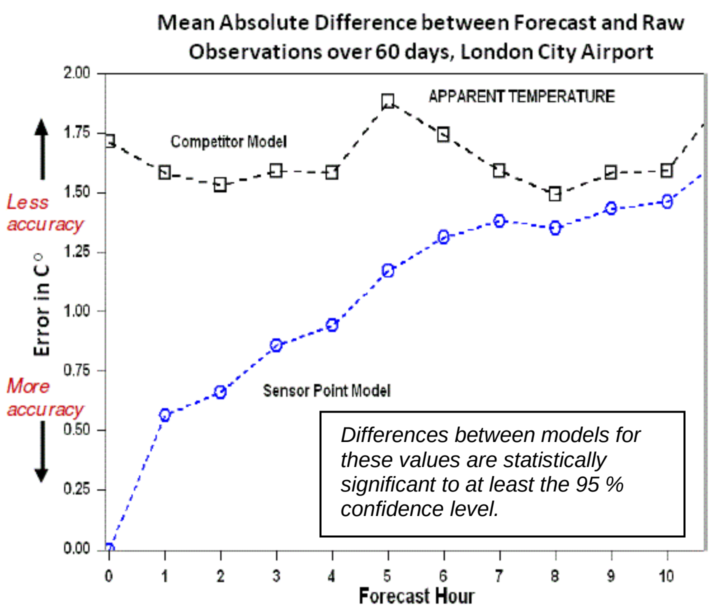
Weather Analytics
Your environment, precisely

Accuracy and Comparisons

-- *Virtual Sensor Point™ Forecasts* --

By grounding a forecast to a specific point, leveraging localized direct observations and maximizing forecast frequency, *Sensor Point™* can produce the highest quality **forecast data** possible, particularly in the first 12 hours where most management and control systems require very high accuracy.

Statistical Verification of *Sensor Point™* Model Forecasts: Comparison with a Competitor Model



Compare with other forecasts:

- Verification analyses comparing 150 separate individual forecast runs at this test site in London showed the competitor model accumulating over 37 % more error than *Sensor Point™*.
- As input to management and control systems, the depth and accuracy of *Sensor Point™* data can maximize system performance. There are no errors or gaps in the data that can cause failures or interruptions.
- Furthermore, when an application demands maximum accuracy, the system supports private on-site sensors, which not only maximizes the localization of the forecasts but also allows new forecasts to be produced every few minutes.

What makes it so accurate?

Sensor Point's accuracy in forecasting comes from:

- **Combining** the best available forecast input data with on-site or nearby sensor readings
- **Focusing** the data to a very small footprint (as small as 1km), and
- **Minimizing** the latency (age) of the forecast.

Fresher is better - When delivered to the customer, *Sensor Point™* system forecasts are based on data and processes that are only **15 to 30 minutes old**. If a proprietary, on-site sensor is being employed the forecasts can be only a few minutes old. The National Weather Service and nearly all competitor models provide updates only every six hours with data cycles from one to seven hours old.

Localized Ground Observations – *Sensor Point™* takes the best available forecast data and uses on-site sensor readings to both ground and focus this trend information. Sophisticated 3D physical modeling techniques are used to combine and translate sensor readings that are not on the exact site into 'virtual' on-site readings and to **localize the forecast data into a 1km footprint on the ground, anywhere in the world**. *Sensor Point™* is the only forecasting system that accommodates private on-site sensors that enable maximum precision and a higher forecast frequency.

Precise historical weather data produced by *Sensor Point™* is a direct application of the precision forecasting process using archived, re-analyzed forecast data and archived hourly official sensor reading data. *Sensor Point™* can therefore accurately **fill in any gaps at weather station locations** and/or provide the best possible virtual historical sensor readings anywhere in the world even where no sensor exists.

