboat, the HMS *Pandora*. After 10 years' service she was sold, renamed the USS *Jeannette* and fitted out for polar exploration. She set sail from San Francisco on 8 July 1879 with a crew of 33 under the command of Lieutenant George Washington DeLong. The *Jeannette's* main task was to claim the North Pole for the United States. Additionally, she was instructed to record scientific observations and to search for the Arctic explorer SS *Vega*, which was attempting to become the first ship to sail the Northeast Passage. Unbeknown to the crew of the *Jeannette*, the *Vega* had spent 10 months drifting in pack ice, but managed to break free within days of the *Jeannette* setting sail and went on to successfully complete its expedition. Aboard the *Vega* was Adolf Nordenskiöld, whose own auroral research while stuck in the winter ice led to his observation of the auroral oval as a crown of light over the magnetic pole, which he referred to as the "aurora glory" (Nordenskiöld 1881).

Two months after her departure, the *Jeannette* became stuck in pack ice off Herald Island. She drifted with the ice for almost two years, between 65° and 70° magnetic latitude, before the crew was forced to abandon ship when pack ice crushed and destroyed it on 12 June 1881. The crew then embarked on a 1000 km, four-month trek across ice and open water with dogs, sledges and three boats full of supplies.

Three months into the ice-trek, the three boats and their crews became separated in a storm. One boat was lost along with its crew and another eventually found a settlement and safety. DeLong and his men were forced to abandon their boat and continue the trek across the ice. The strongest two crew members were sent ahead and although they found a settlement and survived, DeLong and the rest of his crew died before they could be rescued. One of DeLong's last acts, in an attempt to preserve the ship's logbooks, journals and charts, was to move some of them to higher ground to save them from the spring floods. The final auroral observation was entered on 14 September 1881 (UT), just seven weeks before DeLong died and the night after the storm that separated the three boats. Commanding the boat that was lost to the storm was Lieutenant Charles Chipp, who kept his own notebook of auroral observations and galvanometer readings with the intention of publishing them on his return. Against all odds, Chipp's notebook has survived. It is held in the US National Archives and Records Administration and was scanned for this paper. The auroral observations it contains, together with entries in the ship's logs and DeLong's personal journal, form our dataset.

Extracting the data

The Old Weather volunteers have transcribed the complete set of logbooks from the *Jeannette*, which are available to view at http://www.naval-history.net/OW-US/Jeannette/USS_Jeannette-1879-1880.htm. An example from an original logbook page is shown in figure 2. The *Jeannette* crossed the 180° meridian (International Date Line) several times. Ship time and dates in the logs continued as if the ship remained east of the 180° meridian in a time zone representing UT−12 hours. We used the Old Weather project's decimal conversions of the ship's latitude and longitude positions (given in degrees, minutes and seconds; https://github.com/oldweather/oldWeather3/tree/master/by_voyage/Jeannette). These include corrections for errors in the logs and conversion from ship time to UT with gaps (on cloudy days, for example) filled by linear interpolation. Magnetic latitude and longitude values were obtained from http://omniweb.gsfc.nasa.gov/vitmo/cgm_vitmo.html with the date set to 1900. This calculator is based on the International Geomagnetic Reference Field/Definitive Geomagnetic Reference Field (DGRF/IGRF) for epochs 1900–2020. As the magnetic pole moved very little between 1879 and 1900 (<1° latitude) this serves as a good proxy

