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- Citizen science project collecting aurora observations
- Observations will be used to improve auroral modeling, forecasting, and alerts
- Improving public's understanding of aurora and space weather

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Aurorasaurus: A citizen science platform for viewing and reporting the aurora

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Abstract A new, citizen science-based, aurora observing and reporting platform has been developed with the primary aim of collecting auroral observations made by the general public to further improve the modeling of the aurora. In addition, the real-time ability of this platform facilitates the combination of citizen science observations with auroral oval models to improve auroral visibility nowcasting. Aurorasaurus provides easily understandable aurora information, basic gamification, and real-time location-based notification of verified aurora activity to engage citizen scientists. The Aurorasaurus project is one of only a handful of space weather citizen science projects and can provide useful results for the space weather and citizen science communities. Early results are promising with over 2000 registered users submitting over 1000 aurora observations and verifying over 1700 aurora sightings posted on Twitter.

1. Introduction

Citizen science is a rapidly growing, newly formalized, field that is fueled by the concept of crowdsourcing and cognitive surplus, i.e., that small amounts of volunteered time from a vast number of people can contribute to a larger goal [*Shirky*, 2010]. Specifically, citizen science involves "organized research in which members of the public engage in the processes of scientific investigations by asking questions, collecting data, and/or interpreting results" (Citizen Science Central, http://www.citizenscience.org).

Projects that incorporate citizen science have the potential to engage broad audiences, motivate volunteers, increase data collection yet still control data quality, corroborate model results, and increase the speed at which decisions can be made [*Clery*, 2011; *Cooper et al.*, 2010; *Danielsen et al.*, 2010; *Darg et al.*, 2011; *Kelling et al.*, 2009; *Willett et al.*, 2010].

Such projects are frequent and well established in astronomy, fueled by the large and well-organized amateur astronomy networks [e.g., Globe at Night *Walker et al.*, 2008, Zooniverse *Smith et al.*, 2013 and Cosmoquest *Gugliucci et al.*, 2014]. Similarly, in biological fields, citizen science programs are widespread and tend to be based upon the crowdsourced collection of phenological or conservation-related data [*Wiggins and Crowston*, 2010]. However, formal citizen science projects are fairly rare in the field of solar-terrestrial physics [*Knipp*, 2015]. One specific example is *Barnard et al.* [2014] who, in partnership with the leading citizen science astronomy collective Zooniverse, have created a data analysis citizen science project involving the characterization of coronal mass ejections. There are, however, many informal groups or individuals who are functioning as citizen scientists, e.g., ham radio operators [cf. *Coile*, 1997], sprite hunters [cf. *Lyons et al.*, 2012], and northern lights hunters [e.g., *Frissell et al.*, 2014].

An early, well known, aurora hunting citizen scientist was a Vermont farmer named Wilson Bentley who observed and cataloged over 700 auroras over a century ago [*Silverman and Blanchard*, 1983]. Today, there are many aurora hunting citizen scientists like Bentley, partly enabled by the advent of easy-to-use and sensitive digital photography. This advancement in photographic equipment allows even subvisual aurora to be captured and observed on the camera, typically after an exposure of a minute or less.

With the arrival of new technological tools, such as smartphones and social networks, public participation in scientific practice has been enabled and supported as never before. Citizen science can work on a massive scale, generating high-quality data that lead to reliable, valid scientific outcomes, as well as unexpected insights and innovations [*Fore et al.*, 2001; *Trumbull et al.*, 2000].