An Example - The *Sensor Point™* system is an extension of the modeling techniques used by the air traffic controllers at the San Francisco Airport to predict as accurately as possible when the coastal fog will clear from the runways. (See page 5 for details)

Accuracy and Comparisons

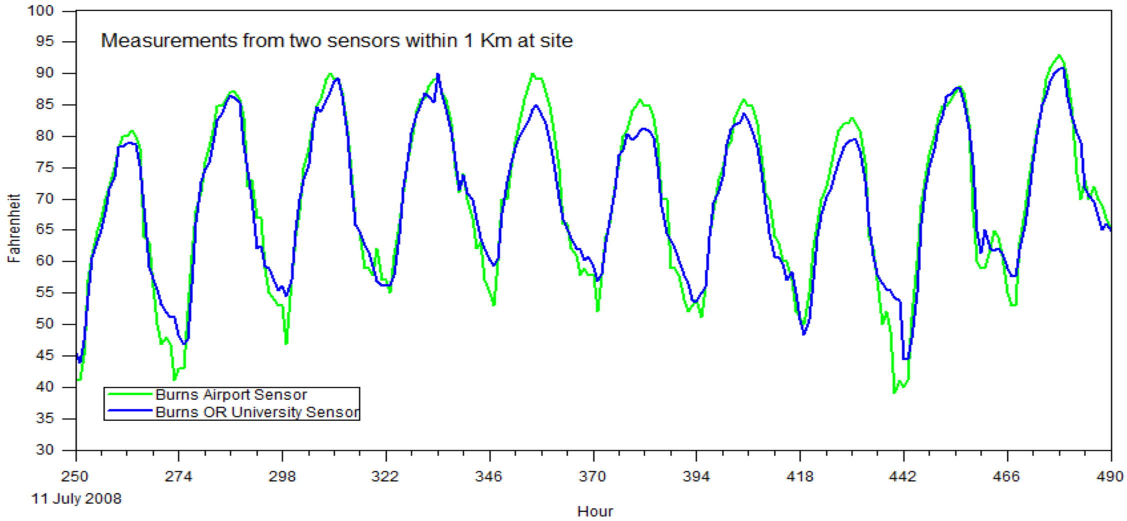
-- *Virtual Sensor Station*™ History and TMY Data--

By applying these same localizing techniques to historical observations and archived, re-analyzed forecast data, ***Sensor Point***™ produces accurate, localized hourly history observations. These techniques were used to create a network of 646,000 ***Virtual Sensor Stations™ (VSS™),*** one every 35 km covering all land and water between the polar ice caps, offering hourly data on over 35 weather variables from January 1979.

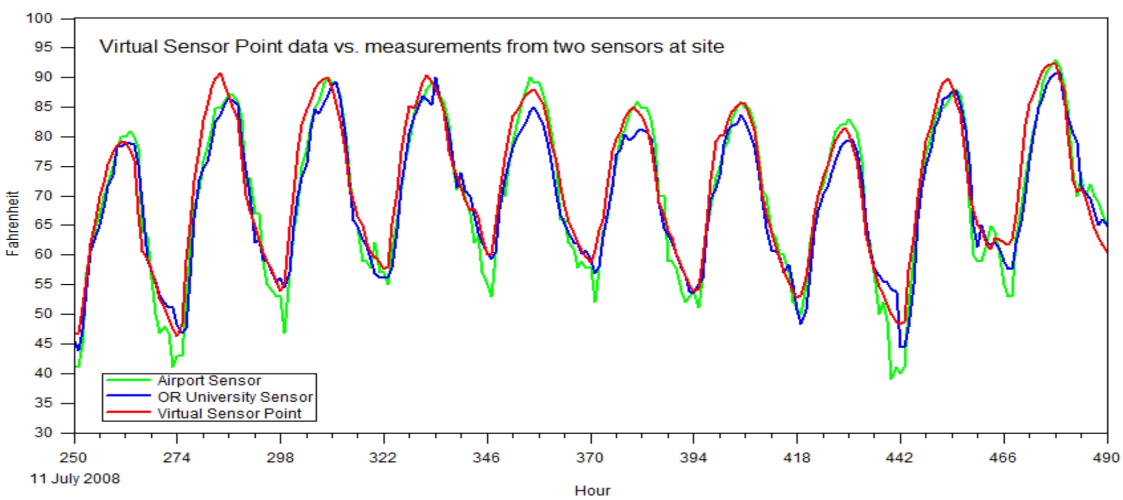
Test mechanism: To verify the accuracy of the historical data output, we positioned a ***Virtual Sensor Station***™ near two or more high-quality weather stations. The comparisons of our VSS™ virtual observations with actual on-site measurements for several variables are shown below.