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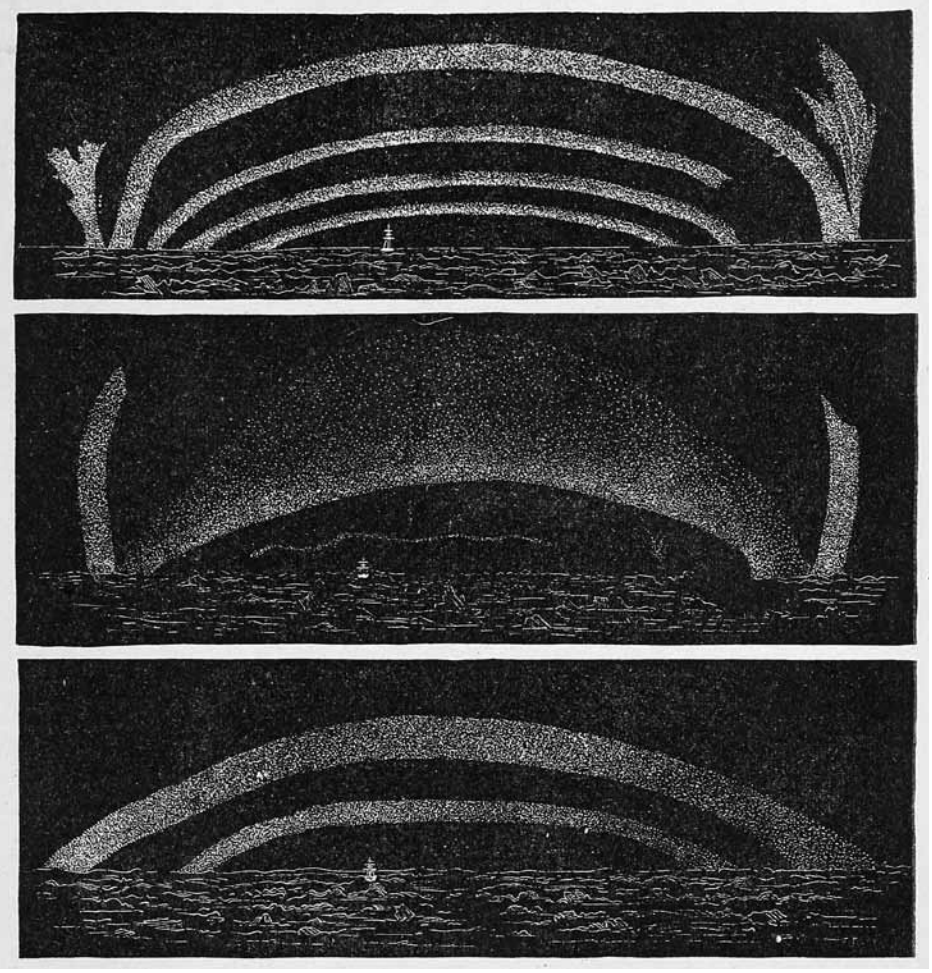

3 Sketches of Arctic aurorae. (Newcomb 1888)

when estimating geomagnetic coordinates and was deemed sufficiently accurate for our purposes. Most log entries contain multiple observations per day (a 24-hour period from midnight to midnight). Observation times are anything from 30 minutes to 23 hours apart and during long-lasting auroral displays are often continuous (for example, from 01:00 to 04:00). The method of choosing a representative display for a particular day varied according to the parameters being measured and is discussed below.

The only index of historical geomagnetic activity extending back far enough in time for our purposes is the *aa* index, which is derived from readings taken originally at two antipodal stations at Greenwich and Melbourne. The three-hourly historical *aa* index from the UK Solar System Data Centre (http://www.ukssdc.ac.uk) was used to investigate any relationship between *aa* value and auroral activity. However, because of the distance between the recording sites and the *Jeannette*'s position, these results must be viewed with caution. Where there are multiple observations per day, the highest *aa* value corresponding to an actual observation time is used. Ship times are adjusted to UT for the purpose of obtaining *aa* index values.

Taking the dates of the *Jeannette*'s first and last auroral sightings produces 430 nights over the two-year period when it would have been dark enough to observe the aurora. The *Jeannette* recorded observations on 228 of these nights. The observations were rarely sketched, but figure 3 shows examples of different types of auroral arches (Newcomb 1888). Many observations contain references to the colour, strength and direction of the aurora and each of these variables was ranked using the descriptions in the logs.

"Many observations refer to the colour, strength and direction of the aurora"

Taking colour first, the detailed log entries described six auroral colours and in most cases also gave helpful information about the position of each colour.

- Spectrum: aurorae observed as having "rainbow", "prismatic" or "different" colours due to the effect of observing directly underneath several overlying colours.
- Red: including aurorae referred to as "brownish-red" that appeared with or above green aurorae.
- Green: the most common colour reported.
- Yellow: including yellow-green.
- White: including white-green and appearing with or above green aurorae.
- Purple: including pink and described as forming lower fringes to "curtains" and green aurorae.

