

Road Weather for QuickMap

Final Report

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ACKNOWLEDGEMENTS

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1. INTRODUCTION

For display in QuickMap, Caltrans desired to have developed, either for external or internal hosting, weather layers similar to those shown in the Western States Rural Transportation Consortium (WSRTC) One-Stop-Shop (OSS). Since layers in QuickMap were presented using Keyhole Markup Language (KML), it was desirable that these weather layers also be presented via KML or that they be readily usable in conjunction with KML. The relevant current weather layers in the WSRTC OSS were:

- Current Weather:
 - Air Temperature (MADIS, Mesowest, State DOT)
 - Relative Humidity (MADIS, Mesowest, State DOT)
 - 1 Hour Precipitation (MADIS, Mesowest, State DOT)
 - 24 Hour Precipitation (MADIS, Mesowest, State DOT)
 - Advanced Hydrological Prediction Service 24 Hour Precipitation (National Weather Service)
 - Wind (MADIS, Mesowest, State DOT)
- Forecast Weather:
 - Air Temperature (National Weather Service – National Digital Forecast Database)
 - Wind Speed (National Weather Service – National Digital Forecast Database)
 - Wind Gust Speed (National Weather Service – National Digital Forecast Database)
 - Humidity (National Weather Service – National Digital Forecast Database)
 - Sky Cover (National Weather Service – National Digital Forecast Database)
 - 12-Hour Chance of Precipitation (National Weather Service – National Digital Forecast Database)
 - 6-Hour Precipitation (National Weather Service – National Digital Forecast Database)
 - Snow (National Weather Service – National Digital Forecast Database)
 - Weather (National Weather Service – National Digital Forecast Database)

It was assumed that these layers or a subset of these layers were sufficient for this effort and that display would be comparable to that used already in the WSRTC One-Stop-Shop.

This document summarizes work conducted in this research project, which ends June 30th, 2017. Following are descriptions of the originally proposed major project tasks and associated deliverables:

Task 1: Project Management

This task covers all activities related to project management.

Prior to the kick-off meeting, a Project Technical Advisory Panel (PTAP) shall be formed to oversee project work and progress. The PTAP shall consist of the Caltrans project champion and project manager.

Due to the nature of research contracts, the PTAP shall determine the acceptance criteria and performance standards for each task prior to the start of each task. A general set of acceptance criteria is set forth in this document as a reference and guideline. These acceptance criteria shall

be refined further by the PTAP during the contract. The PTAP shall communicate both the refined acceptance criteria and performance standards for each task to the project team.

Kickoff

The project champion, project manager, principal investigator (PI), the PTAP and the project team will participate in an initial kick-off meeting to review and discuss project objectives and to address project issues. This kickoff meeting will be conducted via phone conference.

Other Regular Project Meetings

Through all phases of the project, the project team will communicate regularly with the Caltrans project champion and project manager to ensure that Caltrans' needs are fully understood and addressed. In addition to the kick-off meeting and other meetings described above, subsequent project meetings will be conducted as needed, via phone or video conference.

Quarterly Reports

Quarterly reports will be submitted electronically to the Caltrans Project Manager to indicate project status including progress and budget. The standard Caltrans form will be used for reporting. These progress reports will highlight the current status of the project in terms of work accomplished and future work to be completed, and will disclose any technical delays or issues for discussion.

Task 1 Deliverables:

- Quarterly Reports

Task 2: System Development

The prototype system will be developed at WTI, and the production system will be deployed on a hosted server (Amazon Web Services) or at Caltrans. If the system is to be eventually housed at Caltrans, it is understood that the sponsoring program is responsible to develop an enterprise integration plan to server hosting within Caltrans. Caltrans' reviews, acceptances, or approvals of development processes, data importing, design, or any element prior to final user acceptance, shall not reduce, mitigate or eliminate WTI's overriding responsibility to develop a system that satisfies the requirements set forth in this agreement.

Investigate Licenses / Terms for Data

It is assumed that all data to be used in this scope of work is available for use via the public Internet at no charge. Licenses and terms of use will be reviewed to confirm this and to determine appropriate citation, etc. for use.

Develop Data Import Processes

Data import processes will be developed to import data into the system at a frequency corresponding generally to the update frequency from the source.

Develop Data Preparation Processes

Data preparation processes will be developed to produce point data, raster imagery and textual data.

Develop (Prototype) Data Feeds (KML or JSON)

Feeds appropriate for use by Caltrans will be developed using KML, JSON or similar to facilitate incorporation of data layers into QuickMap. Data feeds will incorporate mechanisms to address issues such as marker management for the display of large data sets.

Task 2 Deliverables:

- Prototype Data Feeds

Task 3: System Deployment

Deployment to Server

The data import and data preparation processes will be deployed for production use.

Production Data Feeds

The production data feeds will be deployed for production use.

Task 3 Deliverables:

- Production Data Feeds

Task 4: System Maintenance

Ongoing Maintenance and Support

Task 4 Deliverables:

- General Maintenance and Support of the System

Organization of This Report

In Chapter 2 we present project background, particularly in regard to the related systems. In Chapter 3 we present a summary of work conducted. In Chapter 4, we present graphical examples of the KML layers produced in this project. In Chapter 5, we present a summary.

2. BACKGROUND

Caltrans QuickMap

The Caltrans QuickMap was developed by Caltrans, and presents traveler information via a web interface to travelers within the state. Included are traffic speeds, maintenance and construction information, incidents, changeable message sign messages, camera images and chain control requirements.

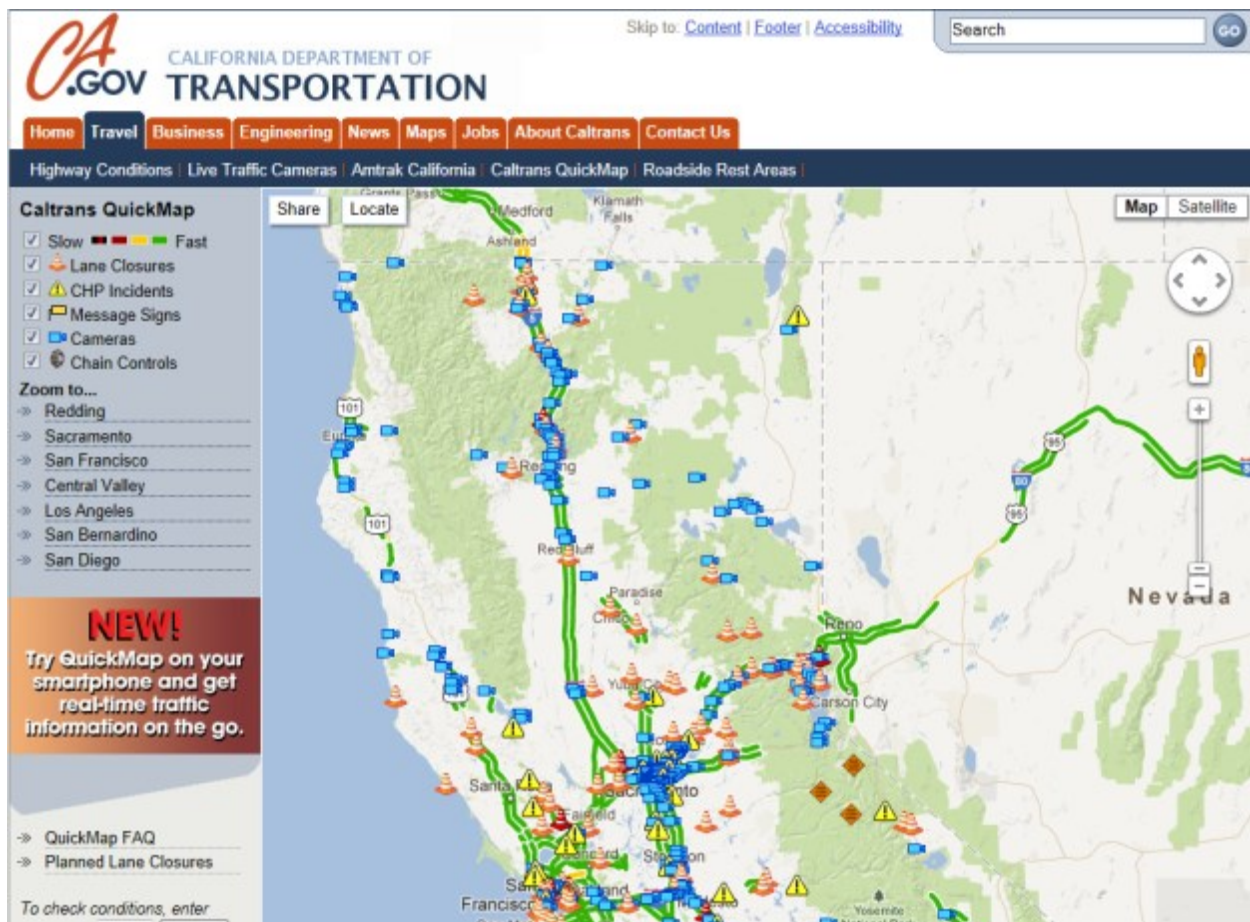


Figure 2-1: Caltrans QuickMap

WSRTC OSS

The WSRTC OSS prototype was developed through multiple phases and funded by Caltrans, the Western Transportation Institute, and the U.S. Department of Transportation. The WSRTC OSS provides traveler information, including road weather information, covering a four state region that includes California, Oregon, Nevada and Washington. The WSRTC OSS is an extension of the WeatherShare project and was selected as one of several projects to demonstrate the potential of including Road Weather Information Systems (RWIS) data via the *Clarus* Initiative. As such, road weather information has been a key offering of the WSRTC OSS from the beginning, particularly to address the needs of rural travelers.

The WSRTC OSS is presented via a browser-based, Google Maps interface that combines raster and icon/marker overlays to present information to users in a user-friendly, intuitive fashion.

The following figures illustrate the weather layers in the WSRTC OSS:

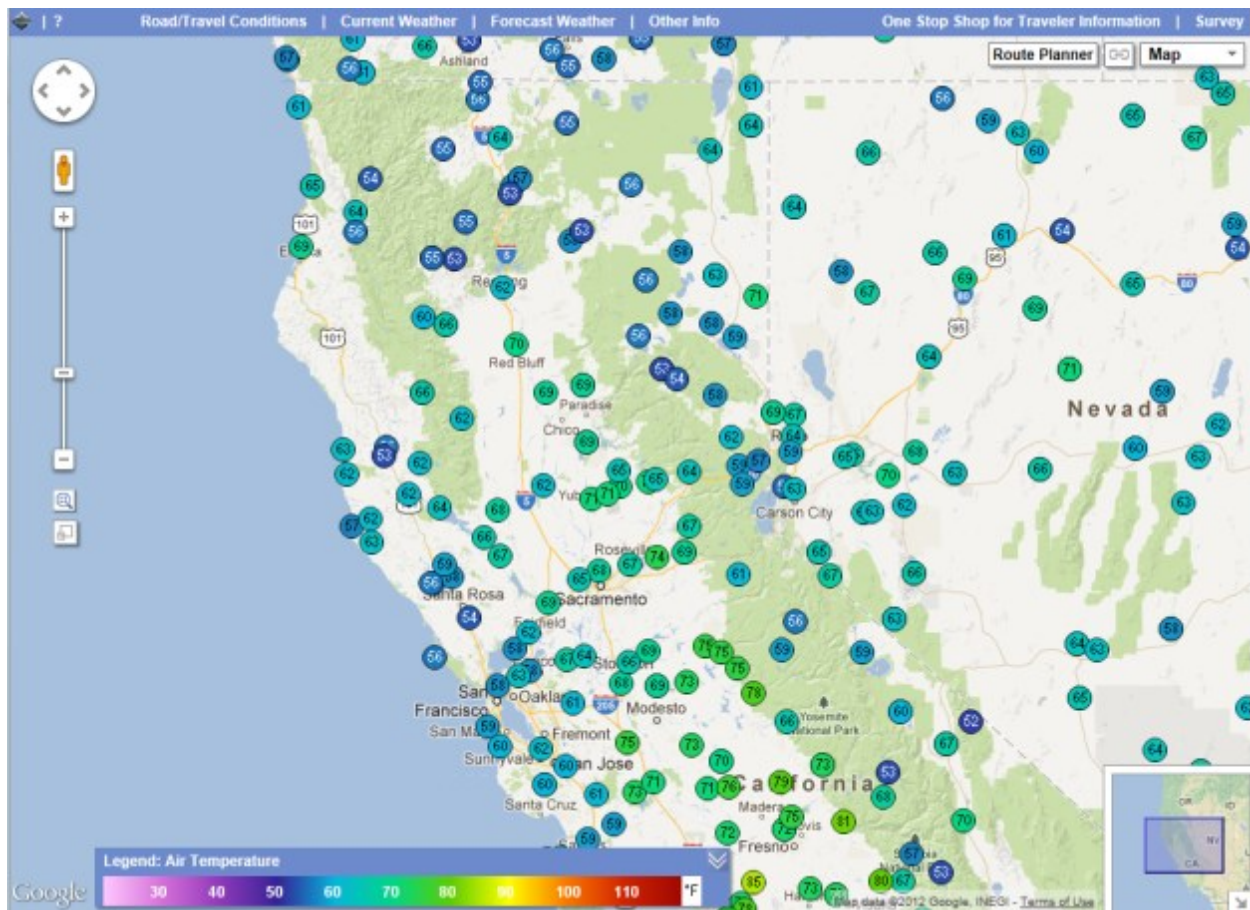


Figure 2-2: WSRTC OSS Current Temperature Layer

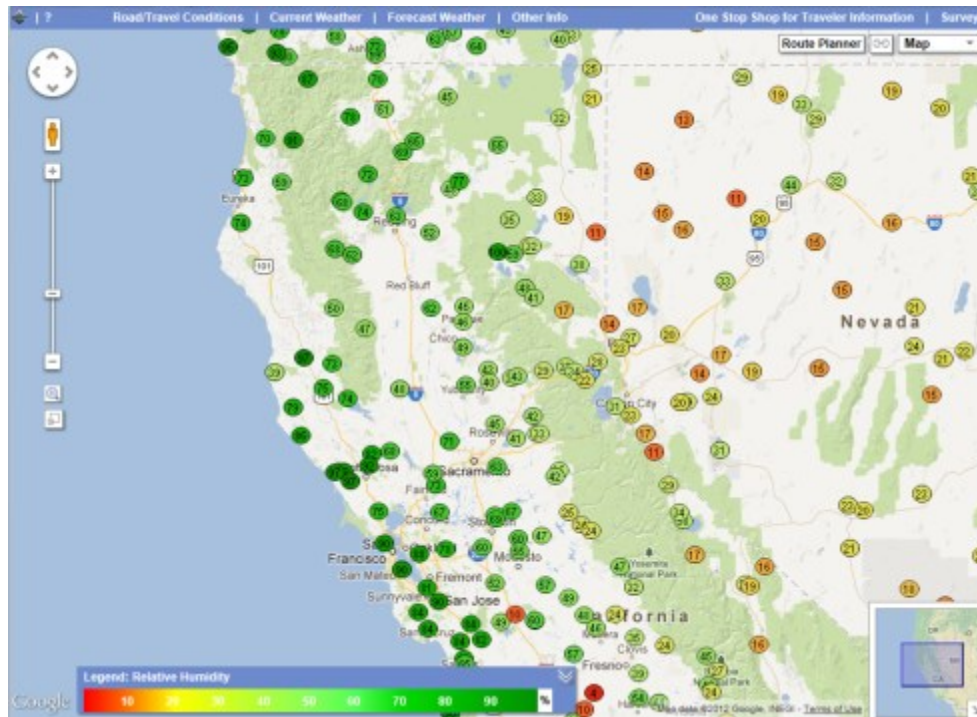


Figure 2-3: WSRTC OSS Current Humidity Layer

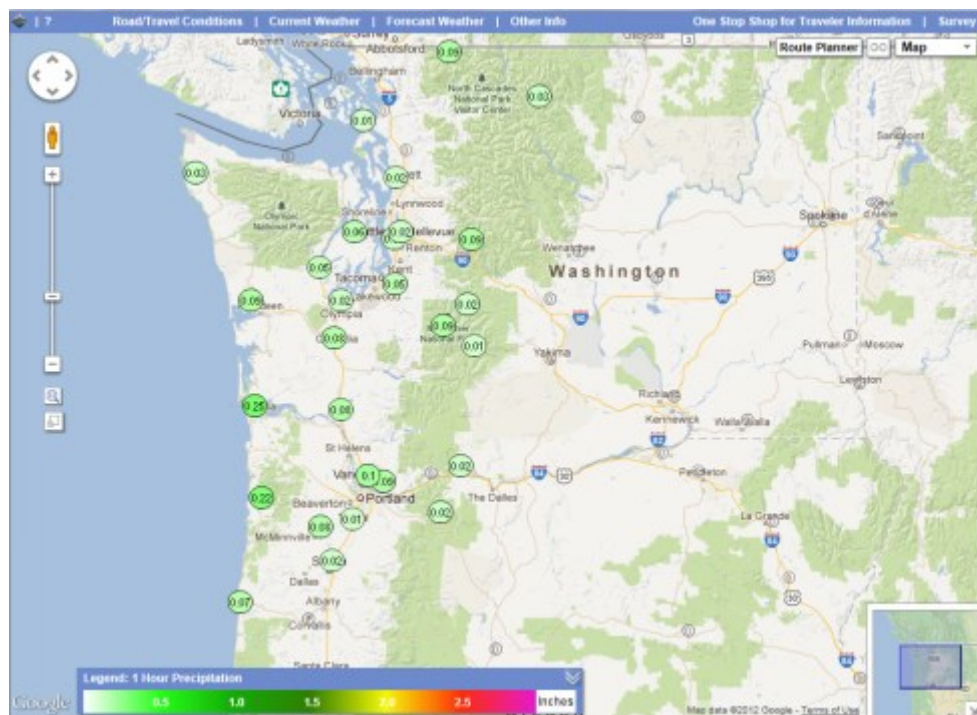


Figure 2-4: WSRTC OSS One Hour Precipitation Layer

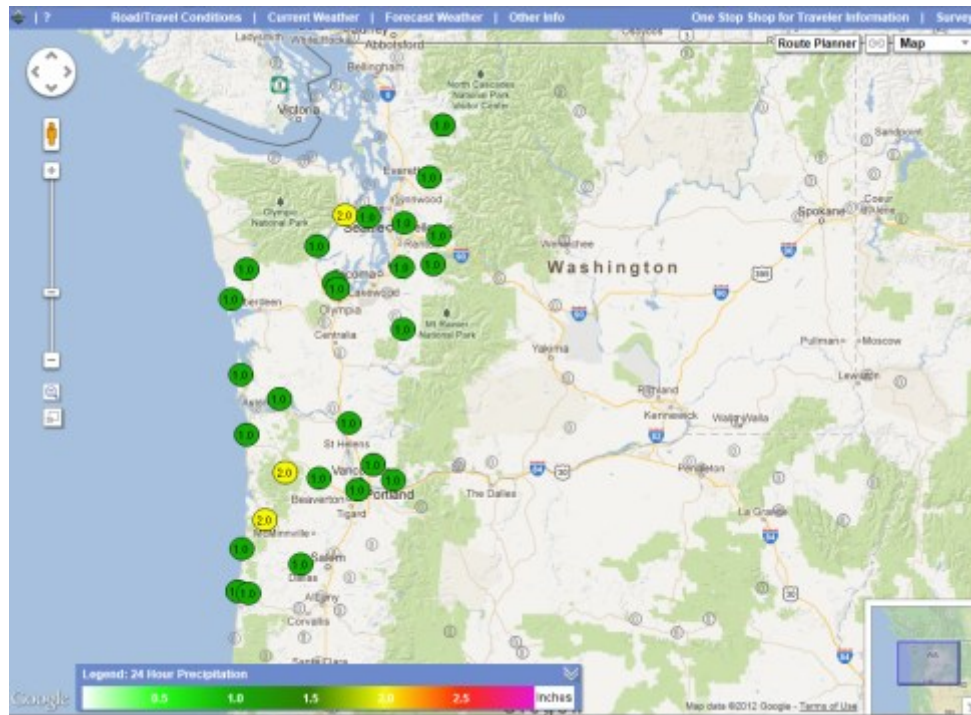


Figure 2-5: WSRTC OSS Twenty-Four Hour Precipitation Layer

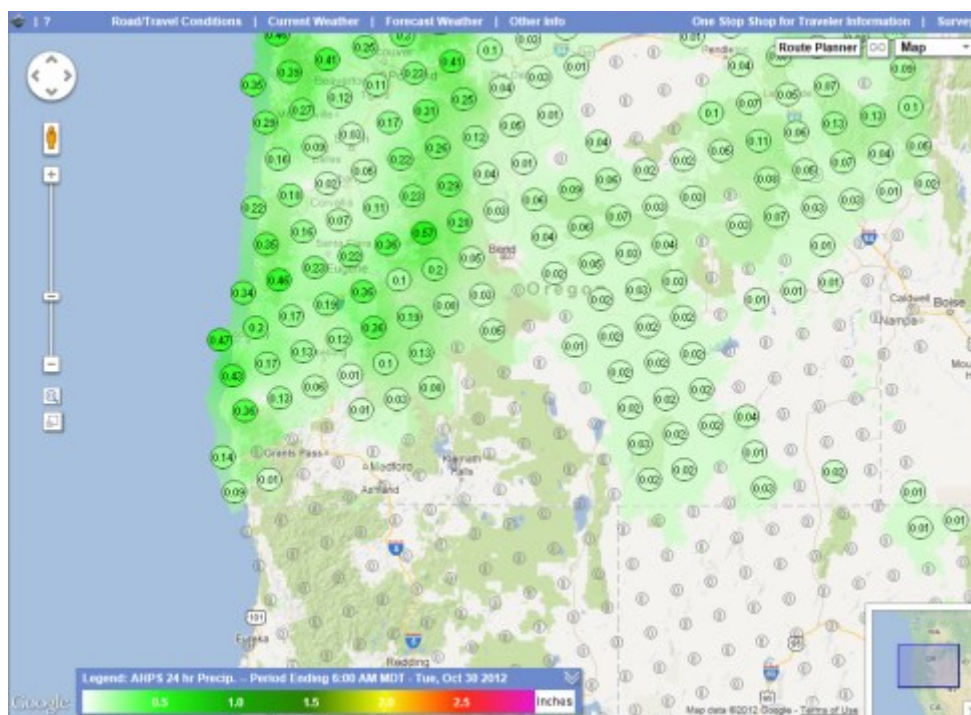


Figure 2-6: WSRTC OSS AHPS 24 Hour Precipitation Layer

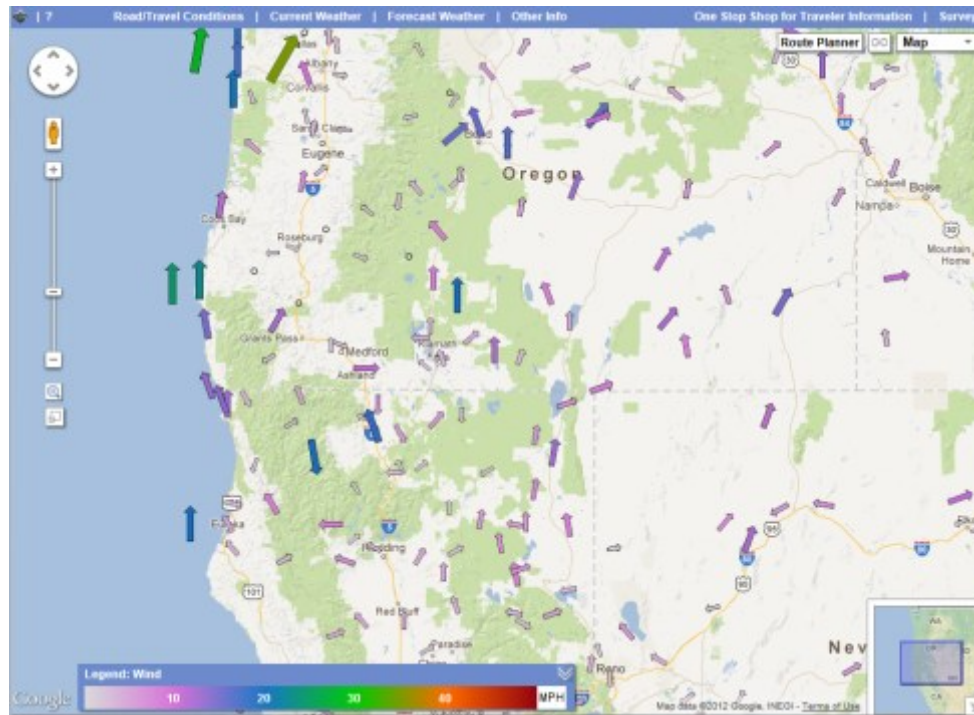


Figure 2-7: WSRTC OSS Current Wind Layer

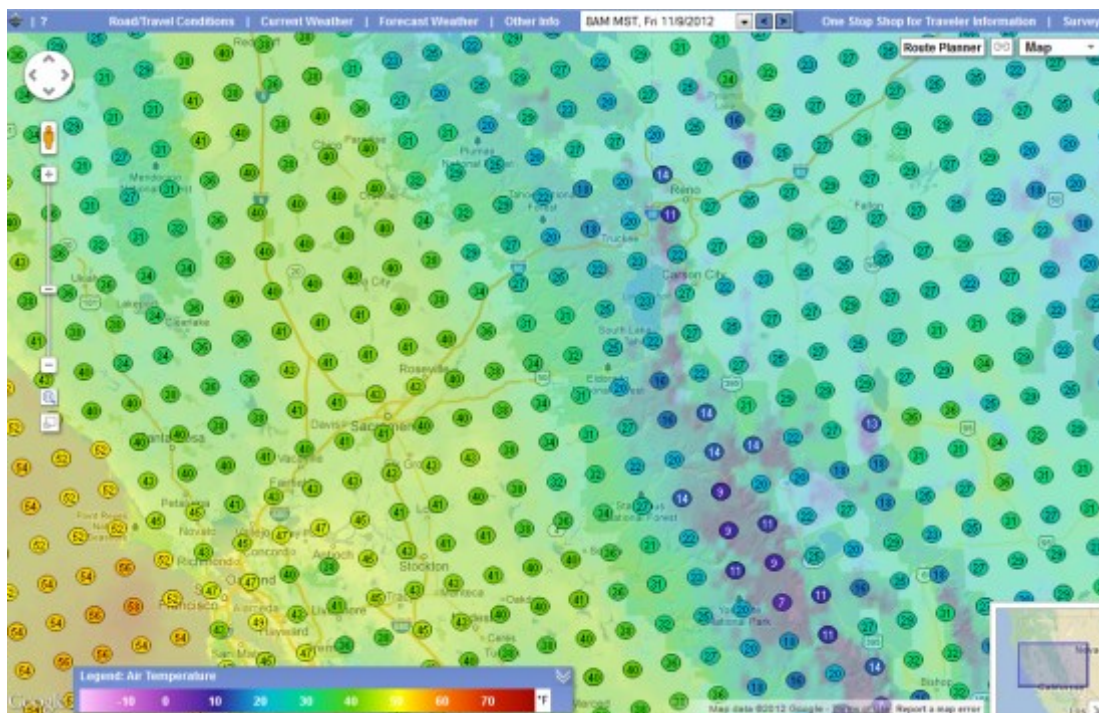


Figure 2-8: WSRTC OSS Predicted Air Temperature Layer

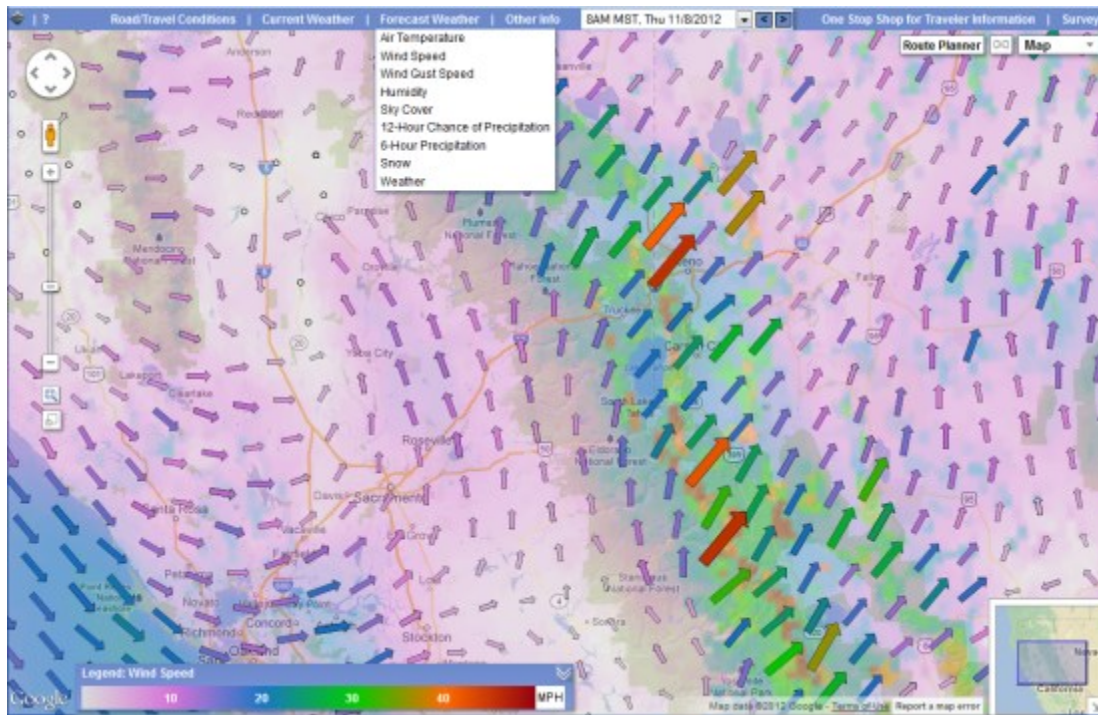


Figure 2-9: WSRTC OSS Predicted Wind Layer

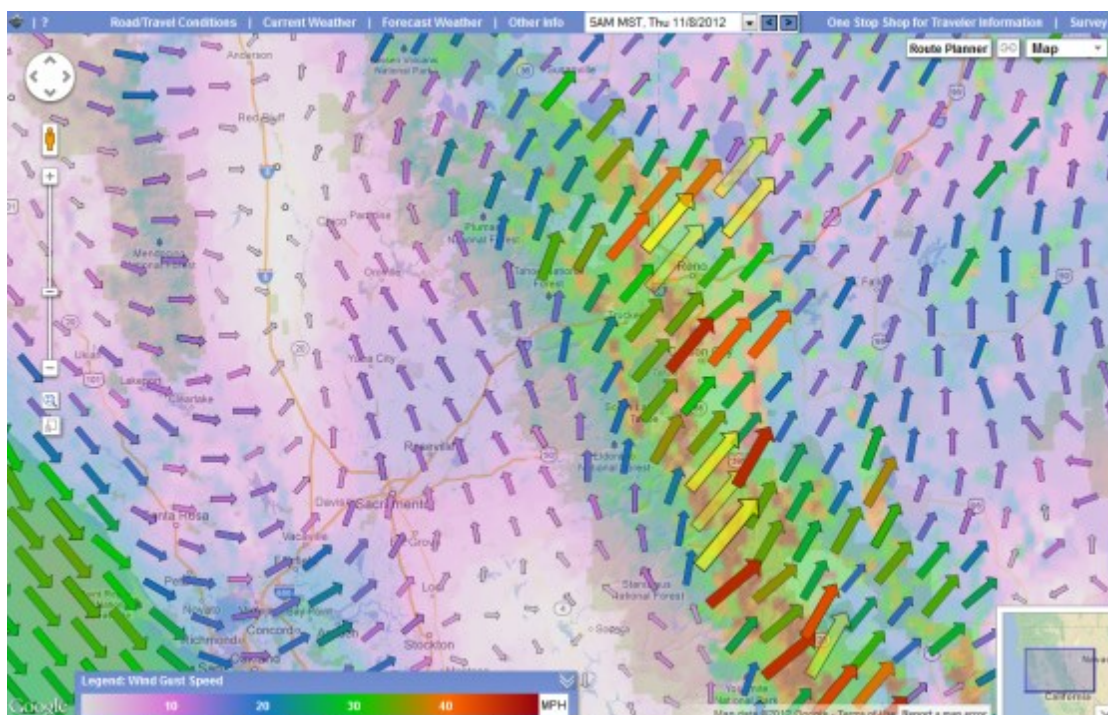


Figure 2-10: WSRTC OSS Predicted Wind Gust Layer

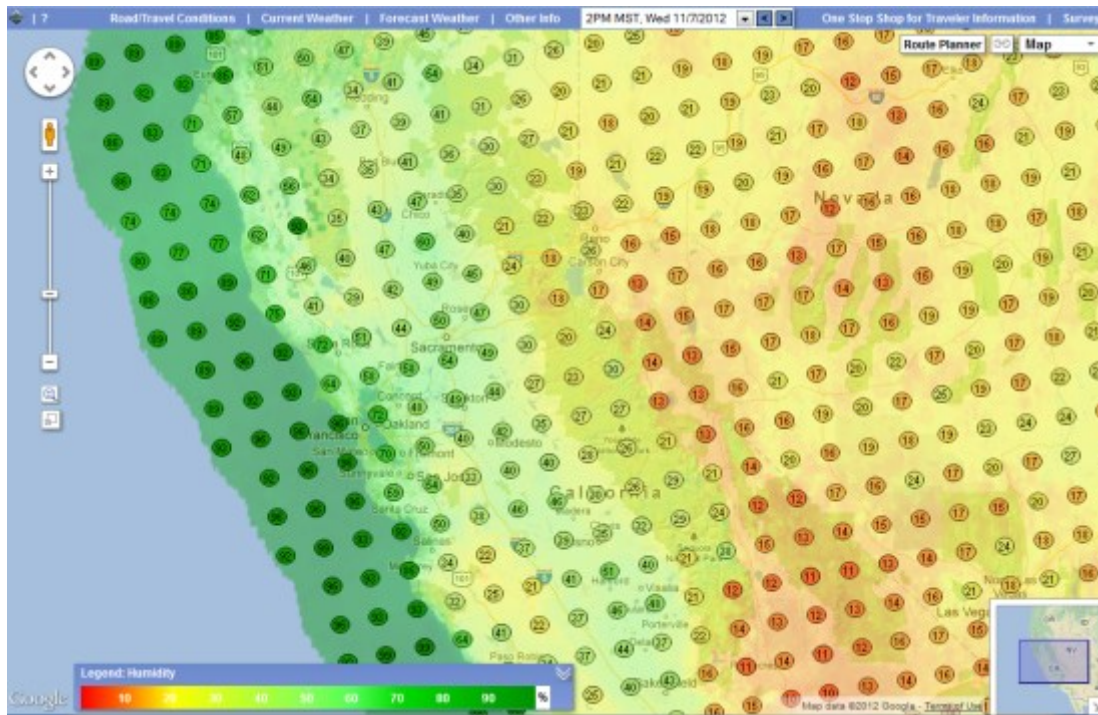


Figure 2-11: WSRTC OSS Predicted Humidity Layer

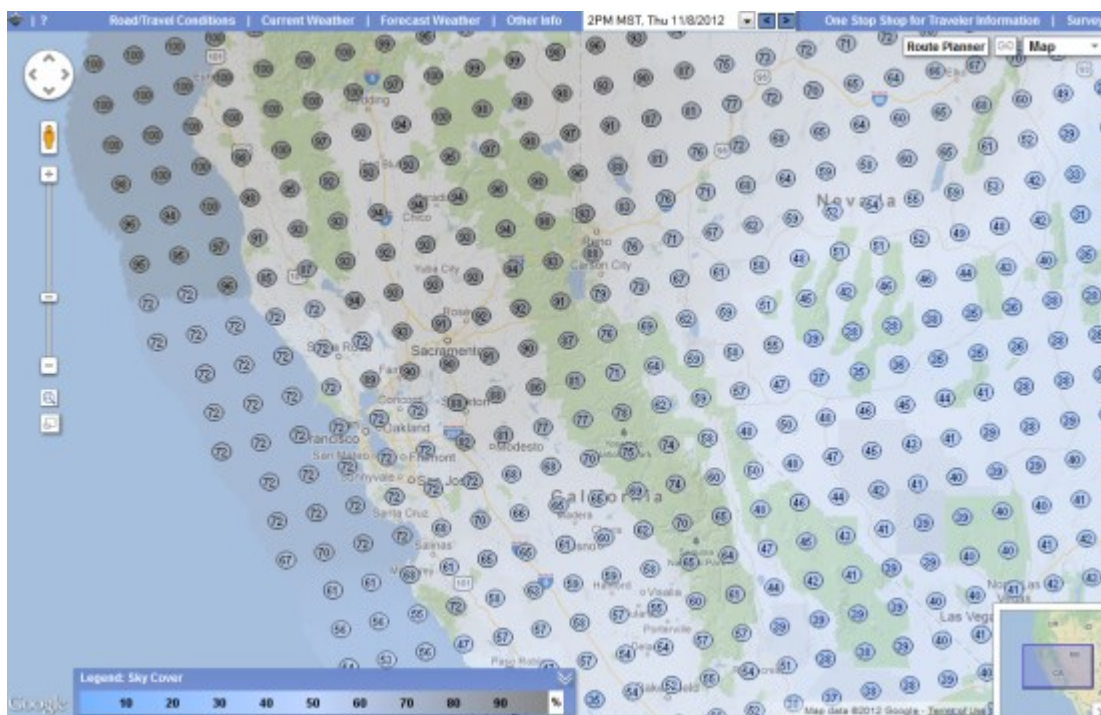


Figure 2-12: WSRTC OSS Predicted Sky Cover Layer

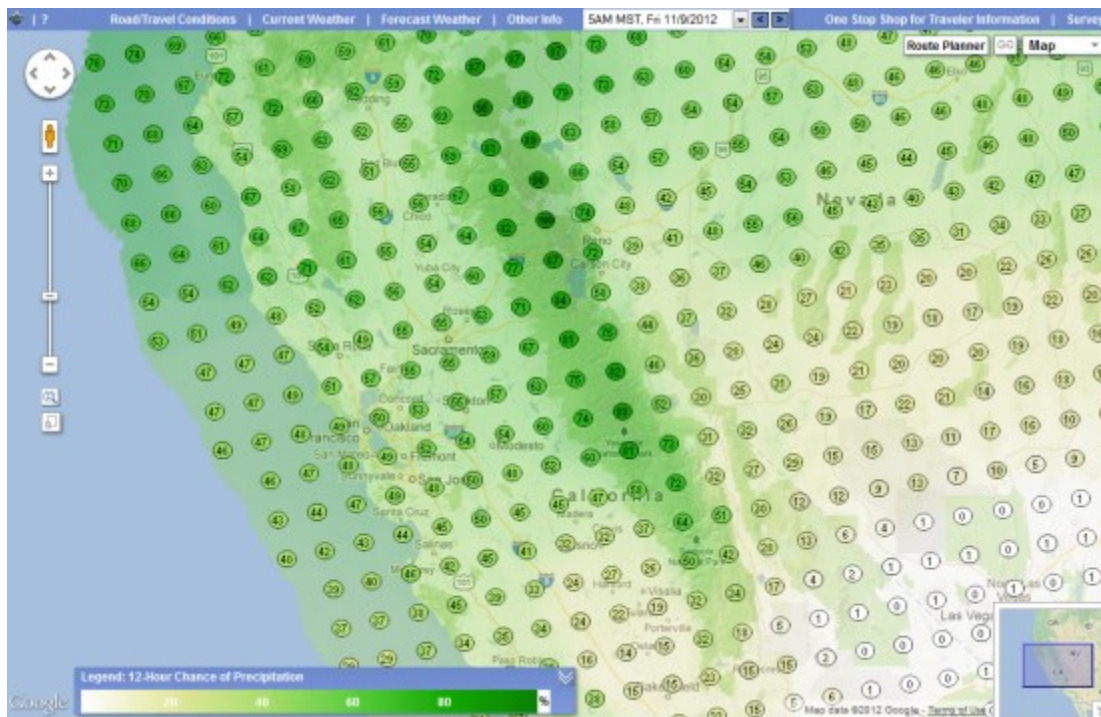


Figure 2-13: WSRTC OSS Predicted 12-Hour Chance of Precipitation Layer

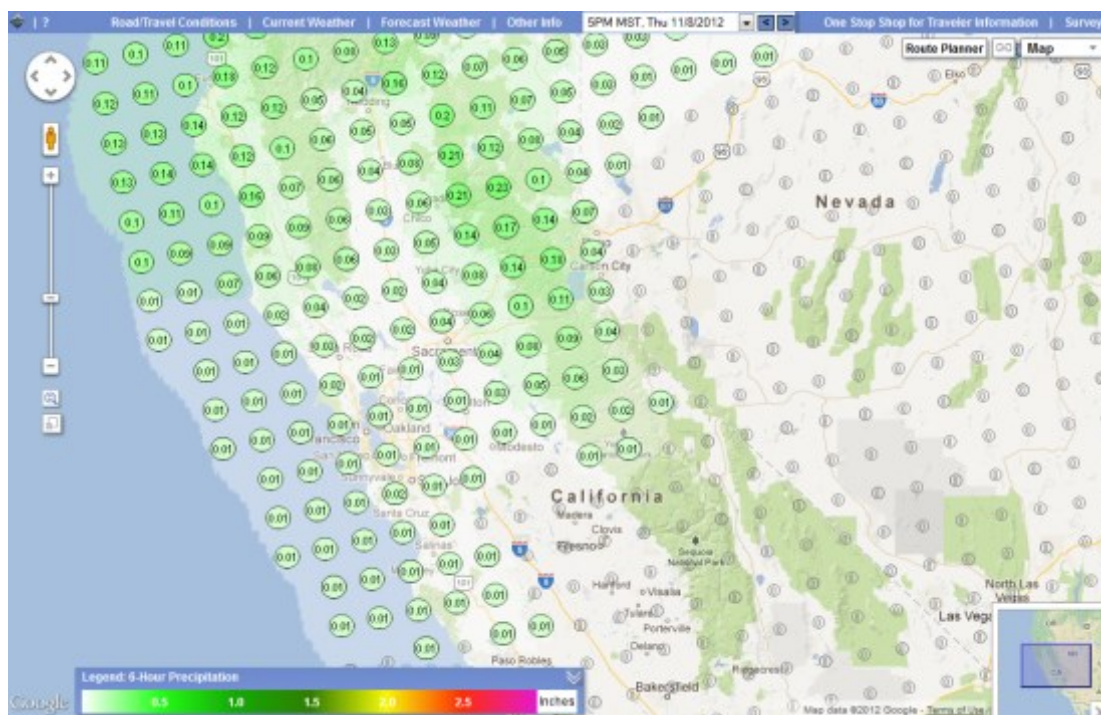


Figure 2-14: WSRTC OSS Predicted 6-Hour Precipitation Amount Layer

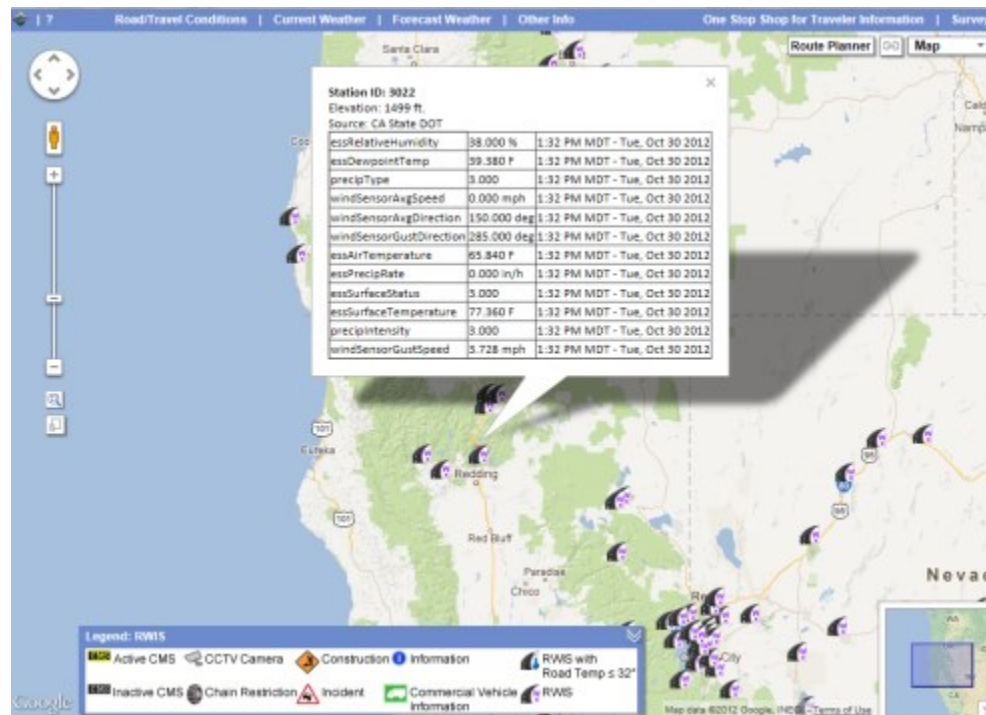


Figure 2-15: WSRTC OSS RWIS Layer and Station Detail Balloon

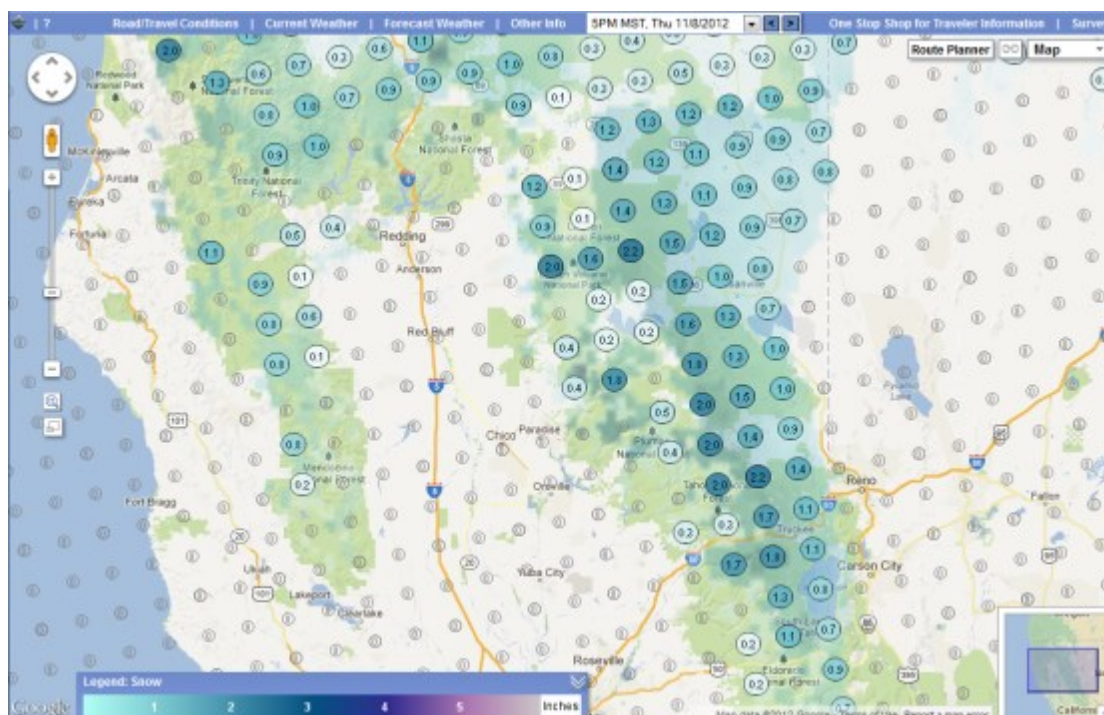


Figure 2-16: WSRTC OSS Predicted Snow Amount Layer

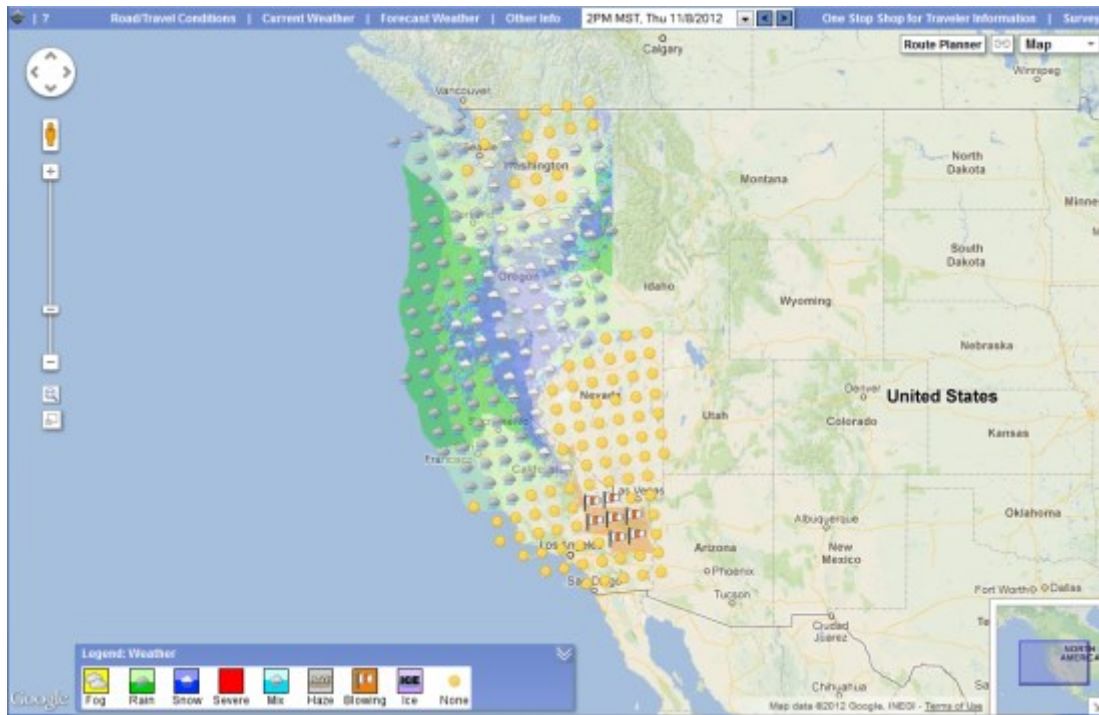


Figure 2-17: WSRTC OSS Predicted Weather Layer

3. WORK CONDUCTED

In this section we document the work conducted on the project relative to the originally proposed tasks and deliverables.

Task 1: Project Management

Kickoff

For the purpose of kicking-off the project, a conference call was held on October 6th, 2014.

Other Regular Project Meetings

Additional project meetings were held on the following dates:

- February 17th, 2015 (conference call / WebEx)
- July 15th, 2015 (conference call / WebEx)
- August 19th, 2015 (conference call / WebEx)
