# The *Clarus* System

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Road Weather Stakeholder Meeting
Albuquerque, New Mexico
September 7, 2011

# The *Clarus* Initiative: 4 Objectives

- Provide a North American resource to **collect**, **quality check**, and **disseminate** weather and road condition **observations**
- Demonstrate that these observations will support **general purpose weather forecasting**
- Demonstrate that the observations will support **real-time operational responses** to weather
- Support the enhancement and creation of models to **improve forecasts at and near the earth's surface**

# *Clarus* Users in 2010

- 4993 unique addresses gaining access (3,524,702 hits) from 67 countries
  - government agencies (federal, state, local)
  - academic institutions
  - weather providers
  - TV stations
  - private sector firms
  - unknown sources (Internet providers, etc.)
- *Clarus* Users in 2009 - 314 unique addresses gaining access (59,000+ hits) from 19 countries

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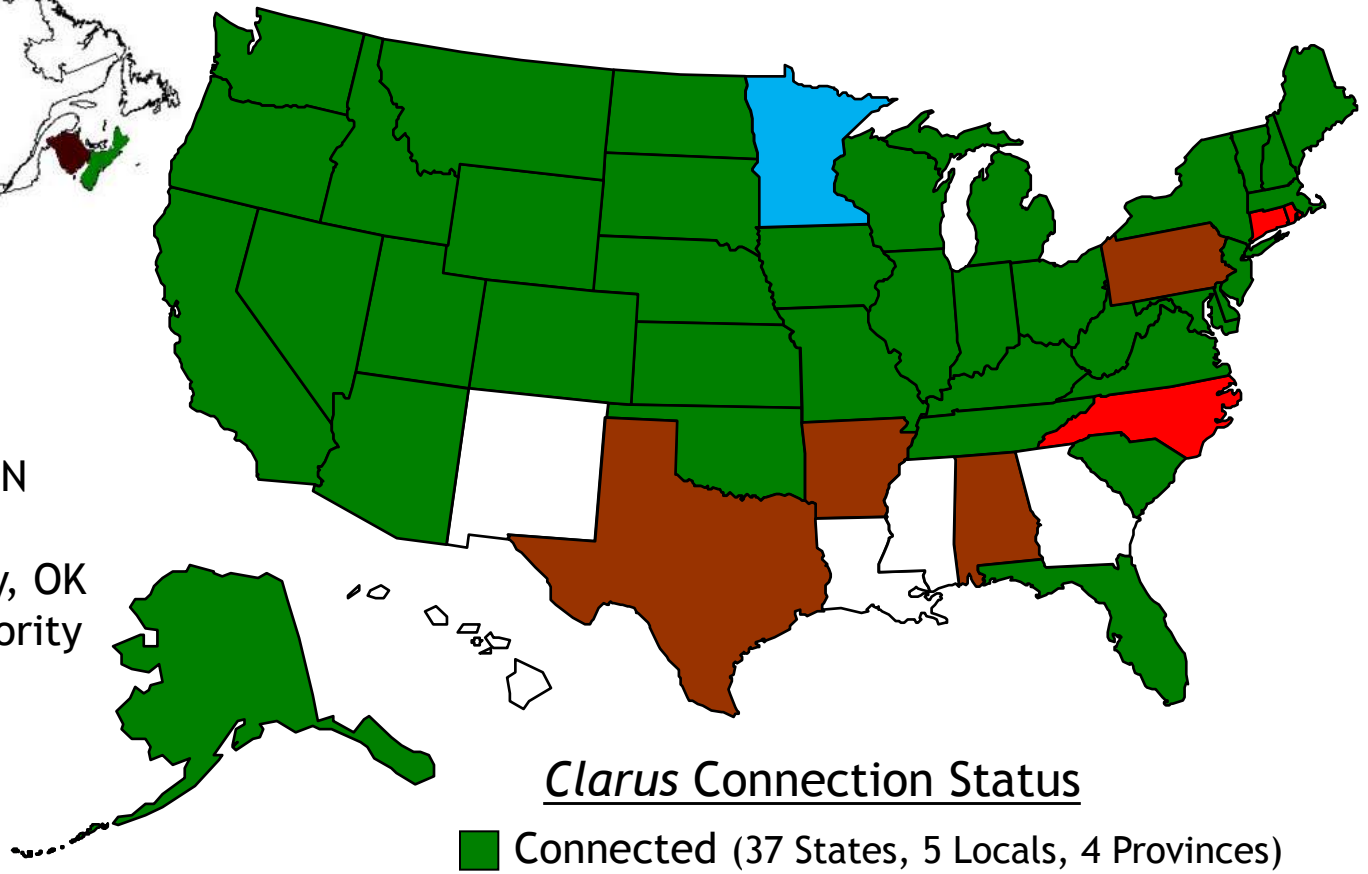
# *Clarus* Users by Country