This ranking is a good fit with current knowledge about the colours that can be observed (Rees 1989). We now know that colour is a useful proxy for the energy of the particles precipitating into the upper atmosphere. On collision with the neutral gas atoms and molecules, some become ionized while others have electrons elevated to excited states, losing this additional energy by emitting photons of specific wavelengths. These "forbidden" emissions only occur at high altitudes (above 100 km) because the paucity of the air means that collisions between gas particles that would otherwise quench these emissions are relatively infrequent. Red aurorae, with an emission at 630 nm, occur in a broad emission region peaking around 250 km, caused by atomic oxygen in the $O(^1D)$ excited state returning to its ground level. This emission occurs above green aurorae, which peak at around 120 km, caused by emissions with a wavelength of 557.7 nm from oxygen atoms returning to the $O(^1D)$ from the $O(^2S)$ excited state. Blue aurorae peak at an altitude of 100 km and result from N_2^+ ions emitting light at a wavelength of 427.8 nm. Nitrogen emits at several wavelengths in both the blue and red part of the visible spectrum which combine to produce a purple fringe to the lower edge of auroral displays at around 100 km. Some auroral displays appear grey or white. This is simply because the eye cannot perceive colour if the emissions are sufficiently low in intensity or their intensity is low compared with sunlight reflected from the Moon. For this reason it is expected that auroral colour will be more challenging to detect by eye when the Moon is at, or approaching, full.

Adjectives used to convey the strength of an auroral display, for example "moderate", "dull", "faint", "splendid", "remarkable" and "very brilliant", fell relatively easily into three categories of auroral strength: weak/moderate, strong, and very strong. Less helpful descriptions such as "display", "gleams", "patches" and "visible" are placed in the weak/moderate category rather than left uncategorized. One (albeit subjective) interpretation might be that although these displays were not remarkable enough to warrant further description, they were not noted simply as "aurora". On days when there were multiple auroral displays of varied strengths, the display ranked the strongest was used to represent the strength and colour(s) on that day.

Recording the direction in which the aurora was seen was less straightforward. Many observations report seeing aurora in several directions or overhead at the zenith with no unambiguous direction of origin. A common-sense approach has, therefore,

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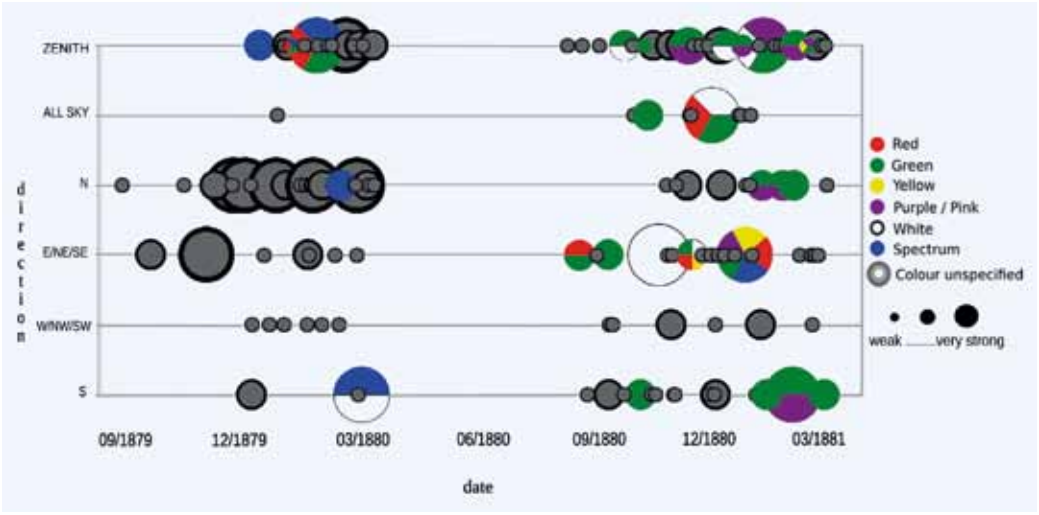

4 Combined direction strength and colour information for 189 observations. On days when there were multiple auroral displays of varied strengths, the display ranked the strongest is used to represent the strength and colour(s) on that day. (Magnetic latitude range is 65° to 70°.)

been employed to determine which horizon the display would have appeared above. For example, to observe "… At 1am auroral curtain 15° in altitude extending from NE to WNW", an observer would be best positioned facing the north horizon. The five direction categories resulting from this approach are "north", "south", "east" (including northeast and southeast), "west" (including northwest and southwest) and "all sky" (including aurora reported from "all directions") plus "zenith" (including displays seen at or through the zenith).