- October 21st, 2015 (in person meeting in Sacramento)
- February 4th, 2016 (conference call)
- April 26th, 2016 (conference call)
- April 28th, 2017 (conference call)

Quarterly Reports

Quarterly reports were submitted electronically to the Caltrans Project Manager to indicate project status including progress and budget on the following dates:

- July 15th, 2014
- October 14th, 2014
- January 16th, 2015
- April 14th, 2015
- July 17th, 2015
- October 15th, 2015
- January 21st, 2016
- April 15th, 2016
- July 21st, 2016
- October 17th, 2016
- January 20th, 2017
- April 17th, 2017

A no-cost time extension was requested on January 12, 2017 per prior Caltrans discussion and guidance. It was determined by the PTAP, that the development and deployment tasks of the project had been completed, and that Task 4, System Maintenance, should be used to maintain the WeatherShare System for an additional 24 months. Ultimately it was decided that the Road Weather for QuickMap contract would be allowed to expire as scheduled and that a separate contract would be used provide further service and support for WeatherShare.

Task 2: System Development

Investigate Licenses / Terms for Data

No additional data was required beyond what had been proposed. All data used is publicly available, free of charge and for use and application. Proper attribution should be given regarding the source of the data.

Develop Data Import Processes

The project team developed import processes to import data into the system at a frequency corresponding generally to the update frequency from the sources. This was done in a manner consistent with what is done in WeatherShare.

Develop Data Preparation Processes

The project team developed data preparation processes to produce point data, raster imagery and textual data.

Develop (Prototype) Data Feeds (KML or JSON)

The project team developed feeds appropriate for use by Caltrans in KML to facilitate incorporation of data layers into QuickMap. The project team used a subset of the original data so-as to provide coverage of the State of California while not requiring further marker management in Google Maps.