Surface Temperature: The measured observations for two separate weather stations are shown in green and blue. Note: our virtual sensor observations (in red) are as close to the actual measurements as the two weather station observations are to each other.

Surface Temperature Observations
Two On-Site Sensors
Burns Airport, Oregon
July 11 - 20 2008

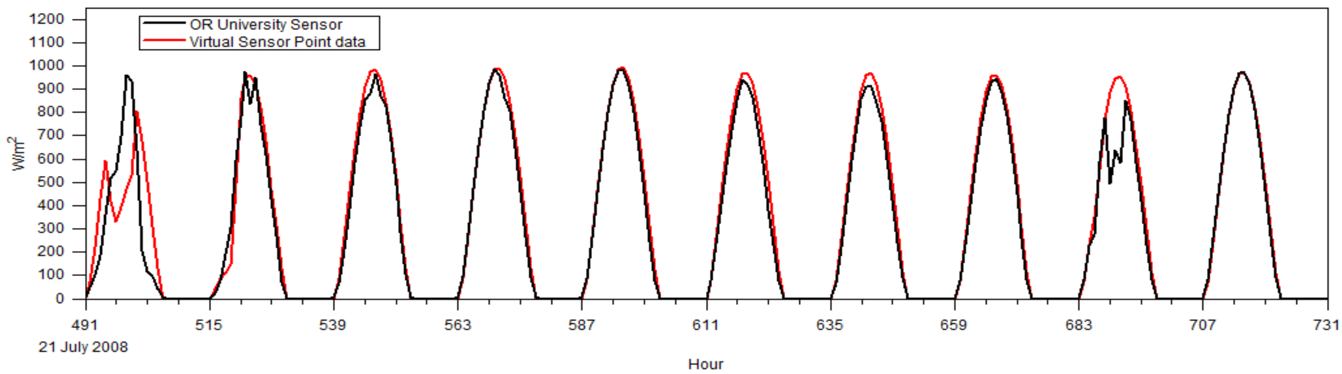


Surface Temperature Comparisons
On-Site Sensors +Virtual Sensor Point
Burns Airport, Oregon
July 11 - 20 2008

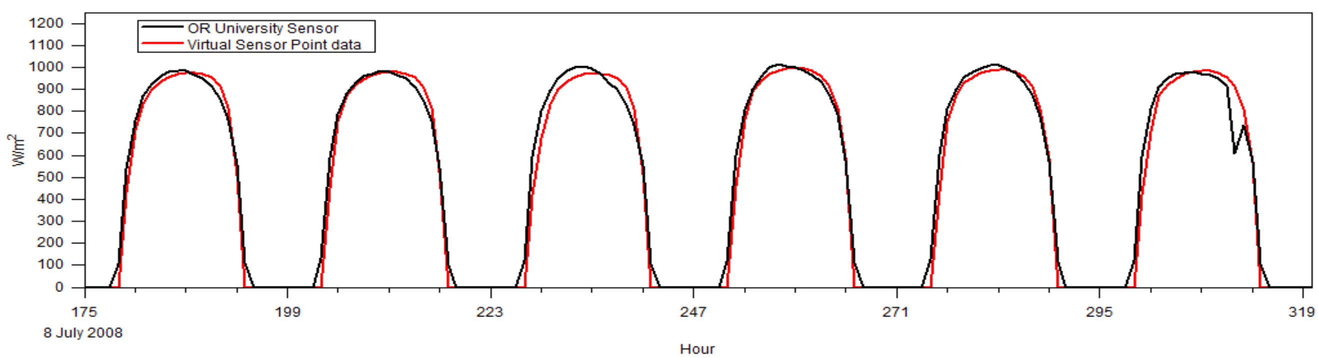


Solar Radiation: Note how close our virtual sensor observations (in red) track the measured Global Horizontal Irradiation (GHI) below. The quality of ***VSS™*** Direct Normal Radiation (DNI) output against actual measured values is shown below for both clear and cloudy days showing a very high correlation for clear and a little less for cloudy conditions.