This approach produced a subset of 213 strength observations of which 189 contain both strength and direction information. Of these, 28 also contain colour information. Each log entry is dated and also contains meticulous meteorological observations, making possible some determination of the variation in aurorae with the seasons, lunar age, weather and time of day.

Dark, cloud-free nights were required for observing the aurora. The two-year period that the *Jeannette* spent drifting between 65° and 70° magnetic latitude covered two autumn–winter periods and, therefore, two seasons of dark nights suitable for viewing the aurora; these seasons show clearly in the frequency of aurora sighted.

Geomagnetic activity

Looking at the *aa* observations throughout the period from 2 September 1879 to 14 September 1881 for which the *Jeannette* recorded auroral sightings, the fraction increases for higher *aa* values (peaking at 25% for $100 < aa < 110$) but there are, nevertheless, a few (2.7%→4.5%) observations during very low geomagnetic activity ($0 < aa < 20$). Solar cycle 12 began in December 1878, a few months before the start of the expedition. Solar activity was, therefore, likely to be low, with geomagnetic activity increasing slightly from one season to the next.

During the period that the *Jeannette* was observing, the Royal Observatory, Greenwich recorded eight geomagnetic storms (Royal Observatory, Greenwich 1955). Two of these occurred when there would not have been sufficient nightfall to observe from the Arctic, but the *Jeannette* recorded auroral displays coinciding with the dates of the remaining six storms. The highest *aa* value of 125 occurred on 3 November 1880 (UT), when a small magnetic storm was recorded at Greenwich. The *Jeannette* records a brilliant aurora covering all the sky, demonstrating that geomagnetic and auroral activity were concentrated over the Arctic. An unremarkable *aa* value of 15 marked the *Jeannette*'s final observation on 14 of September 1881 (UT). This coincided with the end of a great magnetic storm recorded at Greenwich and was the only observation of the aurora made during the trek across the ice. The description in DeLong's journal is very brief (DeLong, vol 2, 1884): "After six pm wind and sea moderated rapidly; clouds broke away; moon and stars appeared, and auroral flashes." That the aurora was recorded at all is remarkable; this was the day after the severe storm claimed the lives of a third of the crew and separated the remaining two boats.

"A severe storm claimed the lives of a third of the crew and separated the boats"

Colour, strength and direction

Figure 4 shows the subset of 189 strength, direction and colour observations. Although several very strong auroral displays were recorded in the 1879–1880 season there is little colour information and what information there is indicates that only the displays exhibiting spectrum colours were noted. Of course, the log entries represent only what the observer thought noteworthy at the time. The increased attention to detail and colour information in the second season might simply be a result of continued imprisonment in the ice resulting in more time and attention for observations.

The 1880–1881 season records an increase in both aurorae seen at the zenith and those classed as strong compared with the 1879–1880 season, indicating that geomagnetic and auroral activity were concentrated over the Arctic at these times, though the increased number of sightings to the south indicates that some geomagnetic activity caused the auroral oval to expand equatorwards. Indeed, three of the southerly observations in figure 4 correspond to geomagnetic storms recorded at the Royal Observatory, Greenwich.

Lunar phase

The phase of the Moon needs to be taken into account when considering historic auroral observations (e.g. Stephenson & Willis 2008). As might be expected, fewer auroral displays are seen around full Moon, which can occur on day 14, 15 or 16 when all but the most intense auroral displays would be difficult to detect.