Task 2 Deliverables:

- The project team delivered Prototype Data Feeds to Caltrans for review.

Task 3: System Deployment

Deployment to Server

The project team deployed data import and data preparation processes for production use onto a production server, hosted by HostGator.

Production Data Feeds

The project team deployed production data feeds for production use onto a production server.

Task 3 Deliverables:

- The project team made Production Data Feeds available for use and review.

Task 4: System Maintenance

Ongoing Maintenance and Support

Task 4 Deliverables:

- The project team conducted General Maintenance and Support of the System consistent with the scope and time period of the contract.

4. KML LAYERS

In this section we present graphically the KML Layers that were produced in this project. The relevant current weather layers included were:

- Current Weather:
 - Air Temperature (MADIS, Mesowest, State DOT)
 - Relative Humidity (MADIS, Mesowest, State DOT)
 - 1 Hour Precipitation (MADIS, Mesowest, State DOT)
 - 24 Hour Precipitation (MADIS, Mesowest, State DOT)
 - Advanced Hydrological Prediction Service 24 Hour Precipitation (National Weather Service)
 - Wind (MADIS, Mesowest, State DOT)
- Forecast Weather:
 - Air Temperature (National Weather Service – National Digital Forecast Database)
 - Wind Speed (National Weather Service – National Digital Forecast Database)
 - Wind Gust Speed (National Weather Service – National Digital Forecast Database)
 - Humidity (National Weather Service – National Digital Forecast Database)
 - Sky Cover (National Weather Service – National Digital Forecast Database)
 - 12-Hour Chance of Precipitation (National Weather Service – National Digital Forecast Database)
 - 6-Hour Precipitation (National Weather Service – National Digital Forecast Database)
 - Snow (National Weather Service – National Digital Forecast Database)
 - Weather (National Weather Service – National Digital Forecast Database)