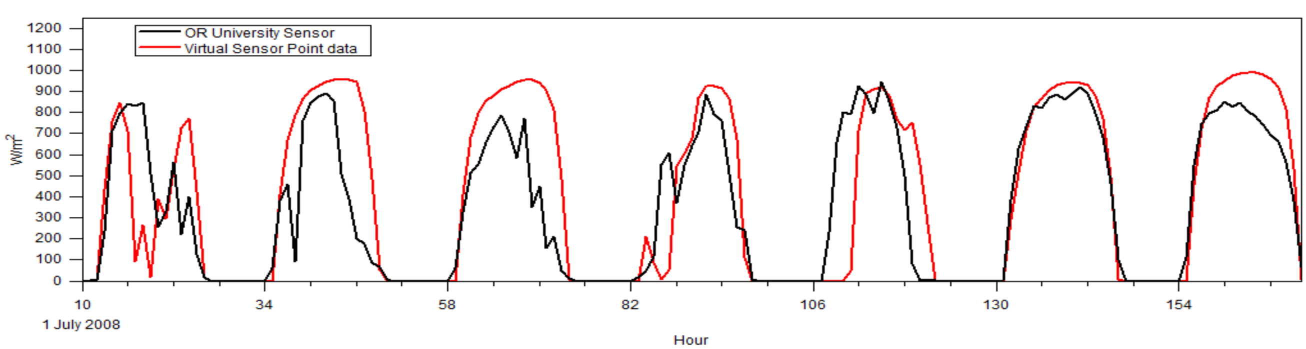
Solar (Global Horizontal) Radiation Comparison
On-site Sensor + Virtual Sensor Point
Burns, Oregon
July 21 - 30 2008



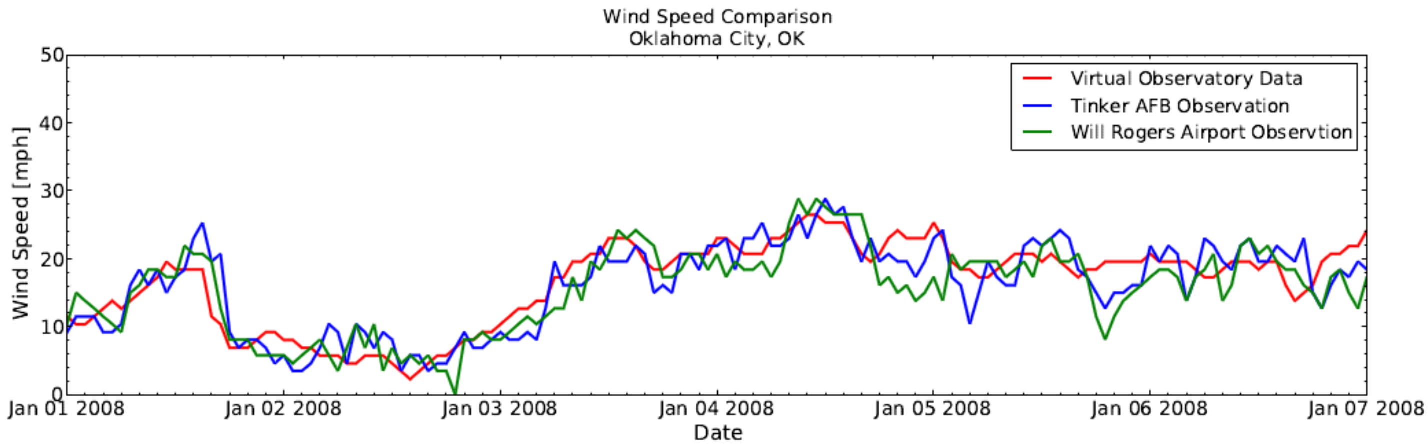
Direct Normal Radiation Comparison
- Clear Days -
On-site Sensor + Virtual Sensor Point
Burns, Oregon
July 8 - 12 2008



