Using Twitter to Receive Storm Reports

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1. INTRODUCTION

For the last several decades, the National Weather Service (NWS) has upgraded its radar networks, satellites and observation mesonets. However, NWS forecasters still depend heavily on a large group of trained, and sometimes untrained, weather spotters to relay relevant storm development and impact information to the weather forecast office. For many years, the means of relaying spotter information to the weather office took two forms: phone calls and amateur radio reports. But in recent years, spotter reports have begun trickling into forecast offices via other methods, including email and instant messaging chat. The NWS, in its efforts to reach more spotters and make it easier for them to report, has developed a pilot project that involves receiving weather spotter reports via Twitter.

Fig. 1 Skywarn® Logo

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2. Spotter Program

Each year over 10,000 severe thunderstorms, 5,000 floods and more than 1,000 tornadoes sweep across the country, threatening lives and property. Despite the latest technological advancements with radars and satellites, NWS forecasters still rely on spotter reports from a network of nearly 300,000 trained spotters. With the Twitter Storm Report program, the NWS looks not only to reach out to trained weather spotters, but also to untrained spotters. Many NWS offices have always accepted untrained spotter reports, but it has not always been easy for those spotters to get their reports into the forecast offices. Most untrained spotters do not broadcast weather information via amateur radio. Also, since they have not participated in formal spotter training, they do not have access to unlisted NWS telephone numbers, used by spotters. The NWS hopes to use Twitter to obtain weather information for this untapped army of amateur weather enthusiasts. These additional reports on local storms will help forecasters issue or modify their warnings and, in turn, provide better value to the communities they serve.

3. Twitter

Twitter is a micro-blogging web site that started in 2006. It allows users to post messages of 140 characters or less, referred to as Tweets. Those who tweet are called tweeters, and they can post their tweets through several methods: either via the Twitter web page, through a mobile phone or via one of numerous third party applications. Their tweets can include simple text, links to pictures or links to other web pages. Users can follow each other, developing a social network. Since it started, Twitter has seen phenomenal growth in both the number of users and public awareness of its existence. As of October 2009, there were more the 45 million users of Twitter worldwide, over 20 million of which were in the United States.

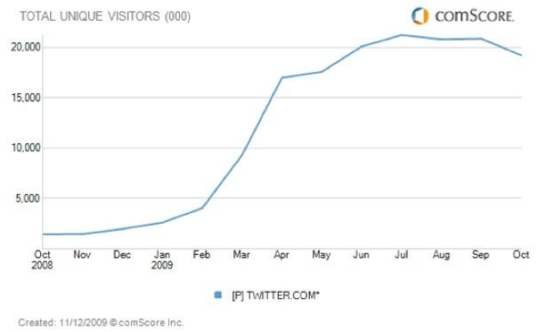

Fig 2 comScore rating of the number of Twitter users

Twitter is not the only micro-blogging site. Several others, including Tumbir, Plurk, Squeeir, Beeing and Jaiku, have been developed over the last few years. However, Twitter has led the way in both user growth and visibility. Fueling Twitter's growth is a rich, flexible and growing Application Programming Interface (API). This API allows third parties not only to develop programs that place "tweets" onto the Twitter web site, but it also allows third parties to search the millions of tweets that have been posted.

Companies such as Best Buy now regularly search Twitter's API looking for customer feedback and when necessary will tweet a disgruntled customer to try and rectify the problem. In the last few months, the United States Geological Service (USGS) has begun to use Twitter to help it in detecting earthquakes. The USGS searches Twitter's API for certain keywords and when found, geo-locates the tweet and correlates that location to a nearby earthquake. Now the NWS has developed an application that will allow weather spotters to tweet their weather reports to the NWS.

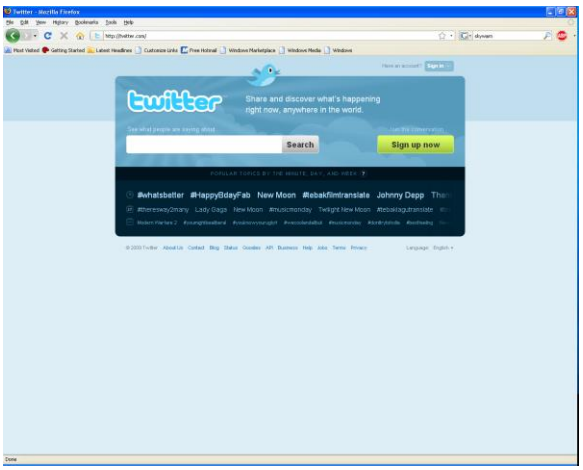

Fig. 3 Twitter Home page

4. Technological Challenges

The development of the Twitter Storm Report project has been challenging with both technological and bureaucratic hurdles that needed to be overcome. One of the technological challenges included: how best to search Twitter's API. You can search Twitter several ways via certain key words, user account names or hashed search terms. Hashed search terms are simply subjects or key words with a hash character (#), also called a pound sign, in front of them. Doing a simple keyword search for "hail" or "flood" will return literally hundreds of tweets with those keywords in them. Not only would you get relevant tweets about ongoing flooding or recent hail storms, but you would also get weather reports from all around the globe and tweets that had nothing to do with weather, but included the word hail or flood. Therefore, it was decided to search for a hashed keyword. The hashed search term that was settled upon was #wxreport. Searching for certain user accounts presented problems related to the Twitter user agreement that will be discussed later in this paper.