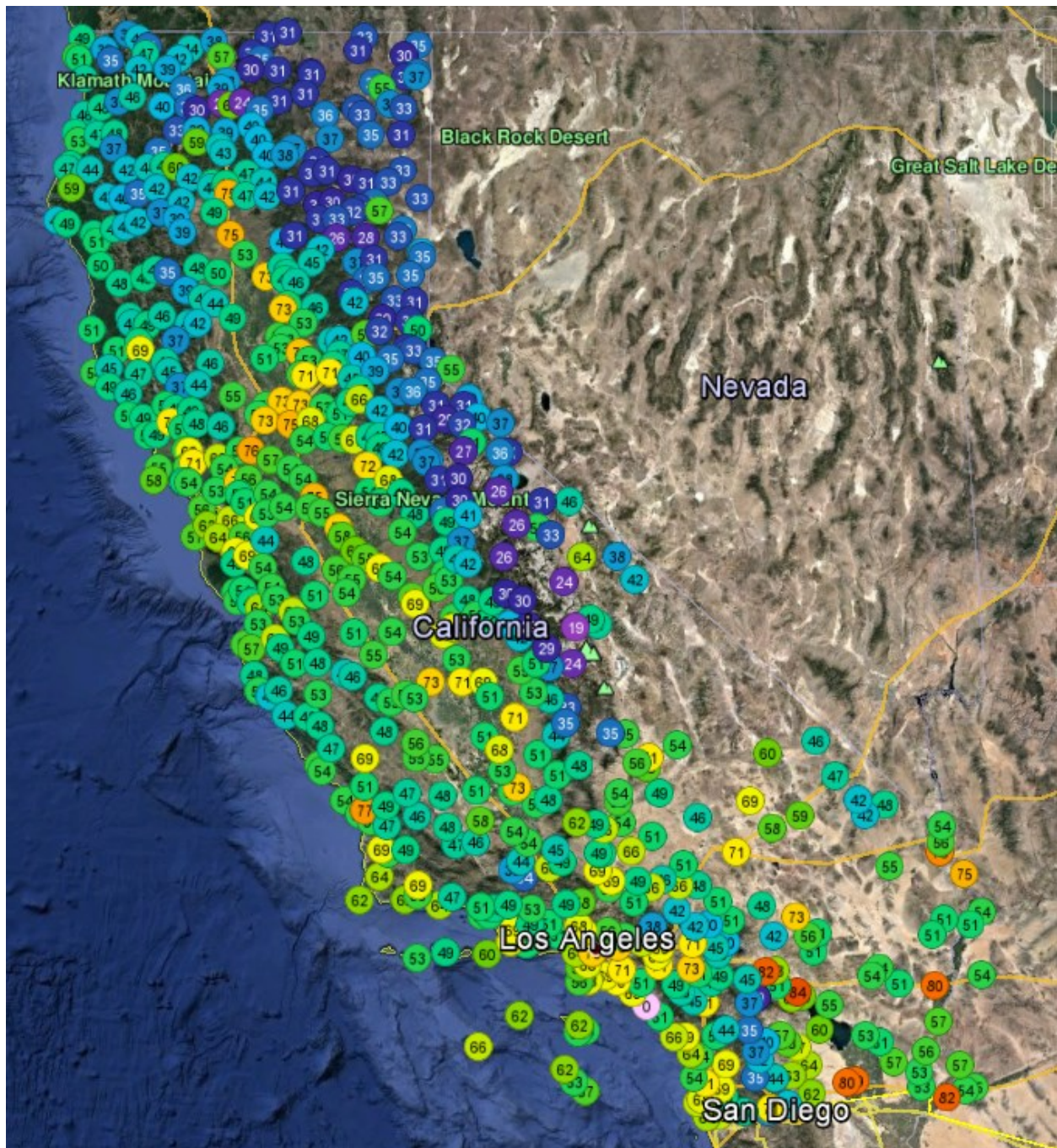


Figure 4-1: Current Conditions – Temperature

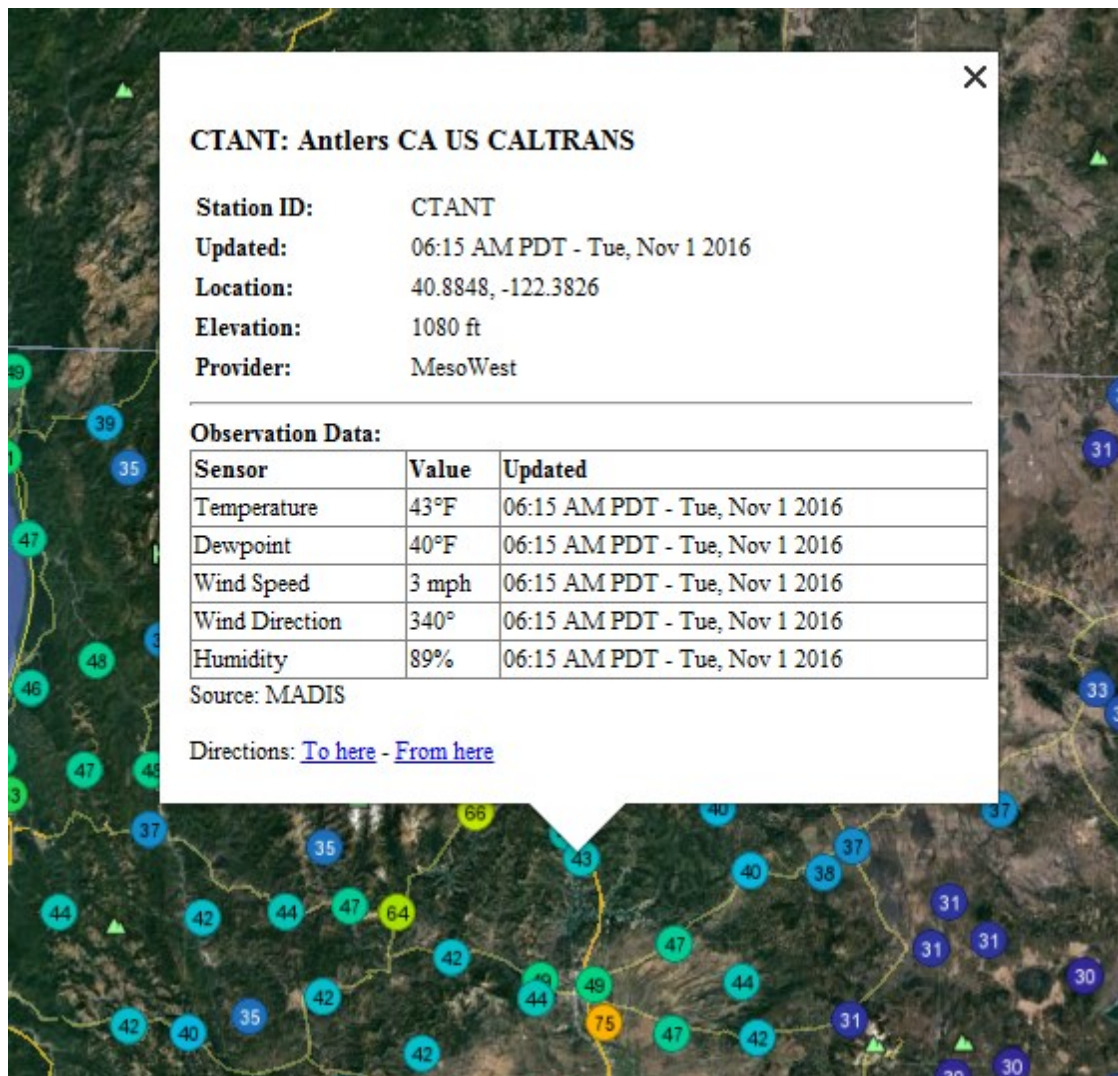


Figure 4-2: Current Conditions at a Site

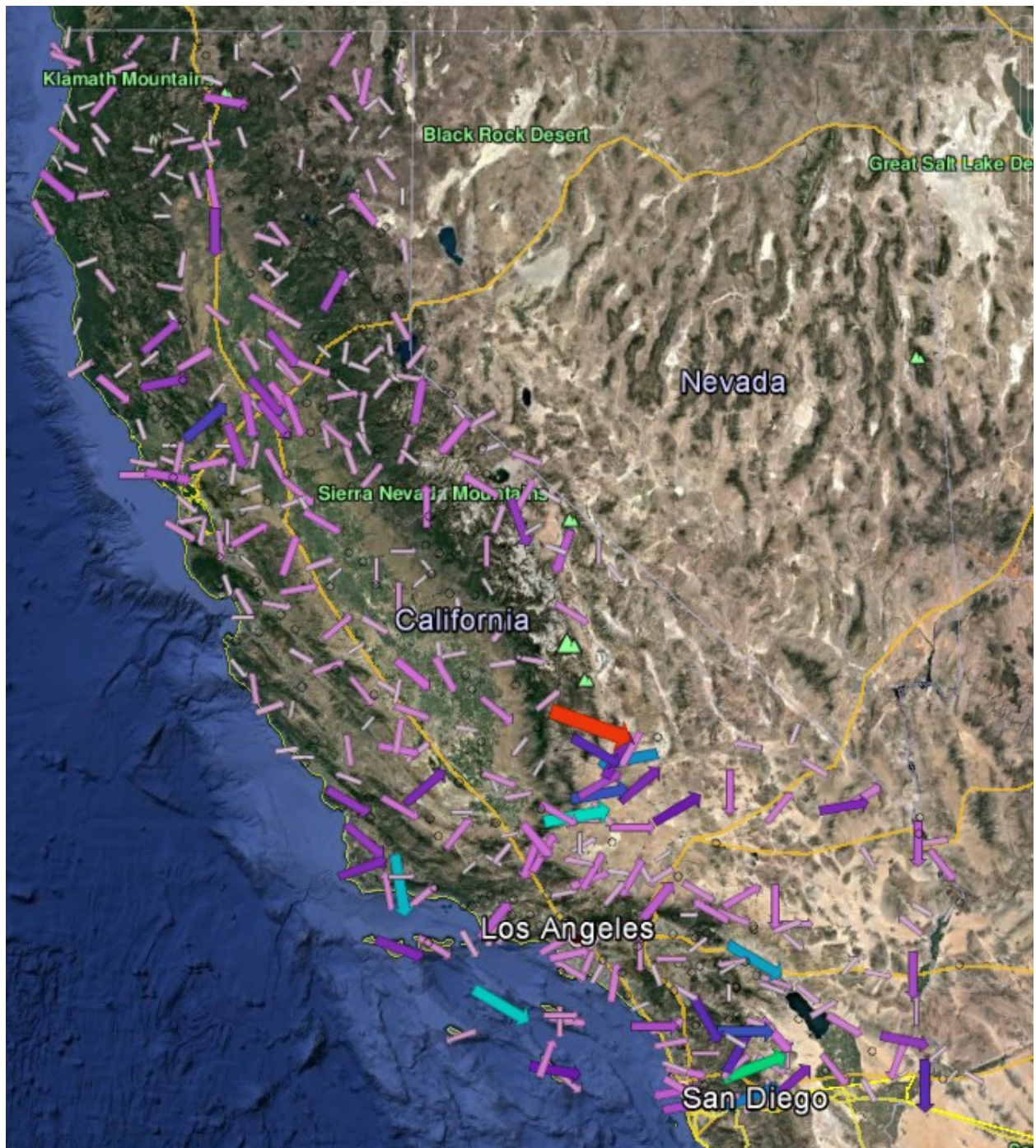


Figure 4-3: Current Conditions – Wind Speed and Direction

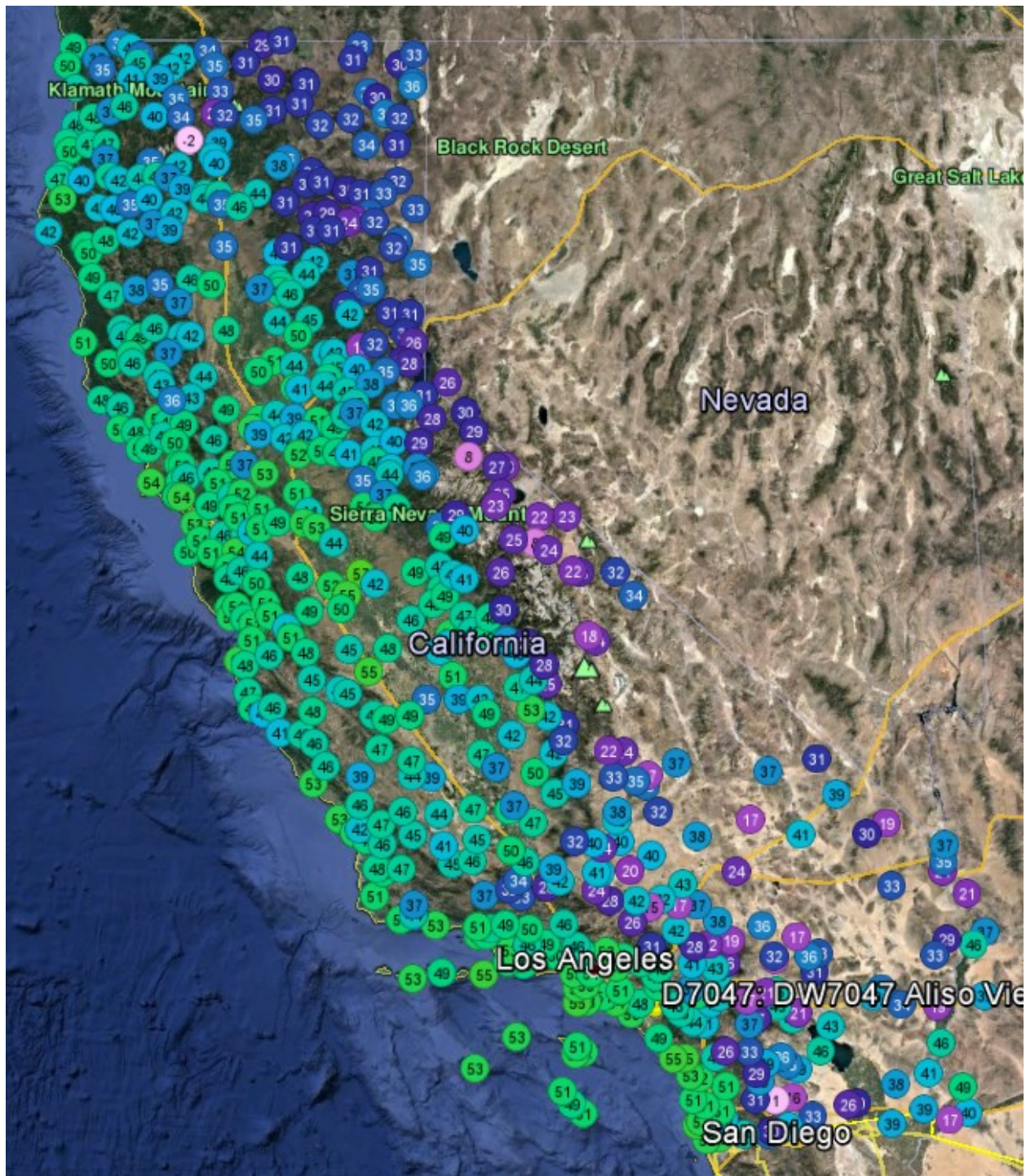


Figure 4-4: Current Conditions – Dew Point

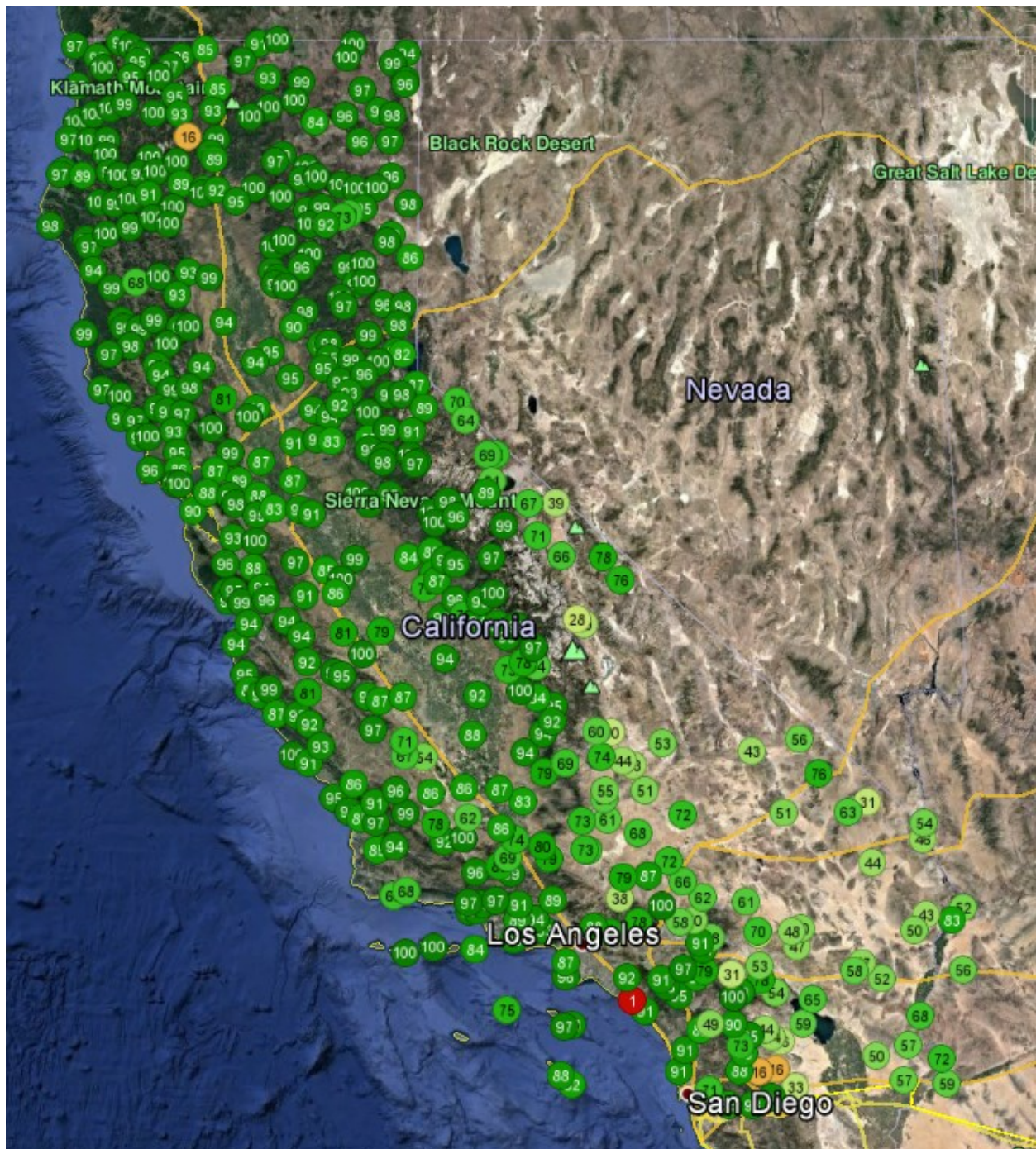


Figure 4-5: Current Conditions – Humidity

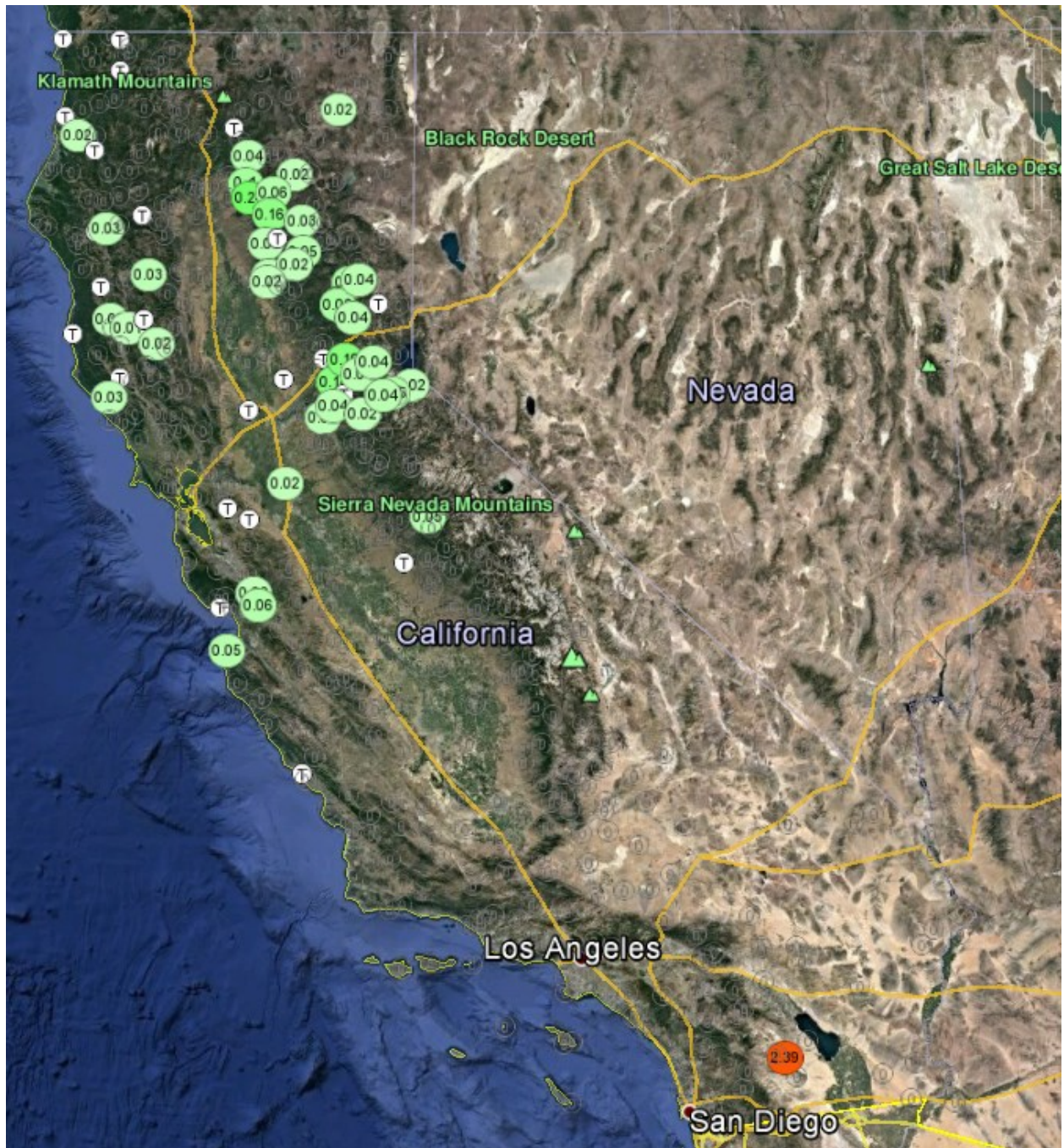


Figure 4-6: Current Conditions – 1-Hour Precipitation

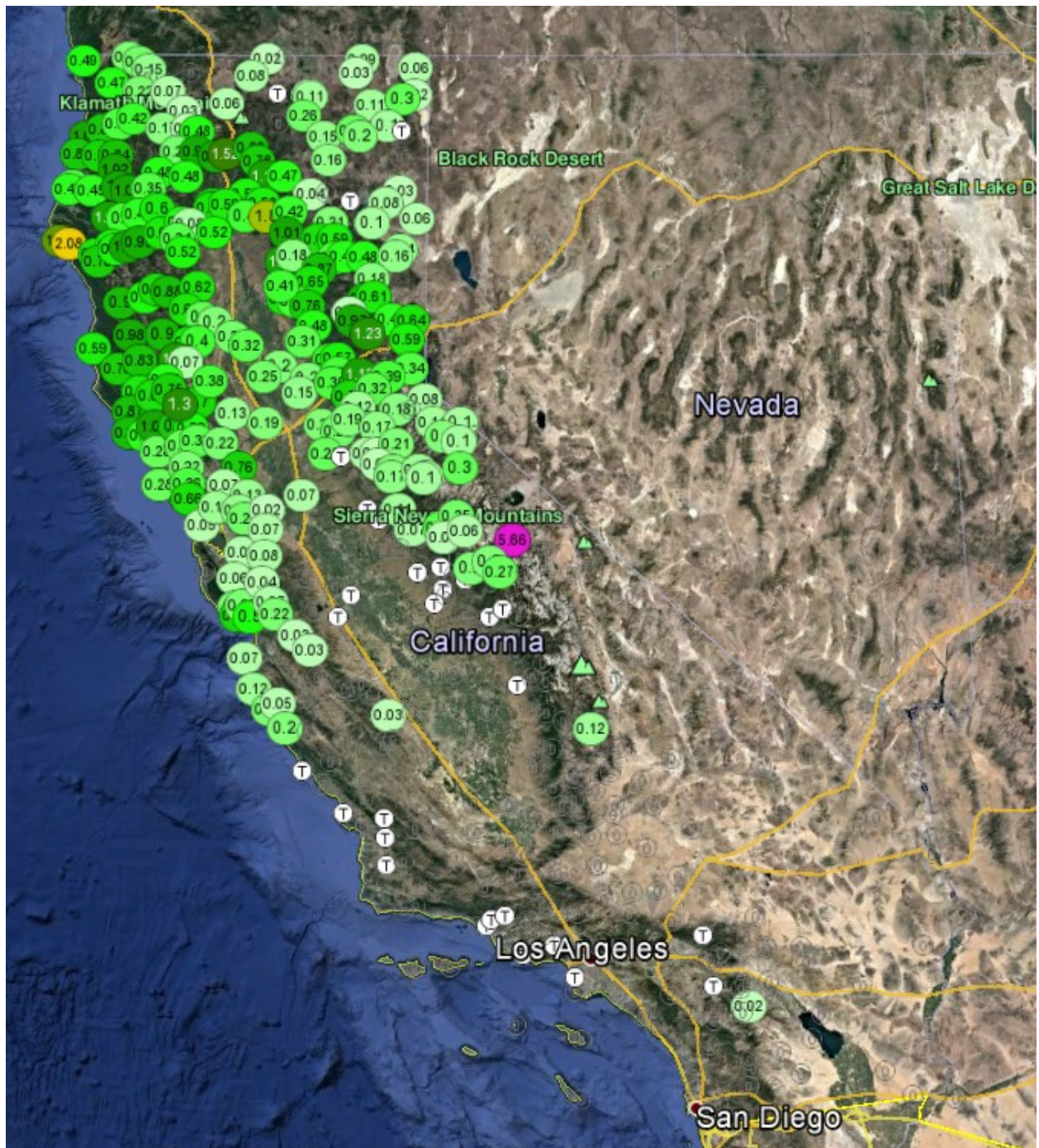


Figure 4-7: Current Conditions – 24-Hour Precipitation

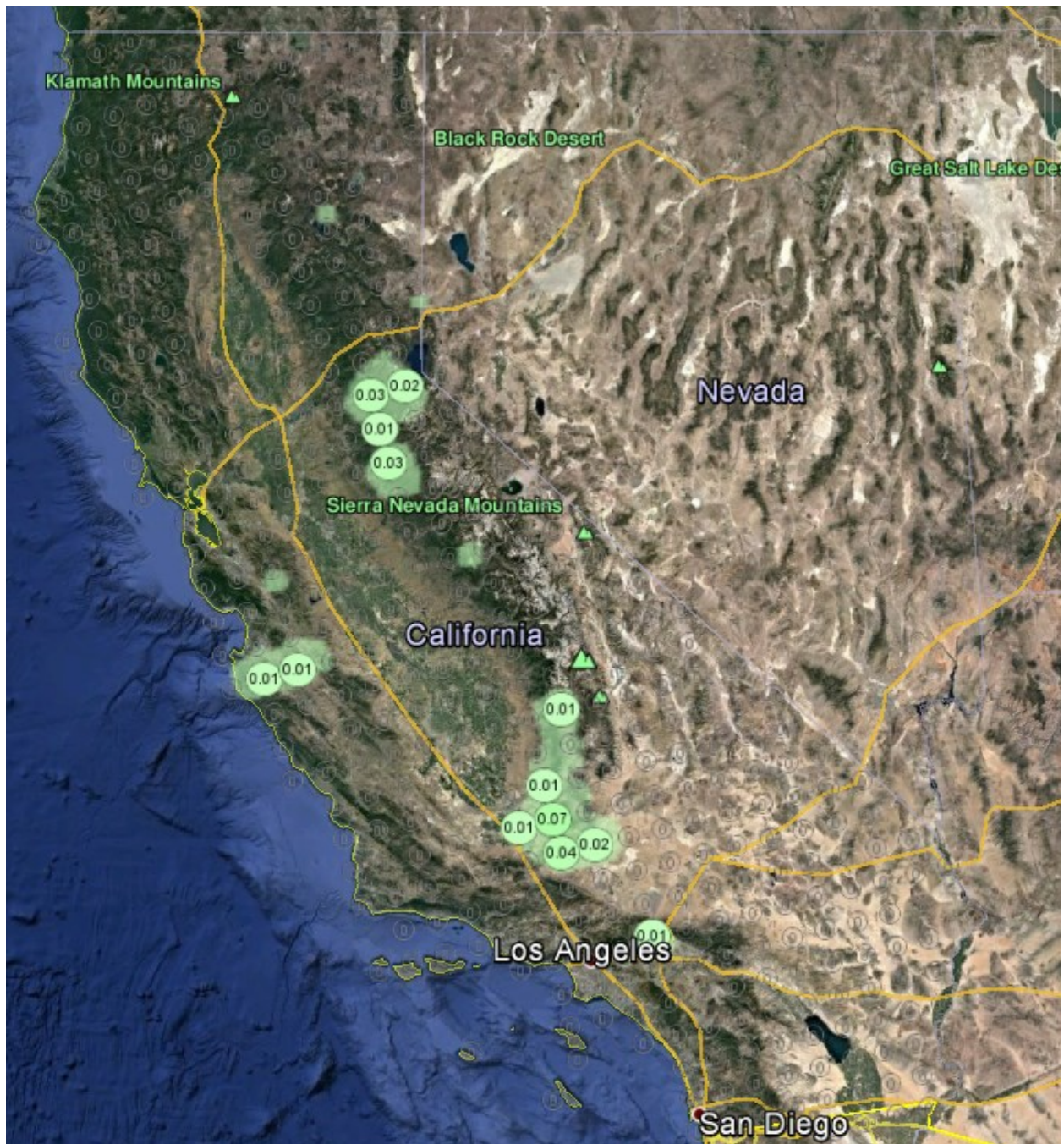


Figure 4-8: Current Conditions – AHPS 24-Hour Precipitation

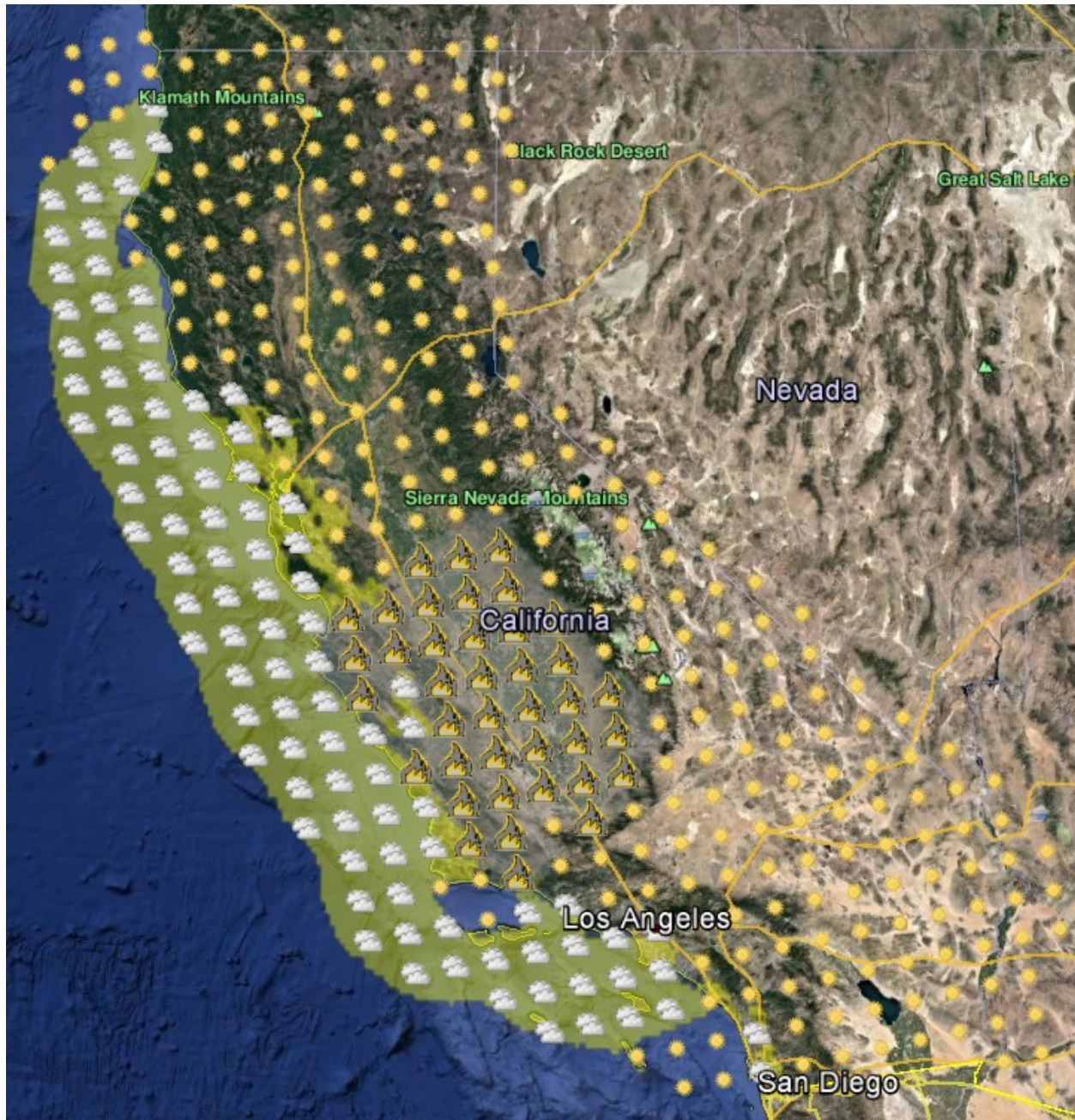


Figure 4-9: Forecast – Weather

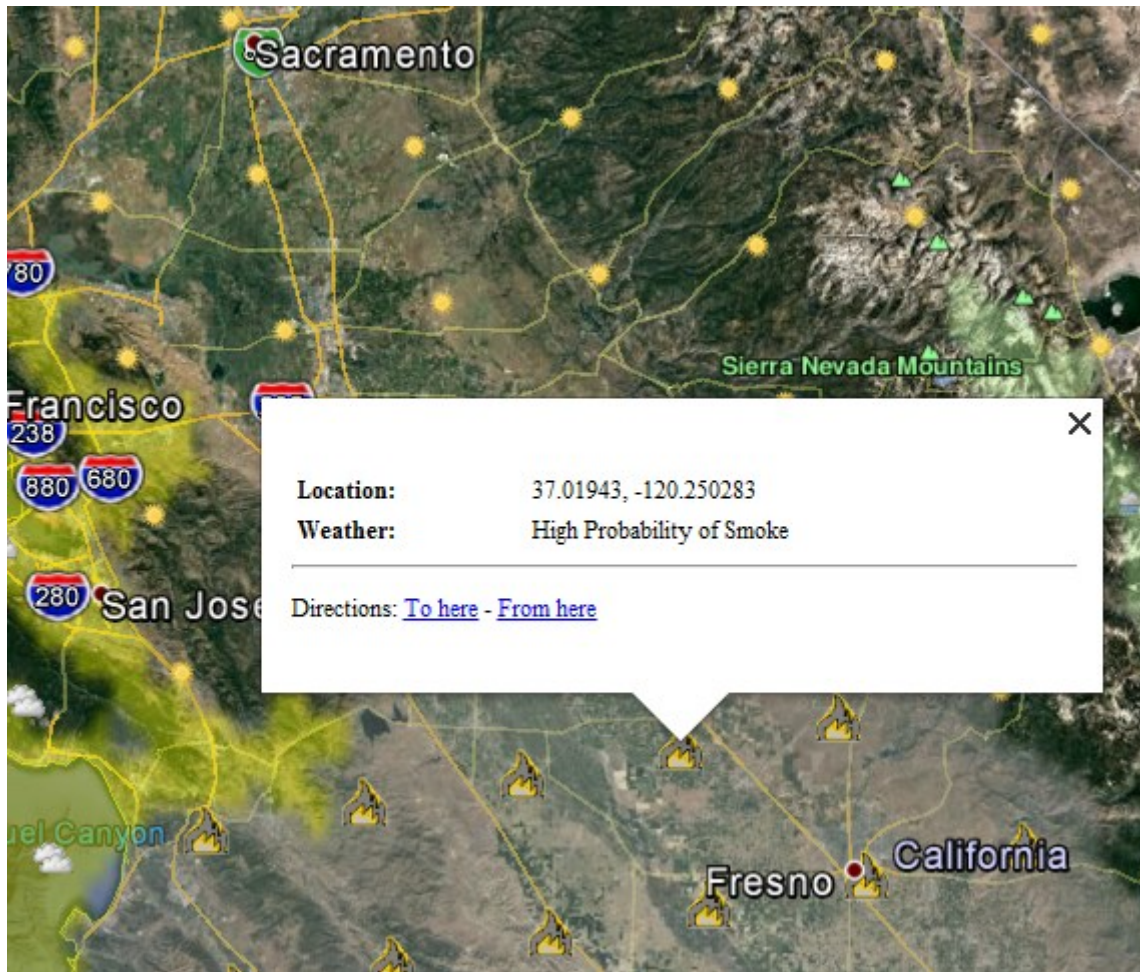


Figure 4-10: NDFD Point Forecast Details

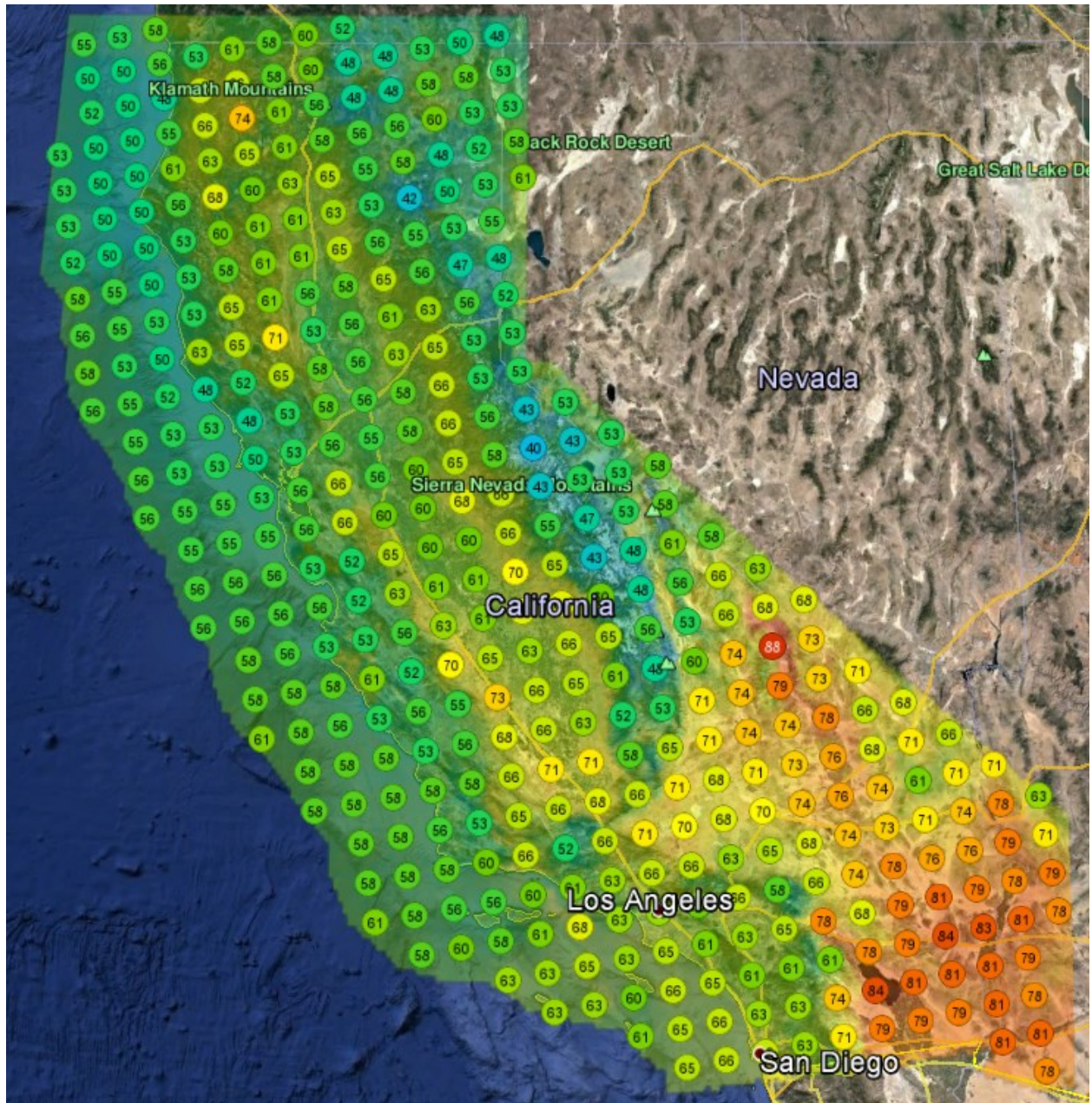


Figure 4-11: Forecast – Temperature