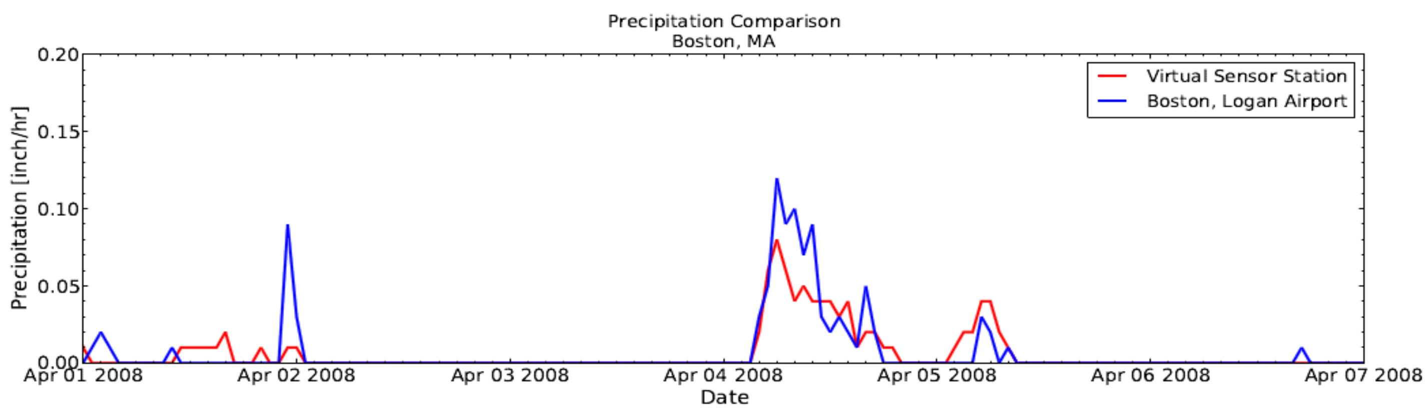
Direct Normal Radiation Comparison
- Cloudy Days -
On-site Sensor + Virtual Sensor Point
Burns, Oregon
July 1 - 7 2008

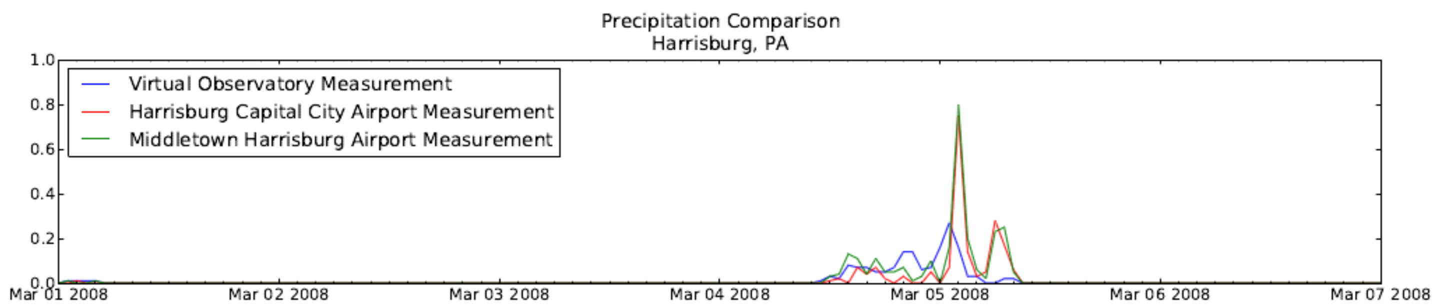


Wind Speed: The result of tests at a location with two separate weather stations is shown below. As above the weather stations observations are in green and blue with our ***VSS™*** output in red. Note: the weather station observations are point readings taken near the top of the hour at 10 meters, while our virtual sensor output represents an average of the wind speed at 10 m over the entire 35 km grid tile. The correlation, however of our ***VSS™*** output and the actual measurements is very high.