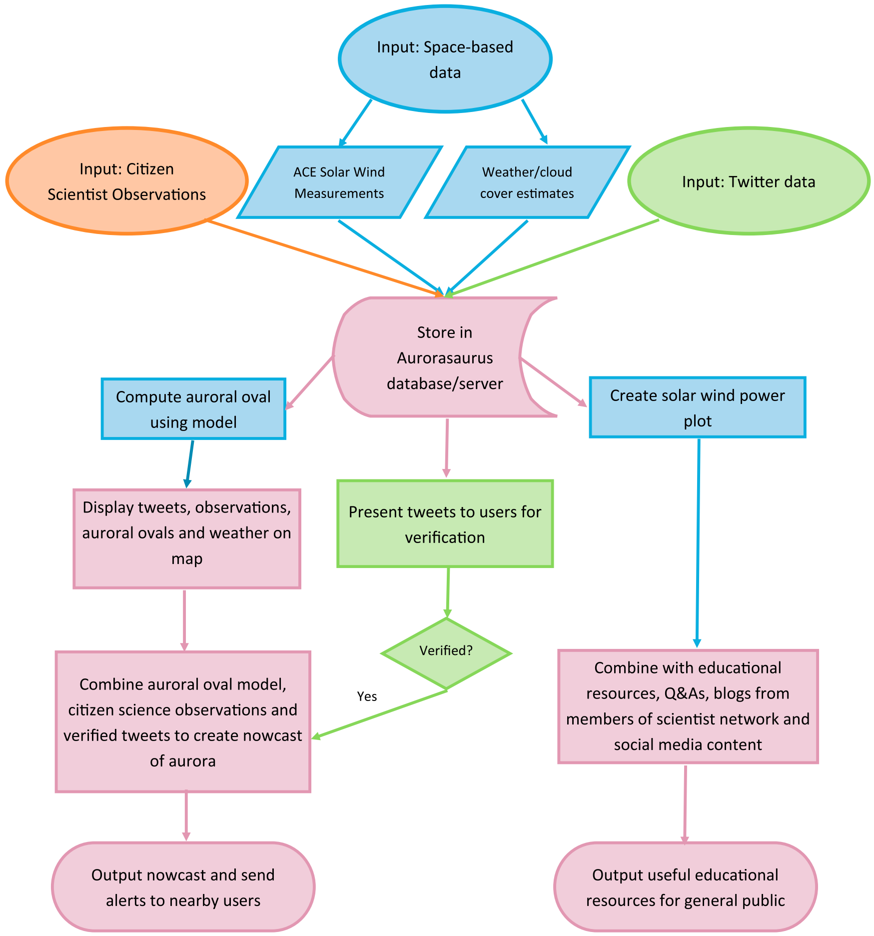

Figure 1. A flow chart demonstrating the different data inputs/outputs (ovals) and processes (rectangles) of the Aurorasaurus project. The blue filled shapes indicate usage of space-based data, orange indicates citizen science data, and green indicates Twitter data. The purple shapes indicate a combination of several data sources. All data sources are fed into the Aurorasaurus database and are then processed in several different ways.

Exploiting these new technological tools and advancements, Aurorasaurus is a citizen science project whose primary aim is to combine traditional space weather data, i.e., satellite data, with citizen science data, i.e., aurora sightings provided by the public, to improve both our understanding of the aurora and our ability to predict when, and from where, it might be visible.

A more detailed summary of what Aurorasaurus is, along with the data it collects and its outputs, is provided in section 2. A discussion of the relevance of Aurorasaurus to the solar-terrestrial community is presented in section 3, and some early results are shown in section 4. A conclusion, given in section 5, provides a summary of Aurorasaurus and explores potential future developments of the project.

2. What Is Aurorasaurus?

Aurorasaurus is an interdisciplinary effort encompassing space weather science, citizen science, and information sciences. The core aspect of the project is to collect citizen science observations of the aurora and use these to improve the real-time nowcasting of its visibility. However, the project also has the broad goals of developing a real-time citizen science network, educating the general public about the aurora and space weather, in general, and providing a test bed for citizen science-based alert systems.

As shown in Figure 1, inputs into the Aurorasaurus platform include data from satellites, citizen scientists, and Twitter. These data are processed and displayed on a map, as they relate to the location of the aurora. The process by which raw data are transformed into actionable outcomes and educational activities is also described.