Nevertheless, 10 auroral displays were observed around full Moon on days 14, 15 or 16 (figure 5). Six are classed as weak, three are strong, and one is unspecified. The strong aurora of 17 October 1880 (ship time) with a 14-day-old Moon is particularly noteworthy for its log entry and description of the effect of the Moon and cloud cover on the auroral display: "At midnight one half of the sky was covered by cumulo-stratus clouds moving from N. to S. and at that moment extending from the zenith to the southern horizon obscuring the moon and the stars. (North of the zenith the sky was clear, except a streak of cirro-stratus above a small bank of rising cumulo-stratus.) Immediately following the cumulo-stratus clouds and near the zenith was a faint auroral arch extending from east to west, with its ends slightly curving to the southward and hidden by the clouds near the horizon. As the clouds nearly uncovered the east end, a mass of bright green light shot up, and spread like a fan over 10° of arc; and just as the east end was completely uncovered the mass changed into brilliant green

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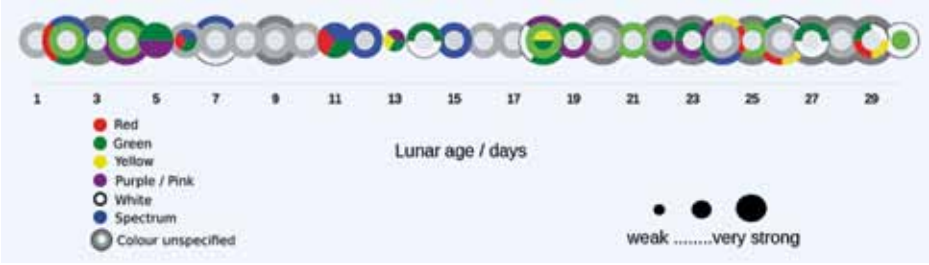

5 Strength and colour of auroral observations, when reported, with lunar age. All three strengths of aurora are represented on this day along with the colour information relating to each strength.

spiral curtains terminating a bright white arch through zenith to west. After perhaps a minute, the clouds being well clear of the arch, the light paled and lost colors, and the arch-ends straggled back to N.W. and N.E., the center being at the zenith. The moon then became entirely uncovered, the floe seemed lighted as in mid day, and but few faint streaks of arches remained, thin and almost indeterminate."

Fewer aurorae were seen around full Moon. Between lunation days 10 and 17, no very strong aurorae were observed. Interestingly, some of the weaker displays reported during this period were described as exhibiting a variety of colours despite the bright moonlight.

"He found disturbances of the needle coincident with the most brilliant auroras"

Time and seasonal variation

Aurorae were most commonly reported around midnight. While this is likely to be the time when skies were darkest, it is also entirely consistent with our understanding of auroral substorms occurring around 24 UT as a consequence of magnetic reconnection in the tail of the magnetosphere.

Cloud cover was estimated as part of the daily meteorological observations. The sky was observed either every hour or every three hours and these observations were entered in the logs as a score according to the "proportion of clear sky in tenths", 0 being completely overcast, 10 being completely clear. By grouping the meteorological observations as follows, each 24-hour period is arbitrarily classed as "clear", "variable" or "cloudy":

- Clear: 18/24 (or 6/8 for three-hourly observations) score ≥7 (i.e. at least 70% clear for 75% of the 24-hour period).
- Cloudy: 18/24 (or 6/8 for three-hourly observations) score ≤3 (i.e. at least 70% cloudy for 75% of the 24-hour period).
- Variable: everything else.

The cloudiest part of the year coincides with the period of the Arctic midnight Sun (between May and August) when the Sun remains above the horizon – two reasons why virtually no aurorae are observed during this time. The last observation in the 1879–1880 season occurred on 5 April 1880 at 01:00 (ship time), 3½ hours before sunrise and with a 27-day-old waning crescent Moon below the horizon. The August observation represents the first seasonal auroral observation of 1880–1881 and occurred on 31 August 1880 at 23:15 (ship time), 3¼ hours after sunset and with a 26-day-old waning crescent Moon above the horizon. As might be expected for a first and last auroral display, neither aurora was particularly remarkable; the former has no indication of strength and the latter is classed as weak. The first and last sightings of the Sun marking the periods of polar night and midnight Sun were often remarked on. The beauty of the prolonged polar night is described on 30 November 1879: "Of course, we do not see the sun at all, and our noon is but the twilight of ordinary latitudes. Occasionally it is beautiful indeed, as, for instance, to-day, when we had a few golden and red streaks in the S., a clear blue sky to about 20° in arc, and the remainder of the heavens dark blue, illuminated by a full moon. Venus was visible at noon" (DeLong, vol 1, 1884).

