P2.5 INTEGRATION OF LIGHTNING AND PRECIPITATION DATA FOR LAND MANAGEMENT AGENCIES

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1. INTRODUCTION

Land management agencies rely on lightning information to predict the potential for fire starts and to make decisions regarding the pre-positioning of monitoring and initial attack resources. The potential for fire starts due to lightning is dependent on fuel type and moisture as well as the location of cloud to ground lightning strikes relative to storm precipitation core. Traditionally, lightning data and WSR-88D reflectivity based products have not been merged into a single display so that direct correlation could be accomplished by fire managers. The Pocatello, Idaho office has developed a web page display that allows the direct correlation of radar and lightning data and made it available to local interagency fire centers.

2. DISCUSSSION

In the Pacific Northwest region, lightning has been documented as the cause of over 70% of fire starts with an average of about 1000 per season. In the early 1960s, the U.S. Weather Bureau deployed the WSR-57 weather radar and Fire Weather Forecasters in the Missoula, MT office recognized the value of sharing radar data with Fire Control Officials (Peterson, 1967). As a result they developed a method of quickly coding radar information to a grid so that it could be transmitted by teletype network to Fire Control Officials in the field.

In the mid 1970s, the US Department of Interior, Bureau of Land Management (BLM) established and began operating a network of lightning direction finding stations (Krider et al, 1980) in the western United States. The network was used to provide early warning of fire starts and to direct fire detection aircraft and suppression crews to areas of lightning activity.

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In the late 1970s, a lightning activity level (LAL) index was developed (Fuquay et al., 1979) to estimate the potential for lightning-caused fire ignitions, and this index became a standard component of the National Fire Danger Rating System (NFDRS) which is still in use today (Deeming et al., 1977).

Further studies (Reap, 1986; Rorig and Ferguson, 1999, 2002) evaluated the relationship between the occurrence of cloud to ground lightning and significant measureable precipitation relative to lightning-caused fire starts. If lightning occurred in conjunction with significant precipitation, then an event was categorized as “wet”. Conversely, if lightning occurred without significant precipitation, then the event was labeled “dry”. The method for determining wet vs. dry events was the comparison of radar data, surface-based precipitation measurements and lightning location data. These studies show that the frequency of lightning-caused fire starts is much greater when lightning occurs without corresponding significant measureable precipitation.

In the mid 1990s, the BLM lightning direction finding network was retired and a national lightning detection network (NLDN) was established by the combination of several regional networks operated by private and academic organizations. The national network was initially operated by Global Atmospherics, Inc. (GAI). The NLDN is a private sector data set, and the NWS acquired this data from GAI and provided it to WFOs on Automated Weather Information Processing System (AWIPS) workstations (Edman, 1997). In addition, since the NLDN data is privately owned, it could not be shared with other government or private sector organizations. Land management agencies have access to the NLDN data on the Weather Information Management System (WIMS).

The NLDN is currently operated by Vaisala, Inc. and in 2005, the NWS and Vaisala signed a contract which provided lightning data to Federal Government agencies (Facundo and Carelli, 2006). This contract also provided terms for the sharing of

lightning data or derived products generated by government agencies.

Given the critical relationship between lightning location, significant precipitation occurrence and the potential for fire starts, WFO Pocatello developed and implemented a web-based near real-time display of radar and lightning data for land management agencies.

3. METHOD

Radar and lightning data is stored in a local AWIPS database at the WFO and the forecaster can display a combination of radar and lightning data on their AWIPS workstation.

To generate displays for use outside the WFO network, lightning data is extracted from the AWIPS database and imported into a local relational database table that is indexed by both location and time. A locally developed script accesses the database and produces image plots of lightning strike locations based on the desired geographic area and time period. The lightning strike images are combined with geographic reference imagery from various sources and WSR-88D Doppler radar data from radar.weather.gov using a combination of free, open-source software tools.

The resulting display imagery is made available to land management agencies via an external web page. Examples of generated images are shown in Figures 1, 2 and 3. Since the Vaisala contract restricts the sharing of this information, the web service is configured to deny access to the lightning location imagery unless the requesting hostname matches one of the allowed patterns (e.g. blm.gov, usfs.gov). This method of restricting access provides a balanced approach to securing the data from unauthorized users without creating a cumbersome user interface.

4. SUMMARY

Land management agencies rely on lightning information to predict the potential for fire starts and to make decisions regarding the pre-positioning of monitoring and initial attack resources. The potential for lightning-based fire starts is dependent on fuel type and moisture as well as the location of cloud to ground lightning strikes relative to storm precipitation core.