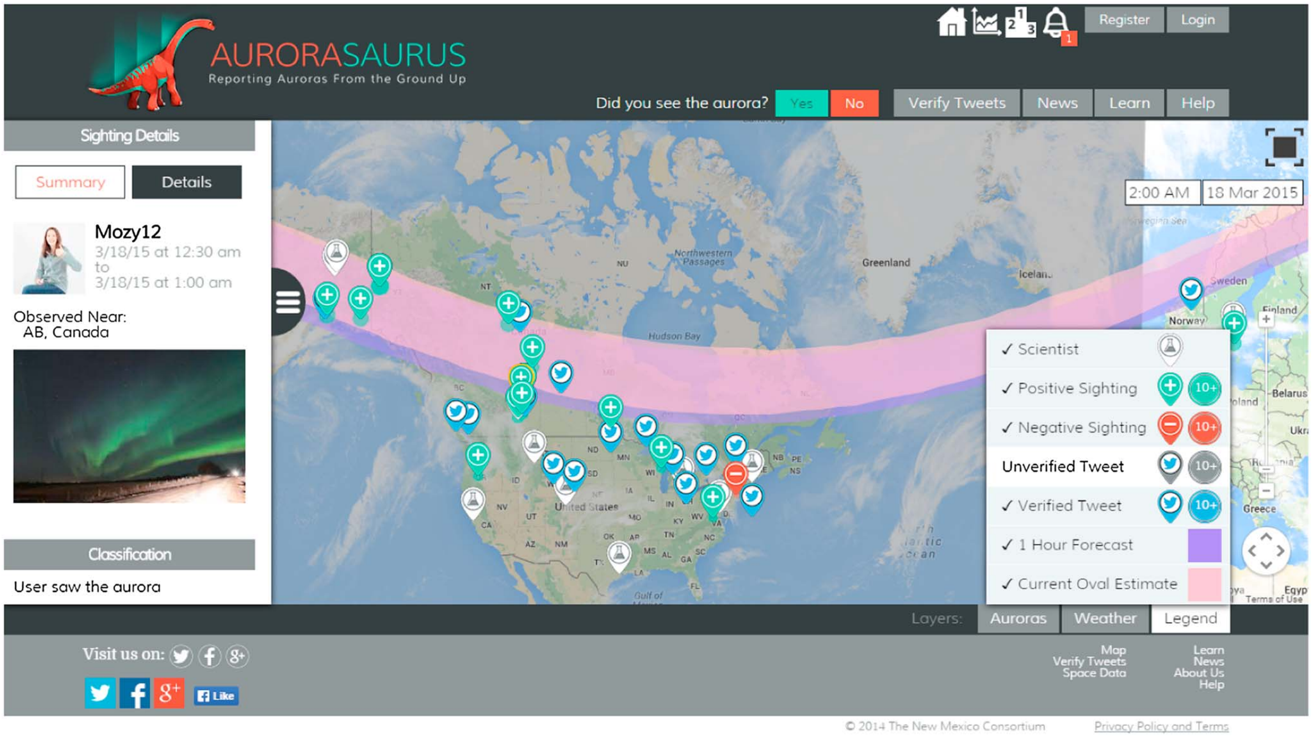

Figure 2. A screen capture of the main Aurorasaurus page is shown (02:00 EDT, 18 March 2015). (bottom right) The legend includes on/off toggles for the current and forecast auroral ovals, citizen observations, and tweets relating to the aurora. (top right) The site navigation icons indicate (from left to right) the Home screen, a real-time plot of the epsilon solar wind power parameter, the Leaderboard of participants, and notifications for registered users. (middle left) Also shown are the sighting details for a positive sighting report (green plus icon). Names have been redacted for privacy.

Since the primary function of Aurorasaurus is to let users know when, and from where, an aurora may be visible, the landing page of the website is a real-time aurora map. However, visitors to the site are also able to change the view to select times and dates from the past—thus allowing them to inspect specific events of interest. As shown in Figure 2, overlaid on this are several layers, each of which can be turned on or off by the visitor. These layers include the estimated current and forecasted auroral ovals (based upon the *Roble and Ridley* [1987] model) along with “geosocial” observations, current weather conditions and cloud cover, and a day/night line.

The relatively new term geosocial refers to the mapping of socially crowdsourced observations. Several other platforms that utilize geosocial mapping at their core include the following: Waze, for real-time traffic and routing information (www.waze.com); eBird, for observations of birds [*Sullivan et al.*, 2009; *Wood et al.*, 2011]; and CoCoRaHS, for weather observations [*Reges et al.*, 2008]. All of these examples have some similarity in form and function to Aurorasaurus though on vastly different topics and using different types of geosocial data.

2.1. Data Collection

Aurorasaurus collects two forms of geosocial data: aurora observations that are reported directly through either the project’s website or mobile apps and aurora observations that are posted on Twitter.

Both registered and anonymous users may reports observations through the website or mobile apps. These observations are submitted through a template submission form and will often include details about the aurora alongside the required location and time of the sighting. There is also the facility to upload a photograph of the observed aurora. An example of such an observation is shown in Figure 3, along with the form users submit their observations with. The submission form is designed for simplicity by splitting an observation into several key components, including the colors observed, the activity level (in terms of speed), the height in the sky (in terms of the angle from the horizon), and some very basic typology options for the auroral shape. Users report their observations using the simple aurora classifications of discrete arcs, diffuse glow, and pulsating patches as these are the most easily distinguishable types of aurora and correspond to different