| 2010 | 2011 |
| --- | --- |
| 1. United States | 1. United States |
| 2. Ireland | 2. Ireland |
| 3. Japan | 3. Canada |
| 4. Canada | 4. Unknown |
| 5. Israel | 5. Israel |

# Participation Status for *Clarus* as of August 24, 2011

Canadian Participation



## Local Participation

- City of Indianapolis, IN
- McHenry County, IL
- City of Oklahoma City, OK
- Kansas Turnpike Authority
- Parks Canada

## *Clarus* Connection Status

- Connected (37 States, 5 Locals, 4 Provinces)
- Connected plus vehicles (1 state)
- Pending (4 States, 3 Locals, 1 Province)
- Considering (3 States, 1 Local)

## Sensor & Station Count

| | |
|---|---|
| 2,253 | Sensor Stations (ESS) |
| 52,471 | Individual Sensors |
| 81 | Vehicles |

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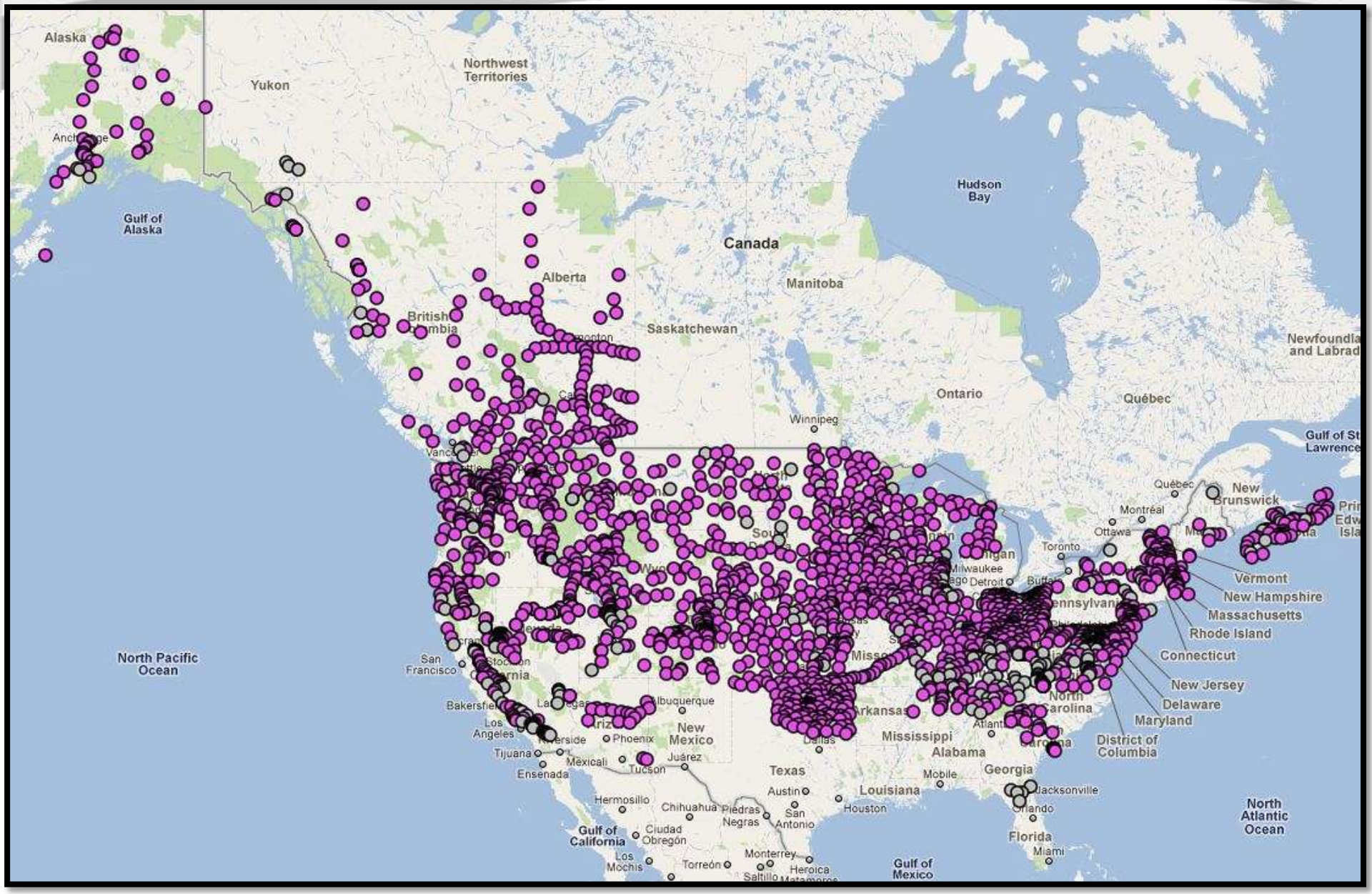
Alaska
Yukon
Northwest Territories
Hudson Bay
Gulf of Alaska
Canada
Alberta
Manitoba
Saskatchewan
Ontario
Québec
Winnipeg
Gulf of St Lawrence
New Brunswick
Montréal
Ottawa
Toronto
Vermont
New Hampshire
Massachusetts
Rhode Island
Connecticut
New Jersey
Delaware
Maryland
District of Columbia
North Carolina
Mississippi
Alabama
Georgia
Florida
Louisiana
Texas
New Mexico
Arkansas
Missouri
Illinois
Michigan
Milwaukee
Detroit
Buffalo
Pennsylvania
North Pacific Ocean
North Atlantic Ocean
Gulf of California
Gulf of Mexico
San Francisco
Los Angeles
Phoenix
Albuquerque
Tucson
Juárez
Tijuana
Ensenada
Hermosillo
Chihuahua
Piedras Negras
San Antonio
Austin
Houston
Dallas
Mobile
Jacksonville
Miami
Monterrey
Torreón
Ciudad Obregón
Los Mochis