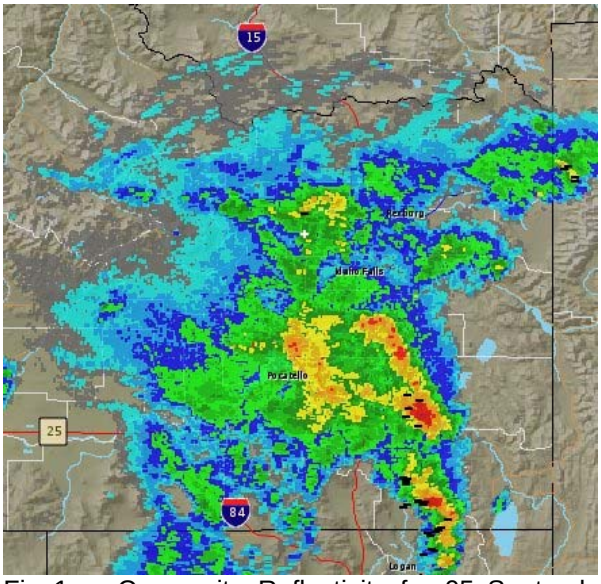

Fig 1. – Composite Reflectivity for 05 September 2007, 1835 UTC and Cloud-to-Ground Lightning locations (negative, black -; positive, white +).

The Pocatello, Idaho WFO has developed a web page display that allows direct correlation of radar and lightning data for local interagency fire centers. This combined display facilitates effective real-time monitoring of the potential for lightning-caused fire starts and provides a mechanism for fire managers to more efficiently deploy monitoring aircraft and initial attack resources. This enhanced capability can provide critical information when fire monitoring and fighting resources are limited by extensive fire activity.

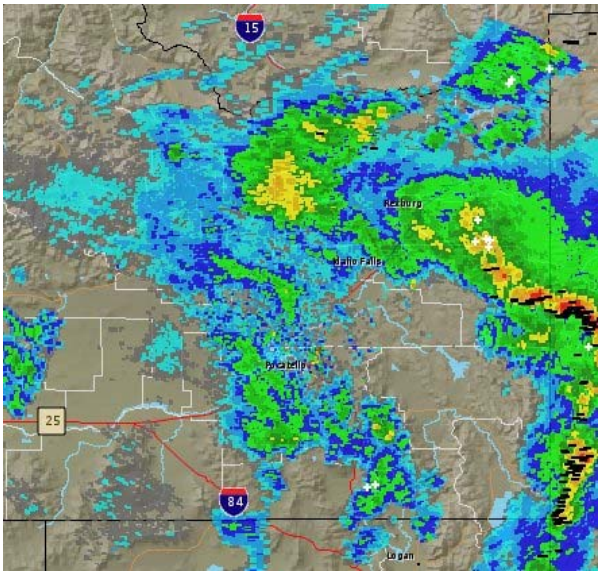

Fig 2 - Composite Reflectivity for 05 September 2007, 2008 UTC and Cloud-to-Ground Lightning locations (as in Fig 1).

We plan on expanding our web page capability to allow lightning data to be combined with other weather data sets by fire managers at local interagency fire centers. In addition, we are exploring the usefulness of providing an observed LAL display for use in the NFDRS.

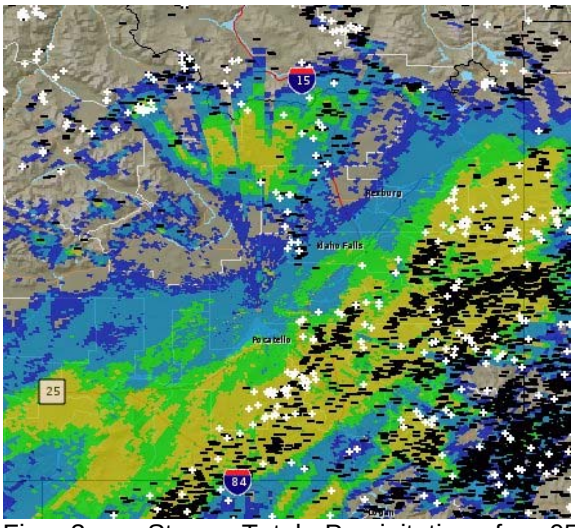

Fig. 3 – Storm Total Precipitation for 05 September 2007 and Cumulative Cloud-to-Ground Lightning locations ending at 2359 UTC (as in Fig. 1).

4.1. *Acknowledgement*

Special thanks to Mike Huston, Lead Forecaster at WFO Pocatello, who discovered the NWS/Vaisala contract terms that allowed the implementation of this data display.

5. REFERENCES

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