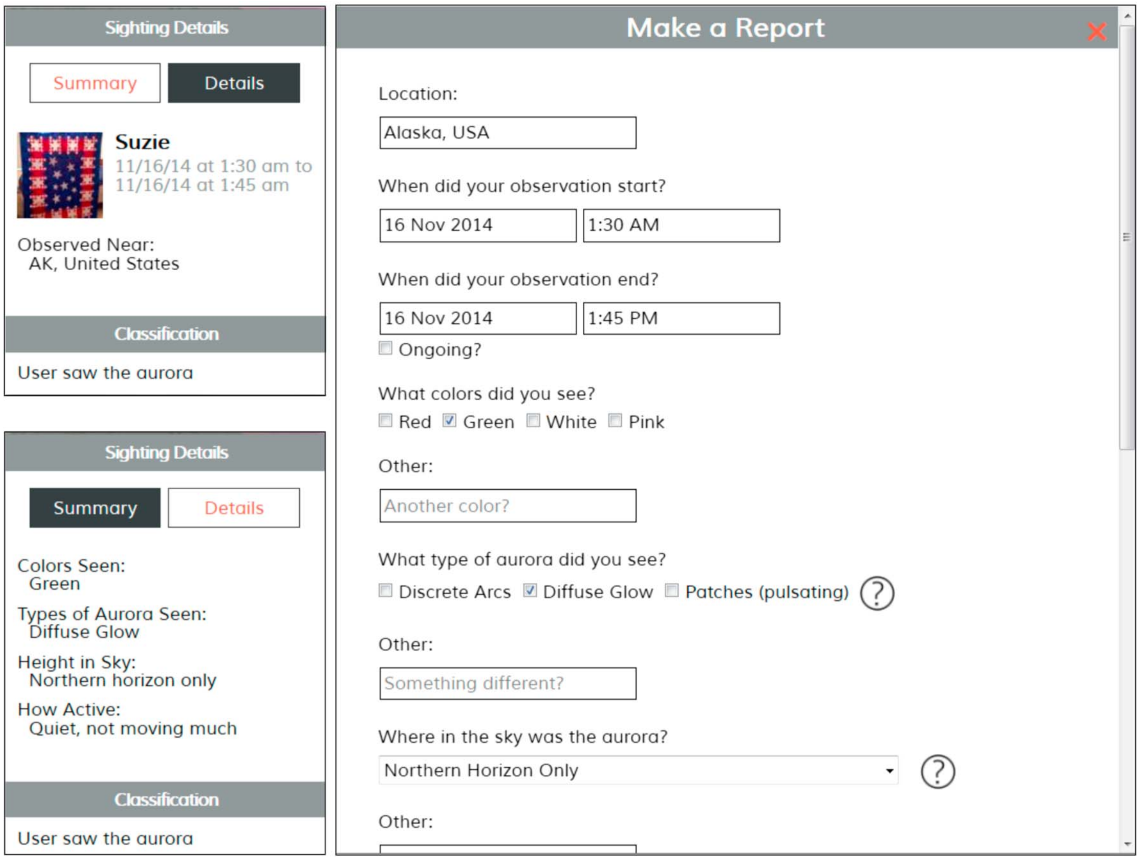

Figure 3. An example of a citizen scientist's aurora sighting report. The two boxes on the left (both with header "Sighting Details") show the report as it appears on the Aurorasaurus site; the large box on the right (header "Make a Report") shows the sighting report submission form.

physical mechanisms. An additional comments field allows users to add any extra details not covered by the previous fields.

While the citizen science observations are extremely useful, they can be somewhat limited in availability. The primary issue is that it requires aurora observers to know of the project before their sighting occurs. Therefore, to complement these data, and to increase the number of observations, Aurorasaurus searches Twitter for any sightings that might have been posted there.

Twitter has been used as a reliable source of information for many large-scale events and natural disasters. For example, Twitter users, who post short updates (140 characters maximum) known as "tweets," have provided real-time publicly available information about events such as earthquakes [*Earle et al.*, 2010; *Crooks et al.*, 2013], influenza outbreaks [*Culotta*, 2010; *Lampos et al.*, 2010], wildfires [*Sutton et al.*, 2008], and service outages [*Motoyama et al.*, 2010]. Typically, such events produce a significant localized rise and exponential decay pattern in the number of tweets relating to that event [*Sakaki et al.*, 2010].

Previous studies have shown that during natural disasters, such as fires and floods, Twitter can be used to evaluate the situation on the ground in real time (a process known as "crowdcrafting") [e.g., *Vieweg et al.*, 2010]. It therefore seemed plausible that Twitter could be used in a similar way to map the visibility of the aurora.

During a "proof of concept" event in late October 2011, *Priedhorsky et al.* [2012] found that social media networks can be used to detect widespread visible aurora. *Case et al.* [2015a], using data collected by the prototype Aurorasaurus website, expanded this result and showed that over a period of 8 months, the number of tweets correlated well with several proxies of auroral activity (i.e., *Kp*, *Dst*, *AE*, and ε).

Aurorasaurus uses the Twitter Search API to identify tweets containing any of the several aurora-related keywords (e.g., "aurora" and "northern lights"). Some filtering is undertaken on the tweets (for example, to remove tweets containing profanity), and an attempt at location extraction is made on the tweets. Some tweets

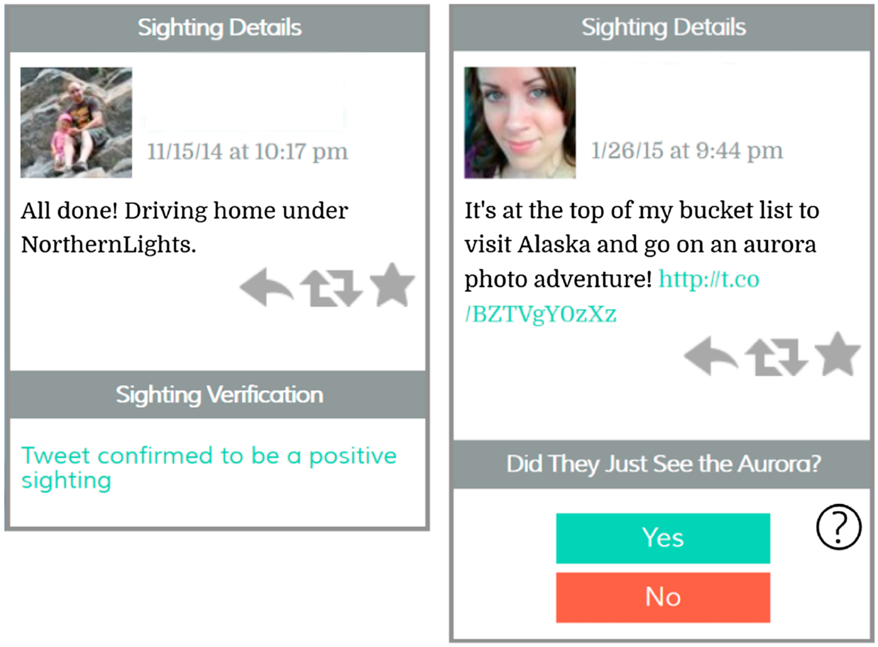

Figure 4. (left) An example of a positive aurora sighting tweet and (right) an example of an aurora-related but nonsighting tweet. Crowdsourcing is used to identify genuine, real-time, aurora observations. Names have been redacted for privacy.

contain location information embedded within them (i.e., the user has opted to share their GPS location). For those that do not, we use the open-source CLAVIN geoparser software (http://clavin.bericotechnologies.com/) to extract a location based upon the text in the tweet. Such extraction methods can never be perfect; however, CLAVIN has shown to have a high-precision rate [*D'Ignazio et al.*, 2014].