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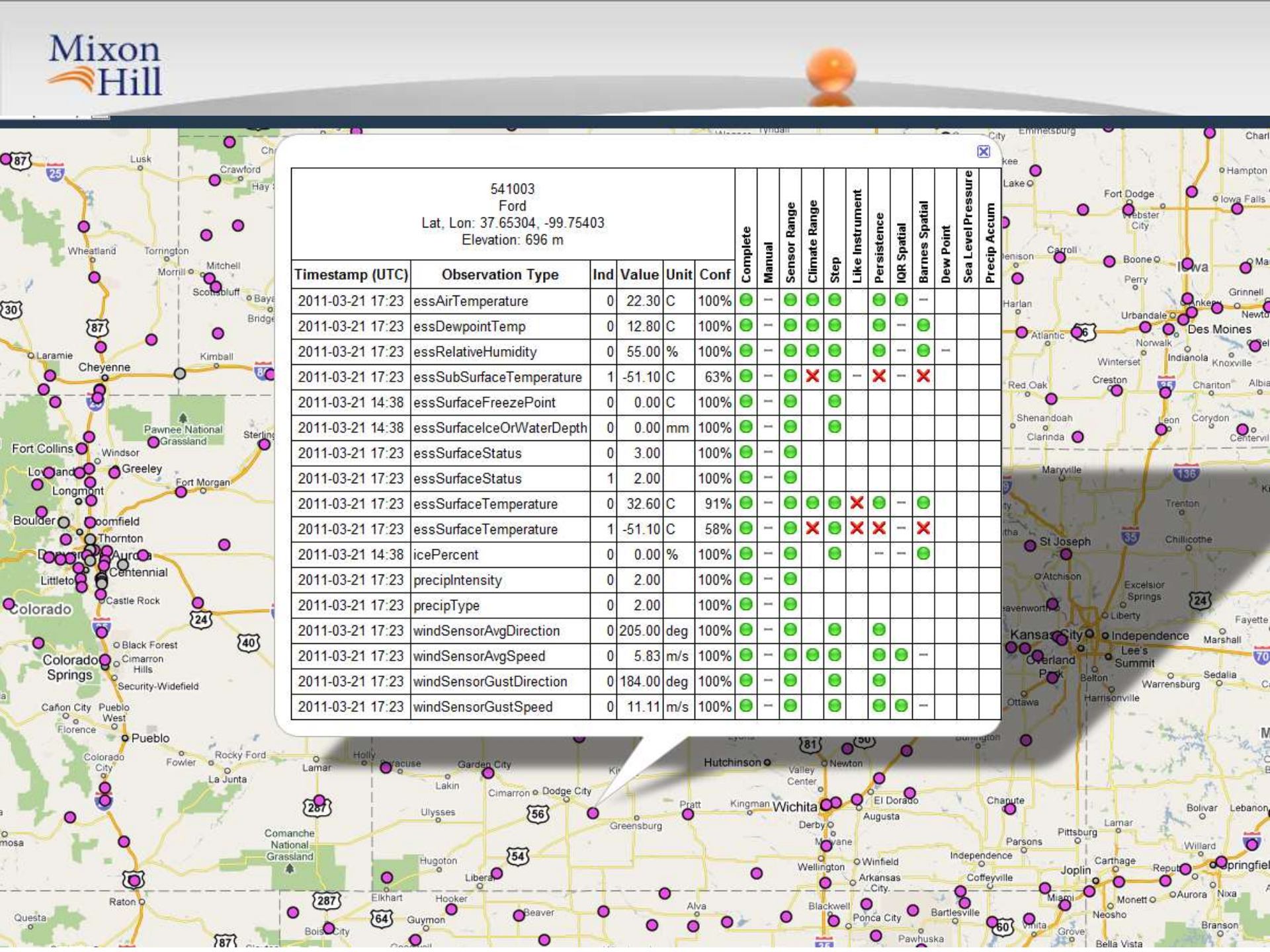