The welcome return of the Sun was often confused by atmospheric refraction as this log entry on 25 January 1880 indicates: "At 12 the sun's upper limb was visible from aloft, but much distorted by refraction."

Weather and magnetism

There were several attempts to link aurora to the weather. After witnessing a particularly vibrant auroral display, DeLong remarked in his journal: "I have remarked heretofore that these wonderful auroral displays, are forerunners of cold weather" (DeLong, vol 1, 1884). After further observation he offered the following summary: "As our days lengthen the auroral displays become less frequent and less brilliant. It is impossible to assign any particular cause for their appearance, or discover any particular effect following them. They have been brilliant in intensely cold weather, and also in mild weather, and again they have been faint under similar temperature; they have existed in all winds and in calms, at full and change of the moon, when the ice has been breaking up and when it has been motionless; in fine, under all sorts and conditions of circumstances. The only prerequisite is a dry atmosphere. It has been said that these auroras are not seen over the ice. All that I can say about that is, that frequently we could see nothing but ice during displays, although there may have been water somewhere."

George Melville, chief engineer of the *Jeannette*, wondered if aurorae might be a form of lightning (Melville 1885): "Thunder and lightning are entirely unknown in the Arctic Ocean. Towards the pole the aurora is the only form in which the presence of electricity in the atmosphere is displayed; and the question arises, why the aurora, instead of the discharges of light, attended by thunder-claps, seen at the equator? To bring about the usual atmospheric phenomena, heat must be applied or extracted. Perhaps, then, the want of heat in the polar regions may account for the absence of thunder and lightning, or can it be that the immense blanket or non-conductor of ice and snow prevents the discharge of the electric current? So that, if a certain degree of heat were introduced, the aurora would burst forth into vivid flashes?"

Lieutenant Charles Chipp was also interested in the electrical properties of the aurora and logged in his notebook more than 2000 galvanometer readings during auroral displays, noting each "deflections of the needle" that occurred. Expedition naturalist and survivor Raymond Newcomb describes Chipp at work (Newcomb 1888): "Mr. Chipp ... took up the subject recommended by the Smithsonian Institution to the Polaris Expedition – namely, observations of the disturbances of the galvanometer during auroras. He had wires laid out over the ice, and earth-plates in the water, and the galvanometer in the current, and obtained over two thousand observations during auroras, which he intended to turn over to a specialist for purposes of analysis and judgment. He always found disturbances of the needle coincident with the most brilliant auroras."

The crew of the *Jeannette* was unable to draw any conclusions from its weather-related observations, but the comments themselves give an insight into an evolving science and contemporary thought processes. These galvanometer readings represent some of the first direct evidence of geomagnetically induced currents at the Earth's surface. The tangent galvanometer used in these experiments detected currents flowing through a long wire by measuring the resulting magnetic deflections of a compass housed within a wire coil connected to the long wire. While Chipp provided a very detailed description in his notebook of the galvanometer he used for these measurements, information about the number of turns on the coil and the magnetic susceptibility of the instrument were

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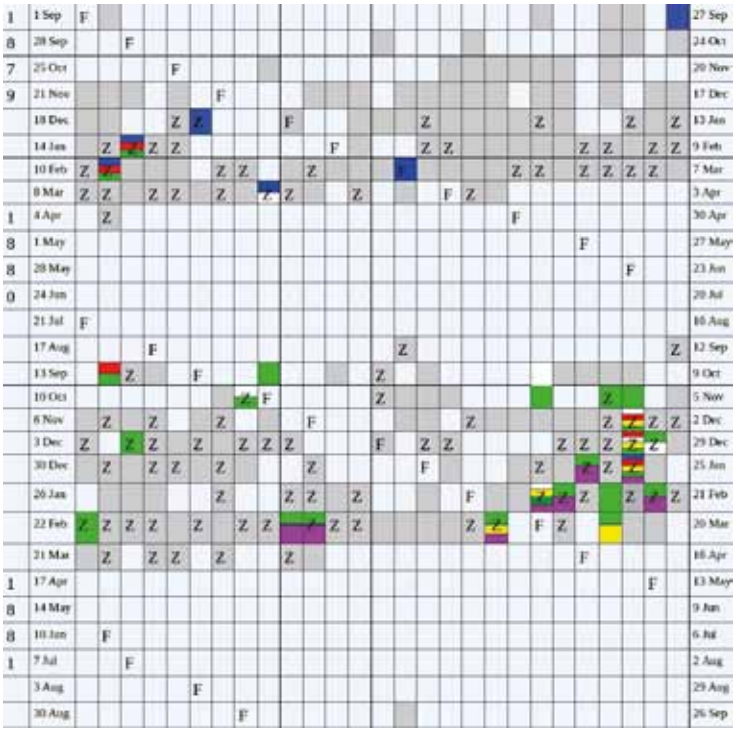