A best practice of using people to validate the text of tweets has developed [e.g., *Yu et al.*, 2012] as filtering alone, even when exploiting machine learning, can never be perfect. For example, it is especially difficult for a machine to discern a recent viewing of aurora (e.g., "I've just seen the aurora!") from a desire to see aurora (e.g., "I just want to see the aurora!"). As such, Aurorasaurus serves prefiltered aurora-related tweets to its users for verification (examples are shown in Figure 4). Our users are encouraged to vote on whether the tweets are genuine real-time sightings of the aurora or not. If enough users vote that a tweet is real sighting, the tweet is "verified" and is treated just like an observation reported by a citizen scientist on the website or through the mobile app. By combining the verified tweets with the reported observations, we are able to enrich our data set and provide greater spatial coverage [*Tapia et al.*, 2011].

So far, the number of verified tweets represents only ~3% of the total number of aurora-related tweets collected. However, preliminary findings suggest that the tweets are a significant source of aurora sightings and can rival or surpass the number of citizen science observations submitted directly to the project. Future work will investigate the efficacy of the citizen science tweet validation and explore more advanced filtering methods.

2.2. Aurora Alerts

Aurorasaurus offers real-time alerts, sent via e-mail and Twitter direct messages, to its registered users when an aurora might be visible near them. To do this, we employ a clustering algorithm on the citizen scientist data (both reported observations and verified tweets). If a certain number of positive sightings are reported in a localized area, which we term a positive cluster, any users located inside that cluster are informed that the aurora has been seen nearby. Users outside, but still nearby, the cluster are informed that an aurora may be visible near them.

In the current implementation, alerts are issued solely based on the citizen science data. Future iterations of the project, which are currently under development, will merge the output from the auroral oval models and the positive sighting clusters to provide a more robust real-time alert system. Specifically, the auroral ovals

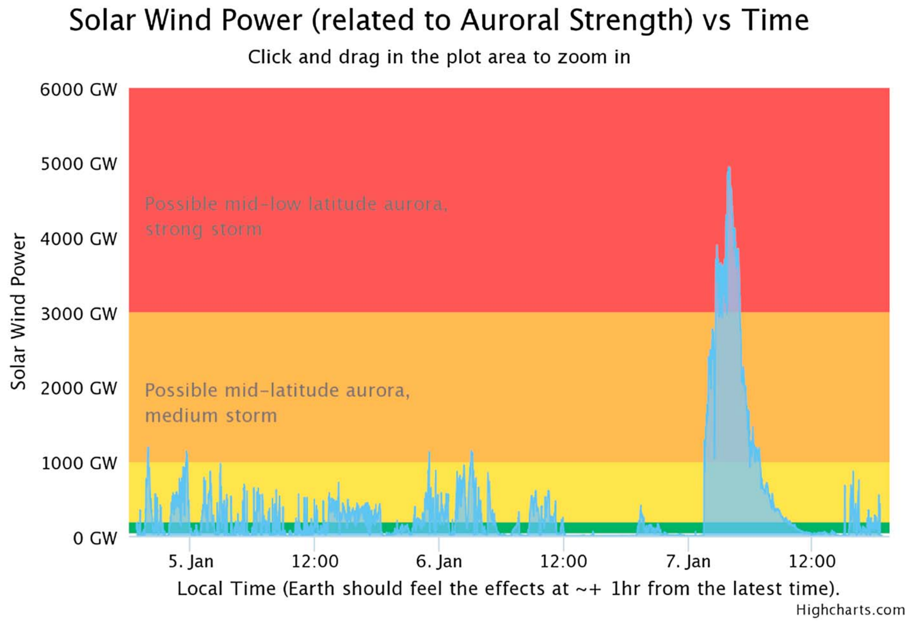

Figure 5. An example of the solar wind power plot on the Aurorasaurus website (5–7 January 2015). The "power" is, in fact, the value of the epsilon coupling function and is calculated in real time using upstream solar wind data from ACE. The chart has several color bands to indicate the possible latitude from which an aurora might be visible.

will adapt to any positive sighting clusters thus providing a responsive, high-resolution estimate of where the aurora can be seen. In turn, this will feed into more accurate alerts for our users.

This hybrid alert system will be more precise than the coarse, large-scale, alerts based on the solar wind data alone and yet more applicable to the population as a whole than using just localized citizen science data. Such a system is also of great interest in the disaster warning and response community [*Tapia et al.*, 2014a, 2014b; *Lalone et al.*, 2015].

2.3. Education and Outreach

The use of terminology in terrestrial and space weather forecasting is a difficult conundrum. Space weather forecasting is extremely complicated, with multiple threats manifesting at different times to multiple customers. Such forecasts are typically not written for the general public and often include references to multiply defined scales of impacts, detailed observations, and model outputs without full explanation.

As one specific example, the NOAA geomagnetic storm scale [*Poppe*, 2000] is aimed toward federal stakeholders and large events (starting at G1 "minor"). A G1 geomagnetic storm corresponds to a *Kp* index of ~4 and is appropriate on a global scale for most customers. However, at this level, aurora may be visible as far south as the U.S./Canadian border and absolutely spectacular in Alaska (not at all minor which communicates nearly insignificant).