541003
Ford
Lat, Lon: 37.65304, -99.75403
Elevation: 696 m

| Timestamp (UTC) | Observation Type | Ind | Value | Unit | Conf | Complete | Manual | Sensor Range | Climate Range | Step | Like Instrument | Persistence | IQR Spatial | Barnes Spatial | Dew Point | Sea Level Pressure | Precip Accum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011-03-21 17:23 | essAirTemperature | 0 | 22.30 | C | 100% | ● | – | ● | ● | ● | | ● | ● | – | | | |
| 2011-03-21 17:23 | essDewpointTemp | 0 | 12.80 | C | 100% | ● | – | ● | ● | ● | | ● | – | ● | | | |
| 2011-03-21 17:23 | essRelativeHumidity | 0 | 55.00 | % | 100% | ● | – | ● | ● | ● | | ● | – | ● | – | | |
| 2011-03-21 17:23 | essSubSurfaceTemperature | 1 | -51.10 | C | 63% | ● | – | ● | ✗ | ● | – | ✗ | – | ✗ | | | |
| 2011-03-21 14:38 | essSurfaceFreezePoint | 0 | 0.00 | C | 100% | ● | – | ● | | ● | | | | | | | |
| 2011-03-21 14:38 | essSurfaceIceOrWaterDepth | 0 | 0.00 | mm | 100% | ● | – | ● | | ● | | | | | | | |
| 2011-03-21 17:23 | essSurfaceStatus | 0 | 3.00 | | 100% | ● | – | ● | | | | | | | | | |
| 2011-03-21 17:23 | essSurfaceStatus | 1 | 2.00 | | 100% | ● | – | ● | | | | | | | | | |
| 2011-03-21 17:23 | essSurfaceTemperature | 0 | 32.60 | C | 91% | ● | – | ● | ● | ● | ✗ | ● | – | ● | | | |
| 2011-03-21 17:23 | essSurfaceTemperature | 1 | -51.10 | C | 58% | ● | – | ● | ✗ | ● | ✗ | ✗ | – | ✗ | | | |
| 2011-03-21 14:38 | icePercent | 0 | 0.00 | % | 100% | ● | – | ● | | ● | | – | – | ● | | | |
| 2011-03-21 17:23 | precipIntensity | 0 | 2.00 | | 100% | ● | – | ● | | | | | | | | | |
| 2011-03-21 17:23 | precipType | 0 | 2.00 | | 100% | ● | – | ● | | | | | | | | | |
| 2011-03-21 17:23 | windSensorAvgDirection | 0 | 205.00 | deg | 100% | ● | – | ● | | ● | | ● | | | | | |
| 2011-03-21 17:23 | windSensorAvgSpeed | 0 | 5.83 | m/s | 100% | ● | – | ● | ● | ● | | ● | ● | – | | | |
| 2011-03-21 17:23 | windSensorGustDirection | 0 | 184.00 | deg | 100% | ● | – | ● | | ● | | ● | | | | | |
| 2011-03-21 17:23 | windSensorGustSpeed | 0 | 11.11 | m/s | 100% | ● | – | ● | | ● | | ● | ● | – | | | |

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# Quality Checking Algorithms

**Complete Flag**

- All tests that can be run have completed
- Why wouldn't a test run?
  - Not configured to run
  - Not enough data to run

**Manual Flag**

- Set by contributor to indicate "Don't necessarily trust this value"
- Set by contributor to indicate "Out of Service"

# Quality Checking Algorithms

**Sensor Range Test**

- Observation compared to manufacturer's published minimum and maximum values
- Example:
  - Air Temperature: 25 C
  - Specs: -20 C to 50 C
  - Test Passed

**Climate Range Test**

- Observation compared to historical climate minimum and maximum values per month by geographic area – **gridded field**
- Example:
  - Air Temperature: 25 C
  - Climate Value for January: -10 C to 20 C
  - Test did not pass

# Quality Checking Algorithms

**Step Test**

- Observation compared to previous observations over a configured time range to determine if the rate of change (plus or minus) was acceptable
- Example:
  - Values: 10 C, 12 C, 15 C, 35 C
  - Test did not pass

**Like Instrument Test**

- Observation compared to the same observation types from the ESS

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010-03-23 17:26 | essSurfaceTemperature (C) | 9.50 | | - | | | | | | | |
| 2010-03-23 17:26 | essSurfaceTemperature (C) | 10.30 | | - | | | | | | | |
| 2010-03-23 17:26 | essSurfaceTemperature (C) | 8.70 | | - | | | | | | | |
| 2010-03-23 17:26 | essSurfaceTemperature (C) | 8.70 | | - | | | | | | | |

# Quality Checking Algorithms

**Persistence Test**

- Observation compared to previous observations to determine if the values had changed **at all** over a period of time
- Example:
  - Values: 38.6%, 38.6%, 38.7%
  - Test passed

**Dewpoint Test**

- Determine the neighbors
- Calculate a dewpoint value based on the temperature & relative humidity
- Conduct a spatial test