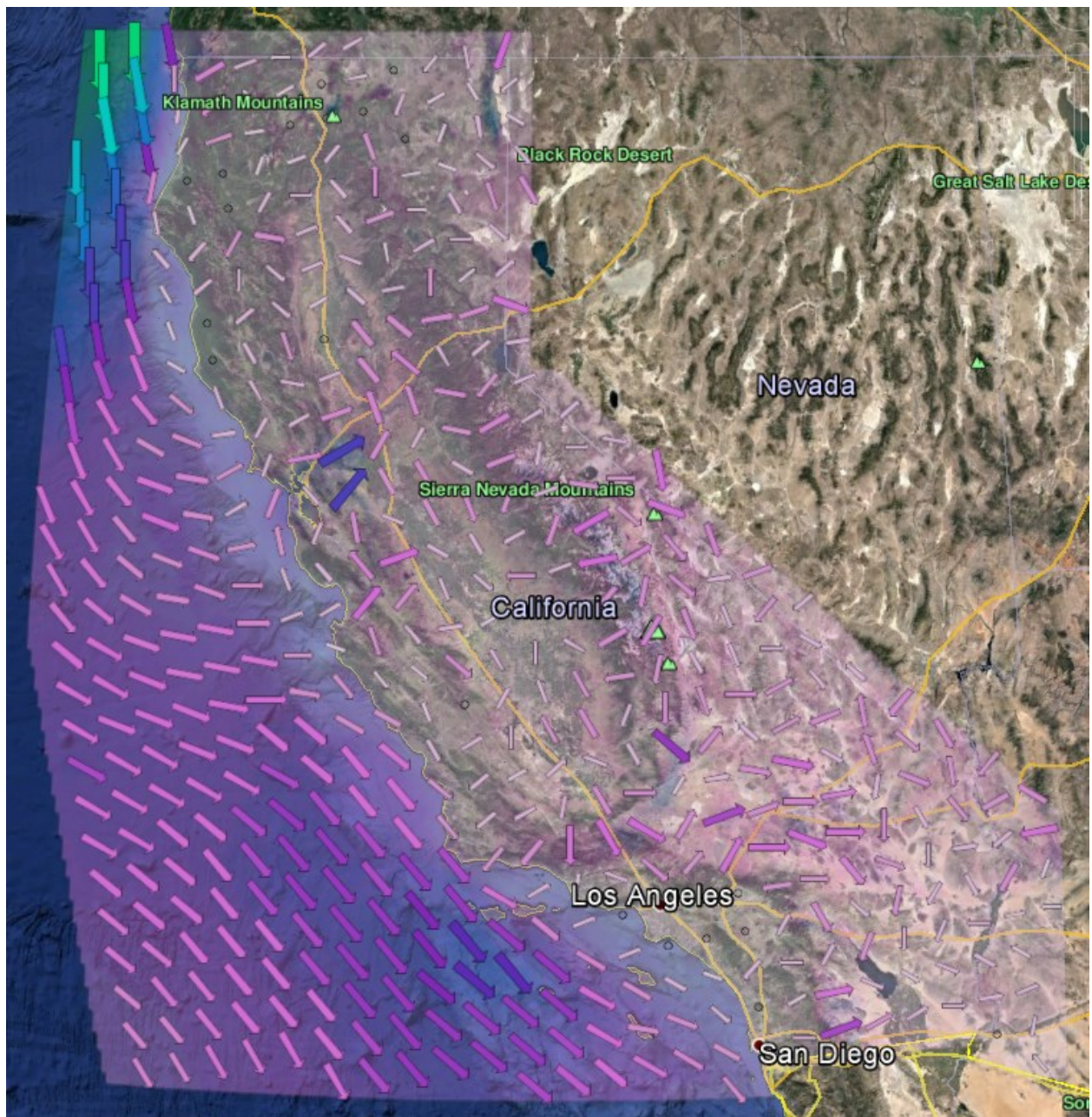


Figure 4-12: Forecast – Wind Speed and Direction

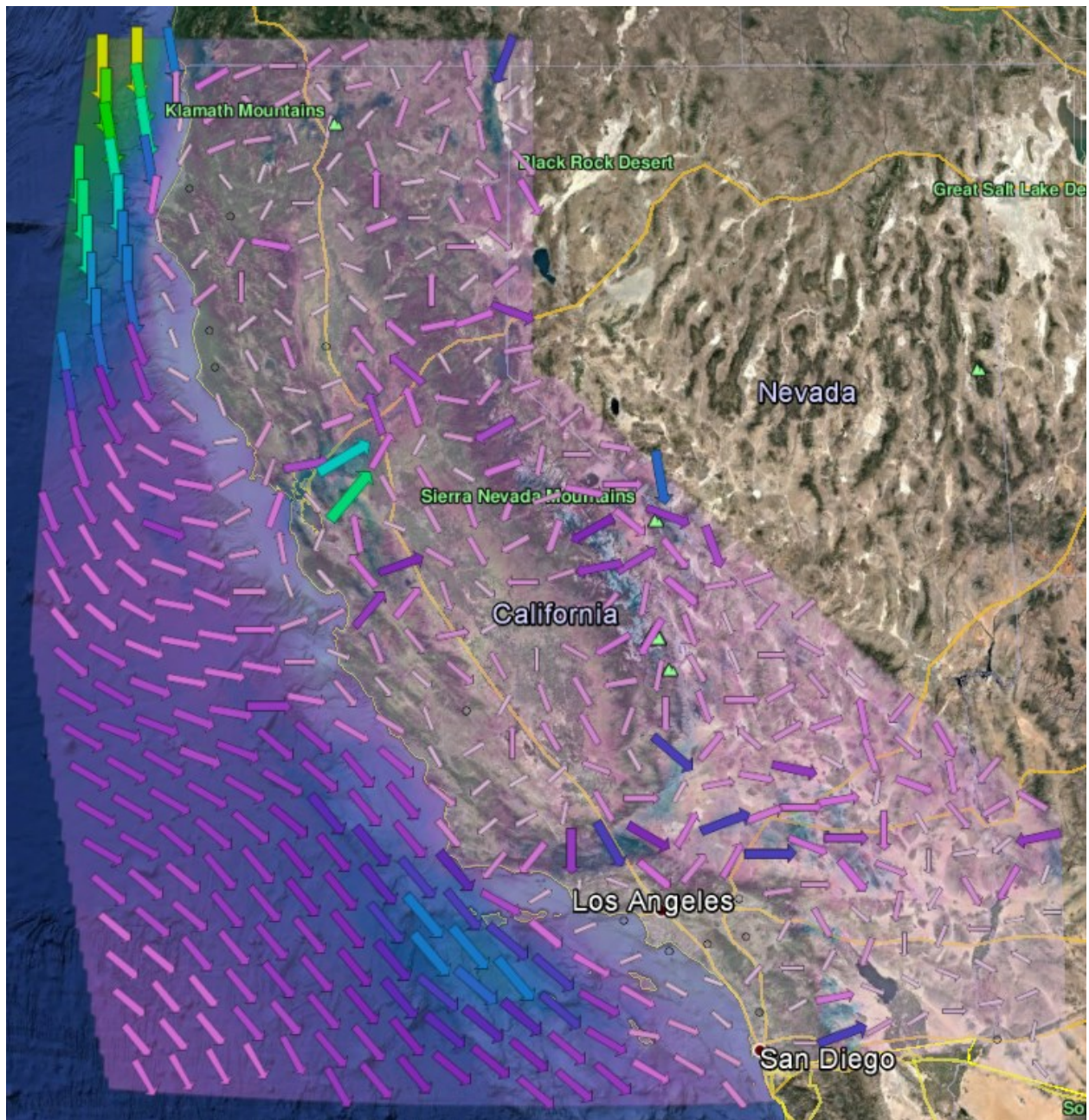


Figure 4-13: Forecast - Wind Gust Speed and Direction

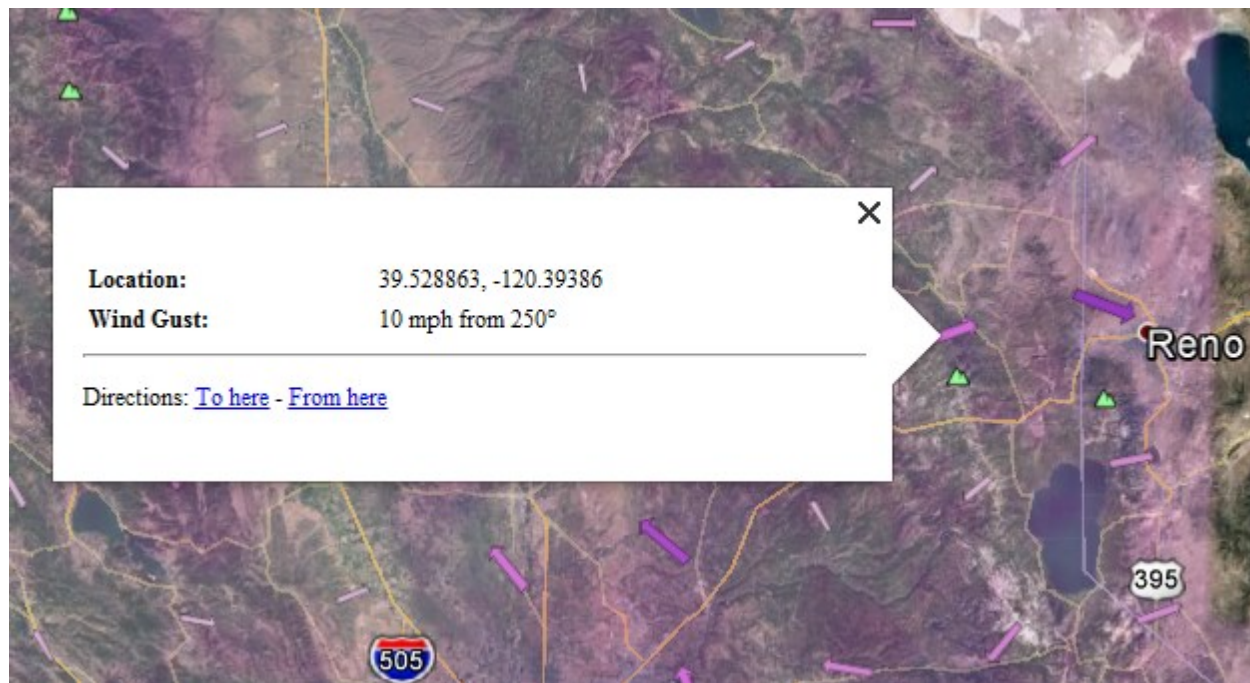


Figure 4-14: NDFD Point Forecast Details

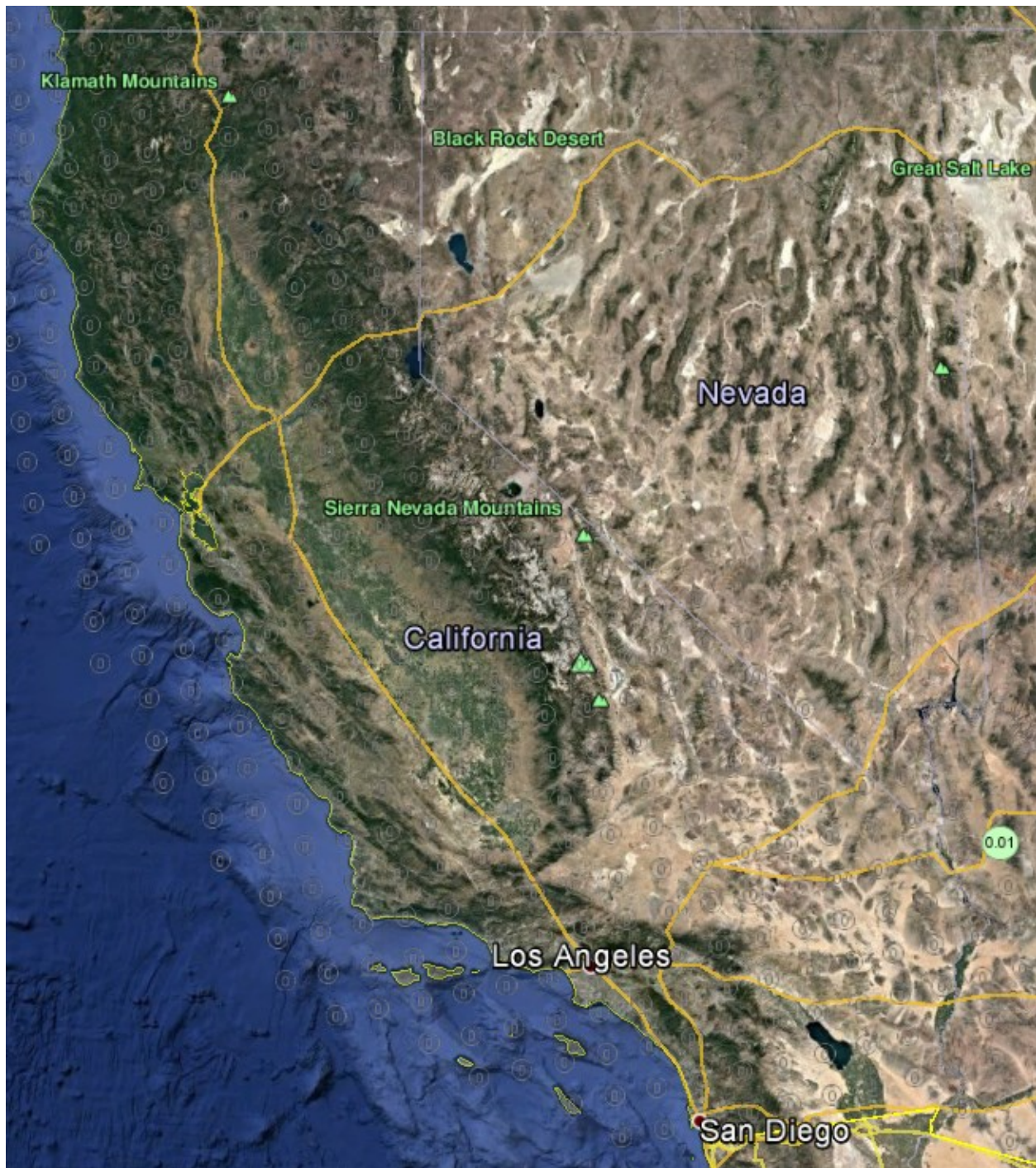


Figure 4-15: Forecast – 6-Hour Precipitation

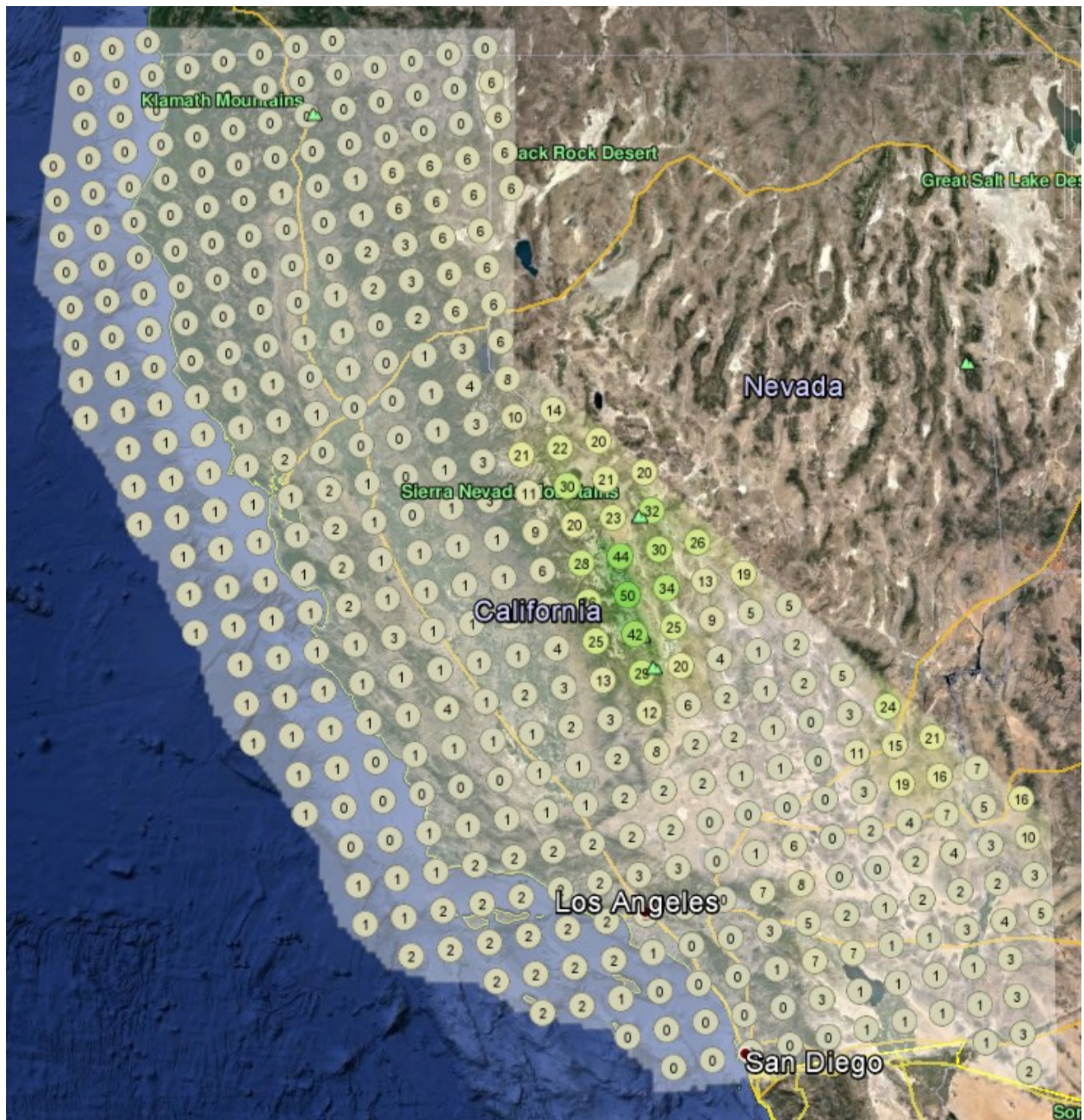


Figure 4-16: Forecast – 12-Hour Probability of Precipitation

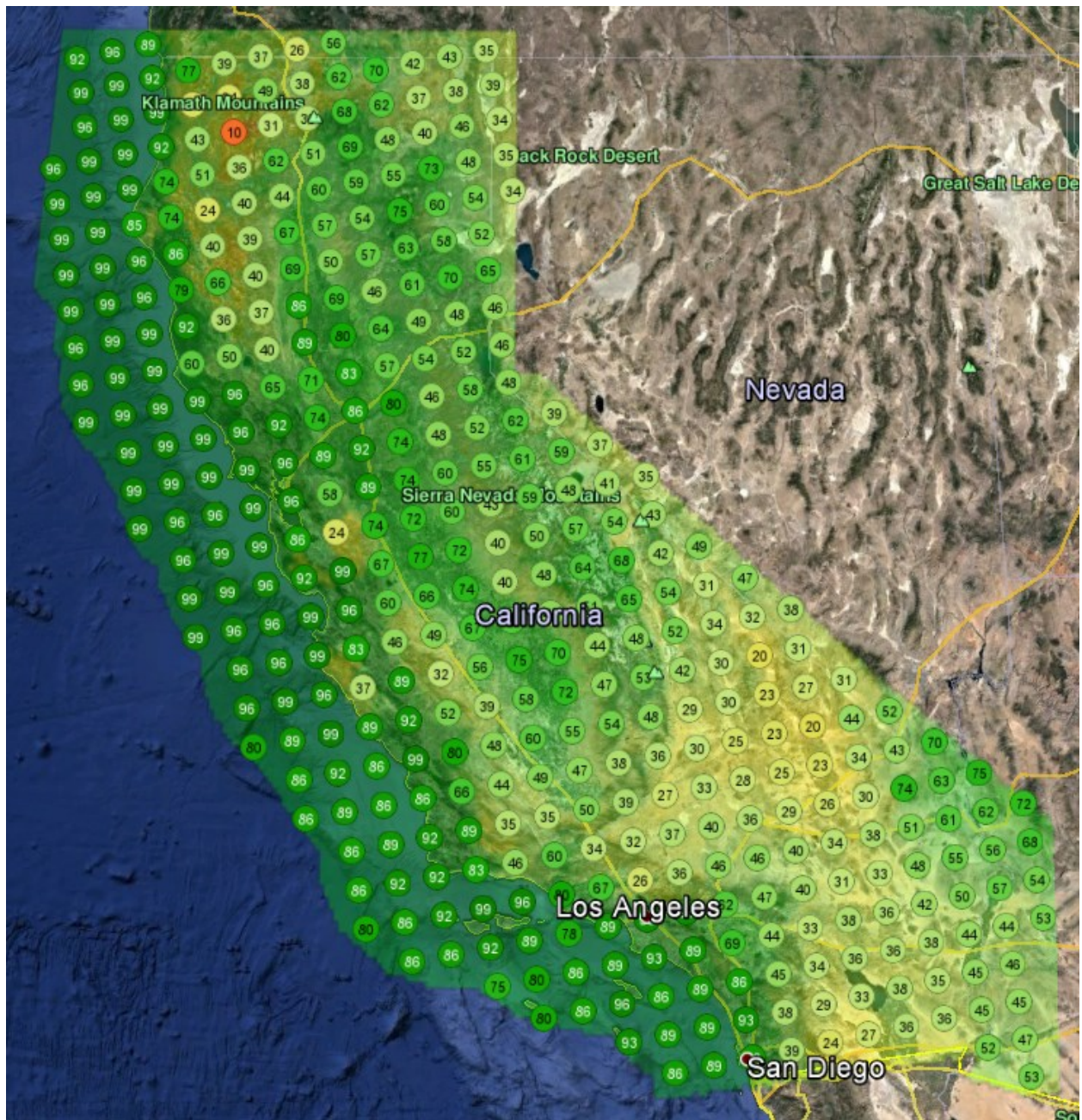


Figure 4-17: Forecast - Humidity

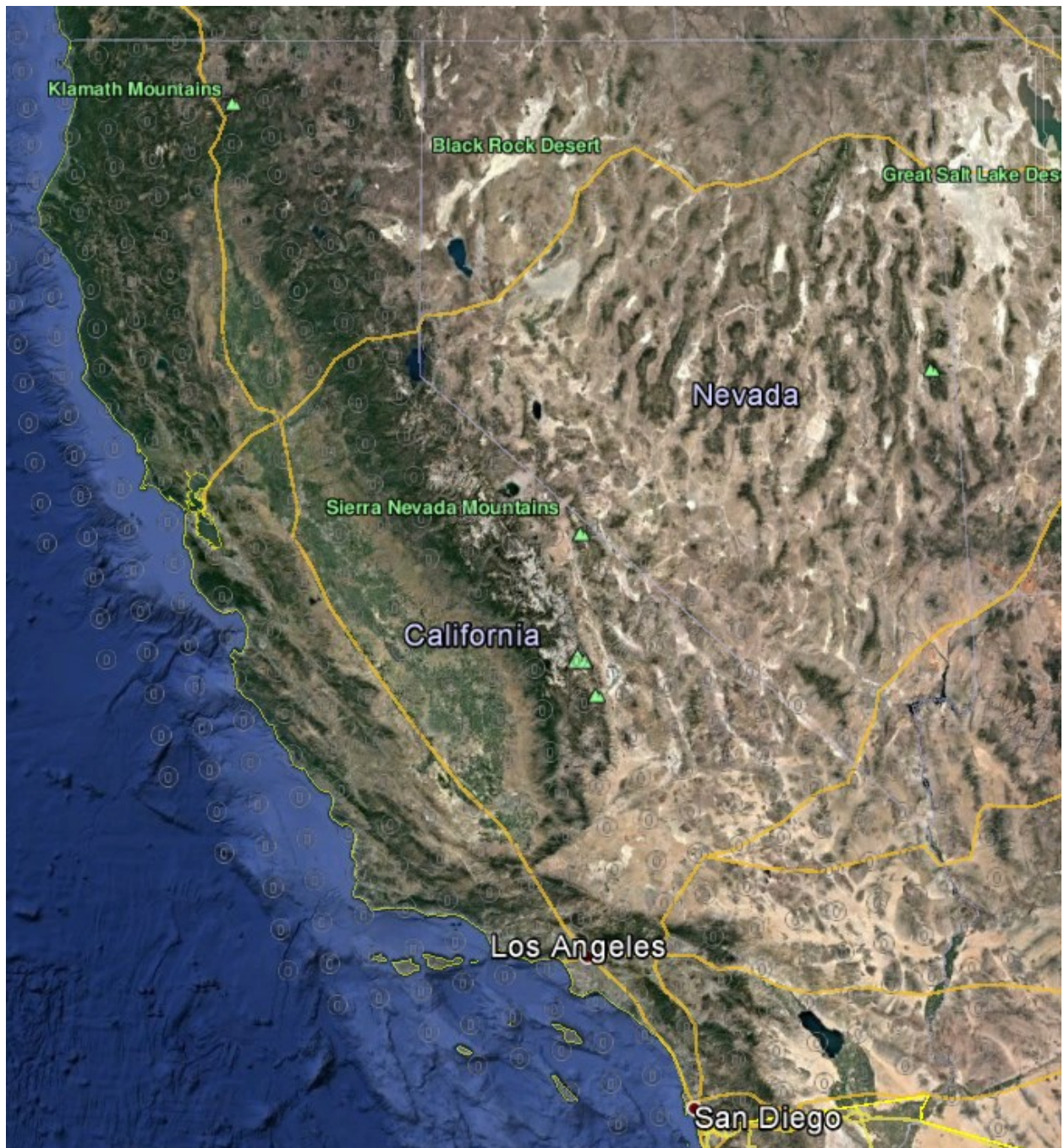


Figure 4-18: Forecast - Snow

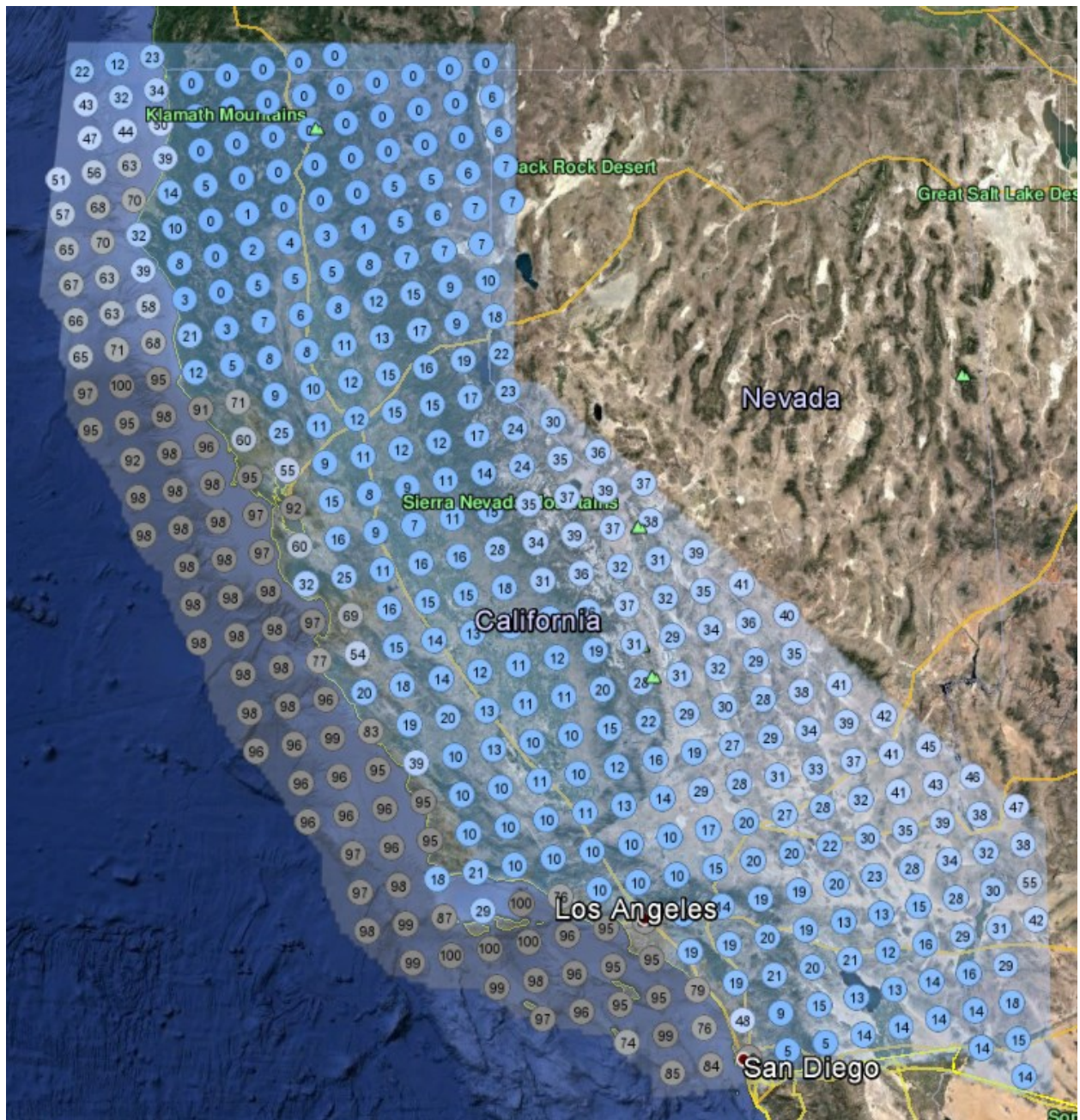


Figure 4-19: Forecast – Sky Cover

5. SUMMARY

The focus of this project was to develop, for display in QuickMap, weather layers similar to those shown in the Western States Rural Transportation Consortium (WSRTC) One-Stop-Shop (OSS). Since layers in QuickMap were presented using Keyhole Markup Language (KML), it was desirable that these weather layers also be presented via KML so that they would be readily usable. The relevant current weather layers in the WSRTC OSS were:

- Current Weather:
 - Air Temperature (MADIS, Mesowest, State DOT)
 - Relative Humidity (MADIS, Mesowest, State DOT)
 - 1 Hour Precipitation (MADIS, Mesowest, State DOT)
 - 24 Hour Precipitation (MADIS, Mesowest, State DOT)
 - Advanced Hydrological Prediction Service 24 Hour Precipitation (National Weather Service)
 - Wind (MADIS, Mesowest, State DOT)
- Forecast Weather:
 - Air Temperature (National Weather Service – National Digital Forecast Database)
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 - Wind Gust Speed (National Weather Service – National Digital Forecast Database)
 - Humidity (National Weather Service – National Digital Forecast Database)
 - Sky Cover (National Weather Service – National Digital Forecast Database)
 - 12-Hour Chance of Precipitation (National Weather Service – National Digital Forecast Database)
 - 6-Hour Precipitation (National Weather Service – National Digital Forecast Database)
 - Snow (National Weather Service – National Digital Forecast Database)
 - Weather (National Weather Service – National Digital Forecast Database)

All of these layers were developed as KML feeds, which were deployed to prototype and production systems, and maintained throughout the time period covered by this contract.

A no-cost time extension was requested on January 12, 2017 per prior Caltrans discussion and guidance. It was determined by the PTAP, that the development and deployment tasks of the project had been completed, and that Task 4, System Maintenance, should be used to maintain the WeatherShare System for an additional 24 months. Ultimately it was decided that the Road Weather for QuickMap contract would be allowed to expire as scheduled and that another contract would be used provide further service and support for WeatherShare.

This document is the final deliverable for this project.