6 A representation of recurrent auroral activity during the USS *Jeannette*'s two-year observation period. Each row represents 27 days with each cell representing one day. Ship time (UT-12).

not recorded, preventing the conversion of these deflections into ampere, the modern unit of electrical current.

Recurrent patterns

The Sun rotates approximately once every 27 days with respect to the Earth, a value associated with mid-solar-latitudes because differential rotation within the solar atmosphere results in the solar equator having a rotational period of 25 days and the poles having a rotational period of 30 days with respect to the Earth. In order to pick out any recurrent patterns in geomagnetic activity resulting from active regions in the solar atmosphere that persist for more than one 27-day rotation of the Sun, daily auroral observations can be stacked in a grid with 27 columns, with time increasing from left to right and from top to bottom (e.g. Willis & Davis 2015). Any persistent recurrent features will align vertically on such a grid, while persistent aurora will appear as horizontal features. When the observations from *Jeanette*'s crew were arranged in this fashion (figure 6) some interesting features emerge. First, it is apparent that auroral coverage was almost complete for the winter months between October 1879 and March 1880, and September 1880 and March 1881. Gaps in these records tend to occur at or near full Moon (marked as F in the appropriate grid squares) although aurora is still seen on some nights where the Moon is full (for example 27 December 1879), when it must have been very bright. Observations that were recorded in the zenith are marked Z, a feature that occurred on many of the nights. While colours of the aurora are not always recorded, one group of observations from 3 November 1880 to 17 March 1881 are associated with multiple descriptions of colour, indicating that they were particularly bright. Each of these observations coincided with a very large sunspot group (Royal Observatory, Greenwich 1907). For example, the observation of the sunspot group (number 397) visible during the interval 24 November to 4 December 1880 was described as: "A very fine stream, the principal members of which are two very large composite spots on November 25. A great number of small spots form on all sides of the two principal spots. The following spot of the two has broken up by November 27, and rapidly diminishes on the succeeding days."

The value of old space weather

An extreme space-weather event is a one-in-100 years occurrence. Looking back at historical proxies for auroral events leads to a better understanding of the long-term processes involved. The auroral records of the captive crew of the USS *Jeannette* were never published as was intended. Now, 135 years later, these records have revealed a detailed insight into Arctic aurorae in the early 1880s. We were able to identify the beginning and end dates of two auroral seasons and the effect of the lunar phase on the visibility of displays. The colours described in the logs are consistent with current knowledge about the energy of auroral particle precipitation in the upper atmosphere. The times that the auroral displays were observed were consistent with our understanding of auroral substorms and we were able to corroborate the position of the auroral oval by looking at the direction in which the aurora was observed, together with information on geomagnetic storms and the *aa* index recorded at the Royal Observatory, Greenwich. We also found some evidence for recurrent auroral activity and found that repeated colourful auroral observations coincided with records of large sunspot groups recorded at the Royal Observatory, Greenwich. We have shown that historical data hidden in an unexpected source can still have relevance to today's space weather. ●

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AUTHORS

Julia Wilkinson, Zooniverse, c/o Astrophysics Dept, University of Oxford, UK. **Chris J Scott**, Dept of Meteorology, University of Reading, UK. **David M Willis**, Space Science and Technology Dept (RAL Space), Rutherford Appleton Laboratory, Didcot, UK and Centre for Fusion, Space and Astrophysics, Dept of Physics, University of Warwick, UK.

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FURTHER READING

Additional figures to accompany this article can be found at https://dx.doi.org/10.6084/m9.figshare.3102490.v1

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Extracted auroral observations used for this study https://github.com/zooniverse/old-weather-data/tree/master/USS%20Jeannette

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