Central tenets of scientific communication are simplification, accuracy, and commitment to communicating uncertainties. Examples used on Aurorasaurus include explaining that an aurora is not directly caused by the Sun and that solar predictions for auroral visibility are necessarily coarse with large uncertainties (especially in onset time).

Aurorasaurus aims to provide clear and low-jargon information about when, and where, an aurora is visible. In addition to plotting the modeled auroral oval on a map, real-time space weather data are provided to help our users understand how the drivers of an aurora vary with time. Rather than using abstract indices (e.g., *Kp*, *Dst*, or *AE*) or describing the magnitude and orientation of the interplanetary magnetic field, to explain the strength of the drivers, we have opted to adopt and plot a measure of the "solar wind power," a colloquial description of the epsilon coupling parameter [*Perreault and Akasofu*, 1978; *Akasofu*, 1981].

As shown in Figure 5, for a geomagnetic storm, the solar wind power can rise sharply to some maximum, indicating enhanced aurora at lower geomagnetic latitudes, and then decrease more slowly to background levels. The solar wind power has the benefit of being expressed in the units of power (GW)—a concept the general public can easily understand. Although, admittedly not the highest correlating parameter with the auroral energy budget [*Newell et al.*, 2007], using the past hour's average of epsilon provides a simplified, accurate proxy for the auroral activity level [cf. *Akasofu*, 2015]—thus meeting the central tenets of science communication (N. Case et al., manuscript in preparation, 2015).

To the public, the aurora often represents a beautiful but poorly understood phenomenon. Space plasma physics is not taught in most schools, including colleges, and most practitioners only enter the field in graduate school. The philosophy behind the educational offerings of the Aurorasaurus website is to offer engaging answers to common questions about the aurora.

Answers are provided in the form of Q&A sessions with members of the project's "scientist network" (facilitated through social media activities such as Reddit AMAs, Google+ Hangouts, and Tweet Chats), FAQ web pages, and unique content such as Infographics. The scientist network is a globally distributed group of aurora/space weather experts who volunteers a modest amount of time for educational outreach.

Some space weather enthusiasts are self-taught and have a well-developed understanding of the aurora. For them, we offer a blog that features in-depth aurora-relevant space physics topics and an insight into the work of scientists studying the aurora. Blog posts are written by members of the Aurorasaurus core team, members of the Scientist Network, and by guest authors. Social media updates about the blog drive traffic to the website and vice versa, a current best practice [*Kietzmann et al.*, 2011]. Partnering with the Scientists Network members' institutions to promote these pieces also helps to increase their visibility.

3. What Is the Relevance of Aurorasaurus to Solar-Terrestrial Physics?

Aurorasaurus has relevant applications to solar-terrestrial physics in several different areas: improving auroral oval forecast models by providing data for real-time validation, facilitating citizen science discoveries of unusual auroral types, improvement in our ability to image large storms, and as an opportunity to educate the public to our field.

There are several auroral oval models in the scientific literature, though perhaps the most widely used is OVATION Prime [*Newell et al.*, 2010, 2014]. This model uses upstream solar wind data (i.e., ACE) as an input and is based upon functional fits to the solar wind coupling function $d\Phi_{MP}/dt$ [*Newell et al.*, 2007]. Aurorasaurus currently uses the University of Alaska Fairbanks (UAF) model (http://www.gi.alaska.edu/AuroraForecast), which is based upon the empirical model of *Roble and Ridley* [1987] and uses estimated real-time *Kp* as the input. The estimated real-time *Kp*, determined using ACE solar wind data, is provided by *Wing et al.* [2005].

There are several shortcomings of solely using models for aurora prediction. For example, auroral oval models cannot yet account for substorms in which auroral activity can expand rapidly to lower latitudes for subhour time intervals. The models also currently rely on ACE real-time beacon data as the primary input, which are single-point measurements on an aged satellite platform. Additionally, ACE solar wind speed measurements are somewhat limited and may be contaminated during solar energetic particle events [e.g., *Baker et al.*, 2013].

Auroral oval models currently lack real-time data for validation, especially for extreme auroral events. Filling in this gap is a goal of NASA Goddard's Community Coordinated Modeling Center [*Zheng*, 2014] and of the greater geospace research community focused on model validation. This topic is important for space weather research-to-operations needs including scintillation and spacecraft charging (Y. Zheng, personal communication, 2014). The collected citizen science data provide locations and times of auroral sightings as well as details such as the color, position in the sky, type, and movement of the aurora.

Citizen science has yielded unexpected discoveries [e.g., *Lintott et al.*, 2009], and such discoveries may be possible with auroral observations as well. Many users have high-quality photography gear with GPS-enabled devices. With a higher density of professional quality observations it is possible to capture rare aurora at unusual places, possibly corresponding to the foot points of magnetospheric satellites, like Radiation Belt Storm Probes, Thermal Emission Imaging System, and GOES. Such conjunctions have made critical gains in field line mapping issues [e.g., *Nishimura et al.*, 2010; *Weiss et al.*, 1992].

Some of the outstanding problems of magnetospheric physics (namely, that of substorm onset triggers and the space-based origins of different types of aurora) could be greatly aided by more advantageous conjunctions and systematic work [e.g., *Borovsky*, 1993, E. Donovan, personal communication, 2014].