# Quality Checking Algorithms

**IQR Spatial Test**

- Neighboring ESS and ASOS/AWOS identified
- Eliminate the neighbors that are +-350 meters
- Eliminate the highest and lowest neighboring values
- Observation compared to remaining neighbors to determine if they are similar
- Requires 5 initial neighbors for the test to run

**Barnes Spatial Test**

- Observation compared to neighboring ESS and ASOS/AWOS to determine if they are similar

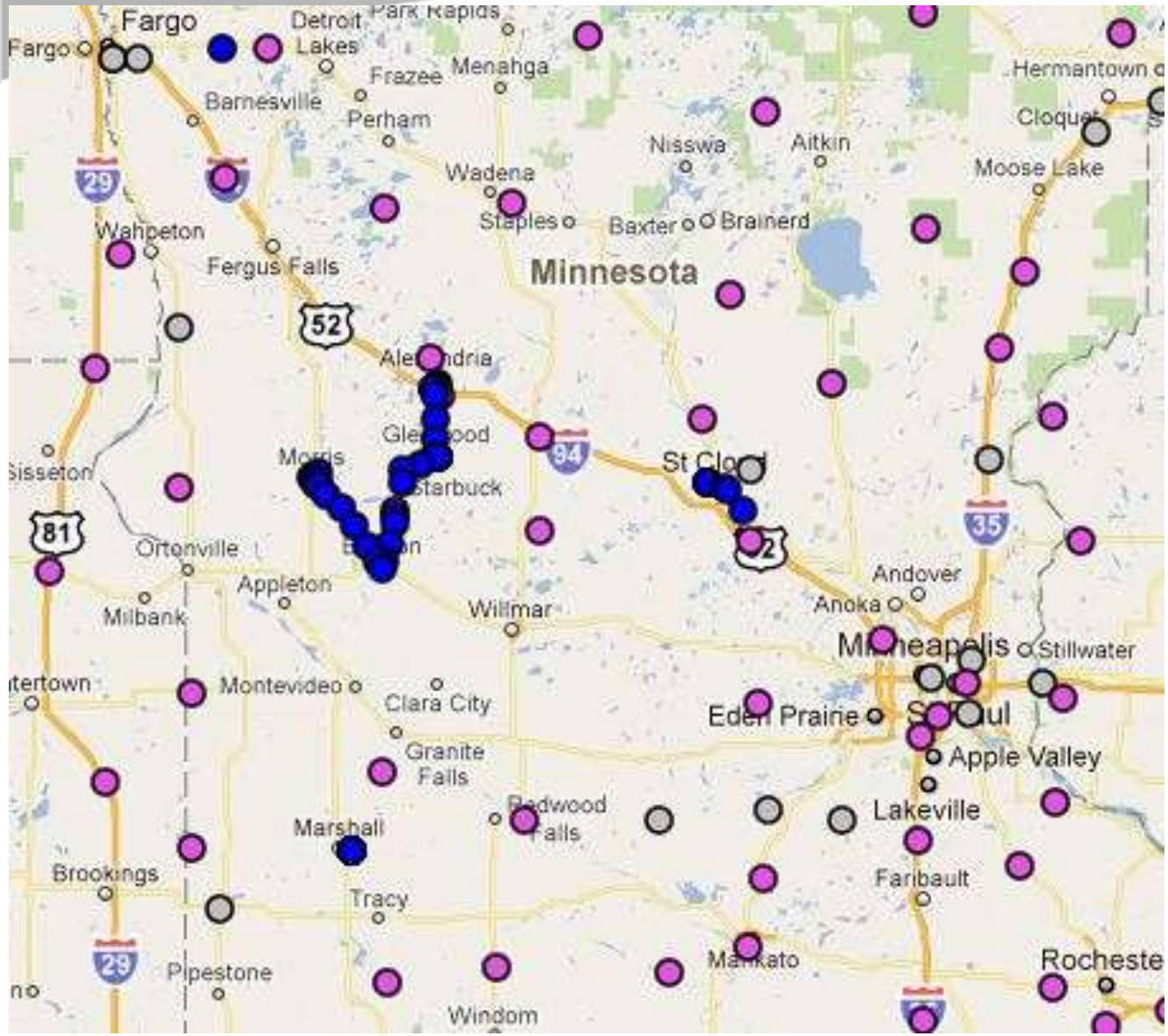
# Quality Checking Algorithms

**Sea Level Pressure Test**

- Calculate a sea level pressure from the station pressure and then conduct a spatial test
- Conversion based on current 700mb Rawinsonde observations or 30-year average gridded data