Once users tweet a weather report with the hashed keyword, the National Weather Service can search and pull out those tweets from Twitter's API. The next challenge was geo-locating where the tweet was sent from. Twitter has announced they will begin allowing third party encoding of geo-location in their tweets. For users who either don't want to use these third party services or who can't access them, they are encouraged to include their location in the tweet. Users can locate themselves with an address, street intersection, town name or latitude and longitude. Once the tweet is found, the location is geo-referenced and then the tweet is plotted on a web map. The plots are color coded based on various weather-related key words within the tweet. Flooding gets a green marker, a tornado gets a red marker, snow a light blue marker, etc.

The web map is an internal web page that each forecast office will be able to access. Since many of the tweets will be from untrained weather spotters it was decided to keep the web map internal to prevent bad or exaggerated weather reports from getting out into the public. Weather offices can access the web map and see all the tweets that have come from their area of responsibility. The forecaster can then decide whether the report is valid and issue a Local Storm Report (LSR) or they can discard the report for whatever reason. The technical challenges have been problematic, but have generally been overcome.

The more daunting challenges were the bureaucratic ones.

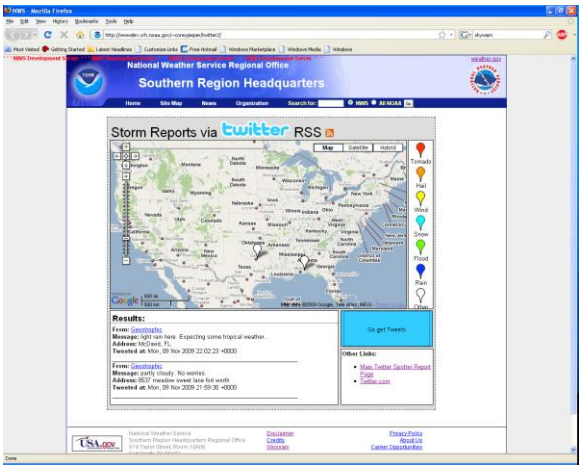

Fig 4 The Twitter Storm Report web map page

5. Bureaucratic Challenges

The government's adoption of emerging technologies has been slow at times. There are certain policy and legal requirements that need to be met before a project like the Twitter Storm Reports can move forward. One of the earliest challenges was the Twitter user agreement. Most of us don't read a web site's user agreement, but government lawyers do. User agreements can place a lot of liability on the user or cause the user to follow certain state laws. That is usually not a problem for the private individual user, but it does become problematic when the user is a federal agency. To reduce the exposure of the government to liability associated with the Twitter user agreement, it was decided not to set up or search for a certain user's account name. That is the reason the hashed search was chosen.

To its credit, the NWS has set up a team to evaluate emerging technologies such as Twitter, Facebook etc. Though support for the Twitter Strom Report was nearly unanimous, the emerging technologies team still had to examine various policies to ensure this project didn't violate any federal policies or laws. A "policy analysis for emerging technologies" had to be completed for this project. Policies that were where examined included: the impact on IT security, records retention, privacy issues, resource impacts, even the Paperwork Reduction Act. It took quite some time to work through all the issues related to these policies. Other bureaucratic challenges that needed to be overcome included communications between local NWS offices and the regional and national headquarters personnel, not associated with the project, but tasked with approving it. These people had to understand the concept of the project in order to get all of the "i's" dotted and the "t's" crossed. In many ways the bureaucratic challenges have proved more daunting than the technological challenges.

6. Future Enhancements

As the Twitter Storm Report project moves forward several enhancements are planned. Currently, tweets are not saved to a database. Once the Twitter API deletes the tweet because of its age (usually about 60 days), the tweet is gone. Creating a database for the tweets would allow them to be stored and reviewed at anytime in the future. By storing the tweets in a database, NWS forecasters could track users to see if they give consistently poor or good reports. Similarly, we would like to implement a method to highlight tweets from trained or reliable spotters. This would allow forecasters to give more weight to tweets from certain users. Finally, the development of geo-location enhancements via Twitter's API will be a tool that will help the project. Since tweets are limited to 140 characters, a significant percentage of available characters are used for the hash search word and the location of the tweet. If the location can be dropped and simply embedded in the tweet itself it would free up additional characters for the user to describe the weather being reported.

7. SUMMARY

The Twitter Storm Report project is an exciting program. It will allow trained spotters to quickly and easily relay their weather information to NWS forecasters. But the project will also reach out to a new generation of weather enthusiasts. It will allow more people to report about storms affecting them and, ultimately, it will help NWS forecasters to increase lead times and improve and refine warnings.

8. ACKNOWLEDGEMENTS

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