Table 1. A List of Aurorasaurus Resources and Useful Figures[a]

Resource	URL	Figures
Website	www.aurorasaurus.org	~2,000 registered users ~1,050 sighting reports ~1,750 verified tweets
Mobile apps (iOS and Android)	www.aurorasaurus.org (from a mobile device)	~3,000 downloads
Facebook	www.fb.com/aurorasaurus.org	~19,000 likes
Twitter	www.twitter.com/tweetaurora	~1,100 followers
Scientist Network	www.aurorasaurus.org/about-us	13 members
E-mail	aurorasaurus.info@gmail.com	
Blog	blog.aurorasaurus.org	

[a]Figures accurate as of July 2015.

Amateur ornithologists on eBird have reported confirmed sightings of extremely rare birds [e.g., *Toochin and Levesque*, 2014], and so the possibility of the amateur community finding a so-called "needle in the haystack" for aurora research is not insignificant. High-latitude amateurs may be in a better position to observe substorm breakups, for instance. Less spectacular phenomena like pulsating and diffuse aurora can also yield new insights when observed at unusual times or locations. Midlatitude aurora and ionospheric disturbances are even more poorly characterized and understood.

As the gap between consumer and professional grade photographic equipment narrows, citizen scientist observers may be able to take a more scientific approach as well to observations, taking camera orientation and settings more quantitatively than qualitatively. This is particularly useful since storm time imaging of aurora over midlatitudes is lacking, as we have been without high Earth orbit imaging spacecraft for a decade. Most global-scale images of auroral events (such as those captured by DE2) date back to the 1980s and a single pixel covered hundreds of kilometers. Yet there are many auroral features at a continuum of scales all the way down to subkilometer [*Stenbaek-Nielsen et al.*, 1998].

Low Earth orbiting satellites can capture higher-resolution data on segments of the auroral oval, but data are not typically available in real-time, passes are separated by over an hour, and dedicated instruments are scarce. Recently, the International Space Station has used their imaging of the aurora to increase interest in the astronaut programs; however, without using additional software to deconvolve viewpoint and rapid motion, such photos cannot be used for scientific study.

Truly rare large events, such as the St. Patrick's Day storm [*Case et al.*, 2015b], could be widely captured with modern technology. With a globally distributed network of dedicated midlatitude observers, stitching together a mosaic view of the aurora during a major geomagnetic storm may be possible. Space scientists need to know the global distribution and evolution of different types of aurora during storms to quantify the energy budget of these storms. This is a quite basic gap in knowledge, which leads to other gaps in understanding magnetosphere-ionosphere coupling. The ability to accurately model extreme events is hampered without this knowledge (A. Ridley, personal communication, 2013).

4. Early Results

Since its official launch in October 2014, Aurorasaurus has primarily been in a "data collection" and a "growth" mode. The number of registered users has been growing steadily as have the number of observations and verified tweets. One notable exception to this was a dramatic increase of registered users during the St. Patrick's Day (17–19 March 2015) storm where the user base increased by 50% in just 1 day [*Case et al.*, 2015b]. Total numbers, for the first 6 months, are shown in Table 1 and indicate strong growth for a new citizen science project.

As might be expected, the number of observations in a given day is predominantly dependent upon auroral activity. Figure 6 demonstrates that the number of observations (i.e., verified tweets and both positive and negative observations) generally peaks during days of enhanced geomagnetic activity (i.e., $Kp \geq 4$). The exact size of the peak is, of course, also dependent upon the number of registered users, and so we might

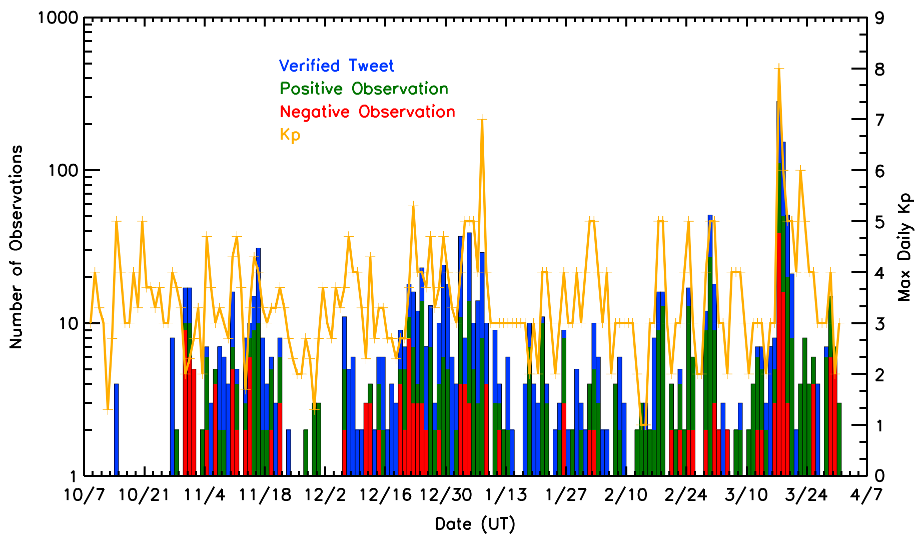

Figure 6. A stack plot of the Aurorasaurus citizen science data over a period spanning 6 months (October 2014 to March 2015). The number of observations (verified tweet = blue, positive sighting = green, and negative sighting = red) per day is plotted on a logarithmic scale. Plotted on the secondary *y* axis is the maximum daily *Kp* value (a quasi-logarithmic scale of geomagnetic activity).

expect that the size of the peaks should increase as time goes on (even for similar-sized auroral events). The St. Patrick's Day storm, however, shows a particularly large increase (approximately 10 times an "average" peak) in the number of observations reported to Aurorasaurus.