**Precipitation Accumulation**

- Applies to:
  - 3-hour
  - 6-hour
  - 12-hour
  - 24-hour
- Uses Stage II & IV precipitation files to accumulate the precipitation for comparison




# Mobile Observations

- Data Need
  - Elevation
- Observations are on the map for one hour
- Used in quality checking

# Select Tools


# Subscription File

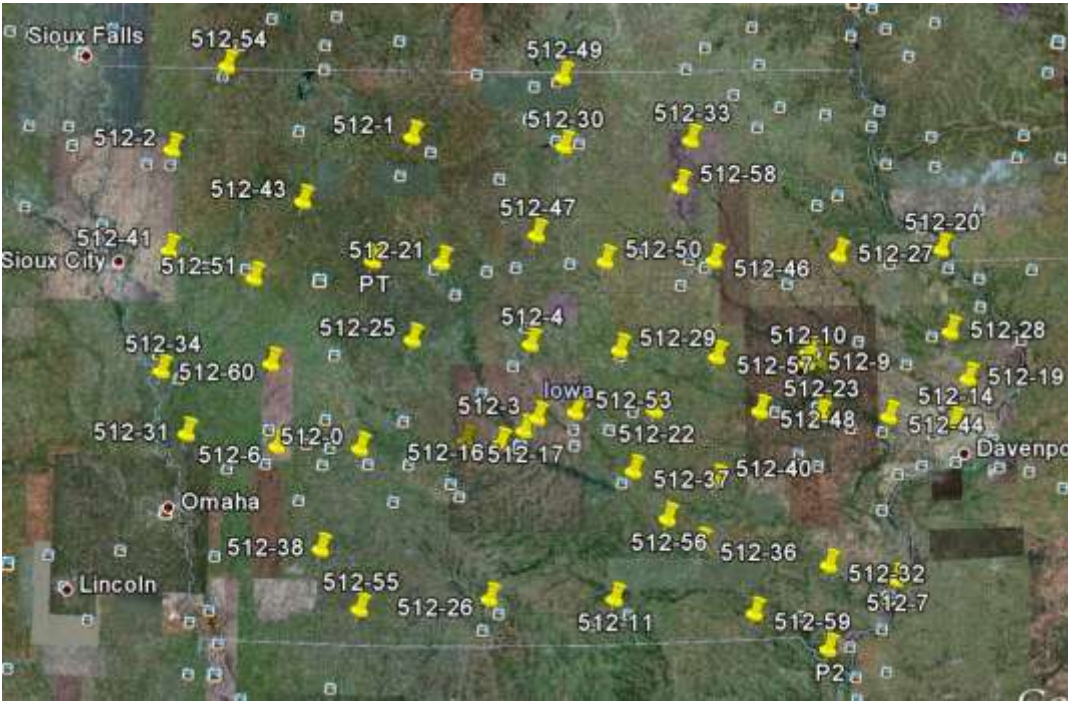
Removed “ClimateId” – Replaced with “Category”

P – Permanent
T – Transportable
M - Mobile

# Communication Notification

- Set up for “No File Received”
- Timing is configurable
- An email can be sent to one or more recipients – owner, vendor
- A file is attached that gives the number of observations received from each station over the past 24 hours

# Google Earth – KML File




**512-25**

IA_State_DOT
Jefferson (IA-4)
42.0518,-94.3783,310

ObsTypeName,ClarusSensorIndex,Timestamp,Observation,Units,EnglishValue,EnglishUnits,Conf

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# Contacts


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