Precipitation: The results of two tests at two separate locations are shown below. Each location showing observations from one or two separate weather stations (in the first graph, the weather stations observations are in blue with our ***VSS™*** output in red; in the second the station observations are in green and red with virtual sensor observations in blue). Note: as with wind speed, the weather station observations are point readings, while our virtual sensor output represents an average of the precipitation in the last hour over the entire 35 km grid tile. The correlation, however of our ***VSS™*** output and the actual measurements in both cases is very high.

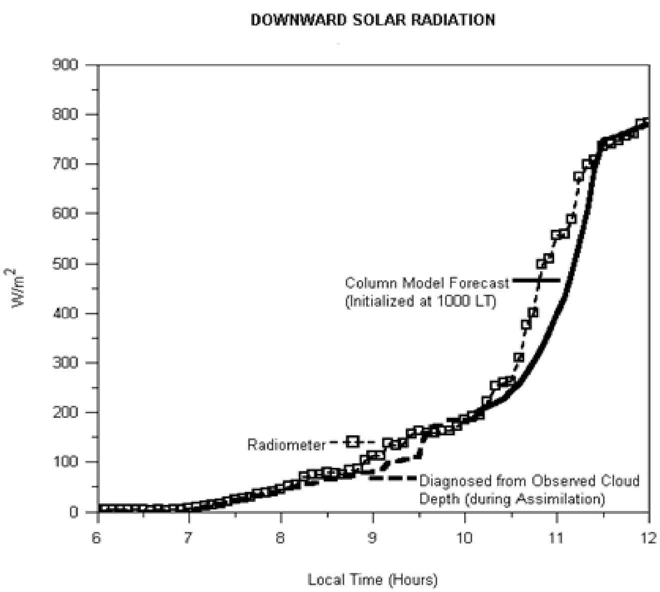


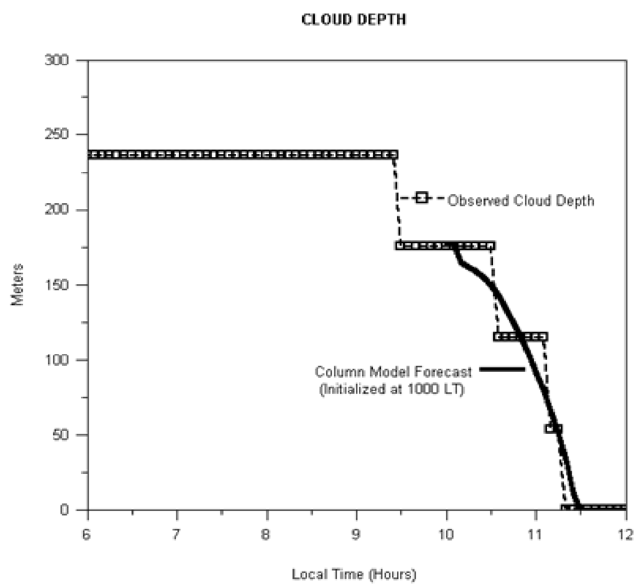


San Francisco Airport (SFO) Example

An earlier version of NOAH-LSM based column model approach used in *Sensor Point*™ has been in continuous use in support of the FAA's San Francisco International Airport (SFO) marine stratus forecasting system project[1] for over six years. The model has predicted, within minutes, the exact time the marine stratus fog would clear from the runways. This allows remote air traffic to be released with confidence that the runway would be clear for their time of landing.

This system utilizes on-site sensors and operates on a five-minute cycle. In addition to predicting ground fog, it also has successfully demonstrated it can provide localized short-term downscaled forecasts of solar radiation. An example of the observed and forecast fog (marine stratus layer clouds) depth and downward solar radiation during the period in which stratus "burns off" in the SFO terminal area is shown below. (For more detail see the paper referenced)





**Short-term Forecasts of Global Solar Radiation vs.
Actual Measurements at San Francisco International Airport**

[1] *J.L. Keller, Use of a column model to support more accurate Terminal Forecasts of stratus burn-off times at the San Francisco International Airport. Proc. Seventh International Aviation Conference, American Meteorological Society, Long Beach, California, February* 1997