The vast majority of registered Aurorasaurus users are located in the U.S. (43%), Europe (42%), or Canada (13%). Other users are located in countries such as Australia, New Zealand, and Russia, among others. This distribution is perhaps not unexpected since the U.S., Europe, and Canada are all near the northern auroral oval (at least in part) and have relatively large English-speaking (even if not native) populations. Our registered users provide good spatial resolution from approximately −170 to +40° longitude, in the Northern Hemisphere.

The magnetic latitude of the positive aurora observations submitted to Aurorasaurus is shown in Figure 7. The locations have been collated into 1° bins, and the colored stacked bars in each bin indicate the number

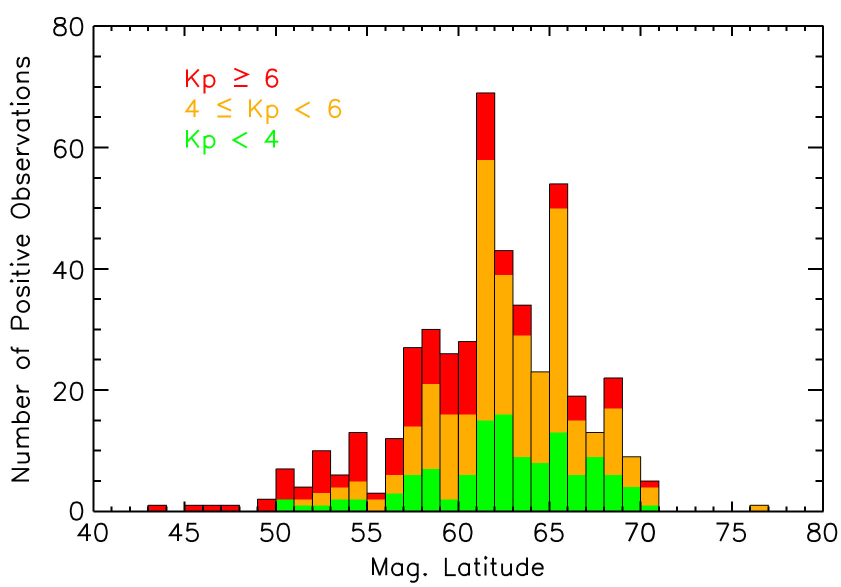

Figure 7. A stack plot of the magnetic latitude of the Aurorasaurus positive aurora observations for the same 6 month period as Figure 6. The number of positive observations per 1° latitude bin is stacked and colored based upon the *Kp* level during the observation.

of observations for each of the three *Kp* groups: $Kp \leq 4$ (green), $4 \leq Kp < 6$ (orange), and $Kp \geq 6$ (red). As expected, observations at lower magnetic latitudes generally occur during higher *Kp* values. Work into comparing these data with several auroral models, for the purposes of verification and validation, is underway.

5. Conclusion

This solar maximum has fundamentally different opportunities for engaging with the public than ever before: Facebook, Twitter, and many social media sites did not exist during the last solar maximum. Digital cameras, along with smartphones and mobile applications, have improved significantly in this period which has fundamentally changed the way the public are able to capture rare events. When strong auroral displays do occur, the public records them, often in real time, on a range of platforms (e.g., Facebook, Twitter, and Flickr).

Citizen science projects have shown great success in many scientific disciplines. Aurorasaurus aims to further this success by building a new community of aurora-hunting citizen scientists, using intellectually engaging resources, aurora visibility alerts, and motivational incentives for participation. Early figures, as shown in Table 1, demonstrate that this relatively new project already has an active and engaged user base.

The Aurorasaurus team is actively working to grow this community to provide denser spatial coverage of aurora observers to increase both the number of notifications issued and the number of "ground truth" observations. Citizen scientist recruitment and retention is a challenge for many citizen science projects, and so the scientific community is encouraged to join and raise awareness of this new project. Also welcome are additional Scientist Network outreach volunteers or scientific collaborators interested in exploiting the auroral observation data.

Aurorasaurus provides new tools to help aurora hunters observe the aurora and has demonstrated, during several auroral events in late 2014 and early 2015, that it is a responsive platform. The project's capability has been robustly designed to scale for larger events, such as the St. Patrick's Day storm, and more participants in the declining phase of this solar cycle.

Aurorasaurus aims to be a timely, agile software solution that provides a new data source for space weather activity. New capabilities will include improved auroral oval tools (including the aurora australis by using the publicly available OVATION Prime model) and more robust data assimilation techniques for nowcasting the visibility of the aurora. This extensible geosocial platform can be ported to other languages and phenomena thus creating tangible value to the emerging field of citizen science.

Auroras are more than just pretty pictures. There are many outstanding scientific mysteries to be explored by advancing the connection between space weather and auroras through citizen science. Aurorasaurus can improve the understanding of, and appreciation for, the dynamics and beauty of the aurora by the public and scientists alike.

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