AUTOMATED WEATHER OBSERVATION SYSTEM (AWOS)

COASTAL ENVIRONMENTAL SYSTEMS, INC.

SENSORS VERSUS SENSES

Rev. 6/1/2010

Sensors vs. Senses

Sensors measure locally, but *algorithms* average over time, which expands the effective area of the observation.

Sample area where algorithm data is valid

	Processing interval	Radius
Sky Condition	**30 min**	**3-5 miles**
Visibility	**10 min**	**2-3 miles**
Precipitation	**10 min**	**1-2 miles**
Freezing Rain	**15 min**	**2-3 miles**
Temp/DP	**5 min.**	**5 miles**
Wind	**5 sec/2 min.**	**1-2 miles**
Pressure	**1 min.**	**5 miles**
Thunderstorm	**15 min.**	**30 nm**

Source: http://205.156.54.206/asos/obs.htm

Sensors vs. Senses

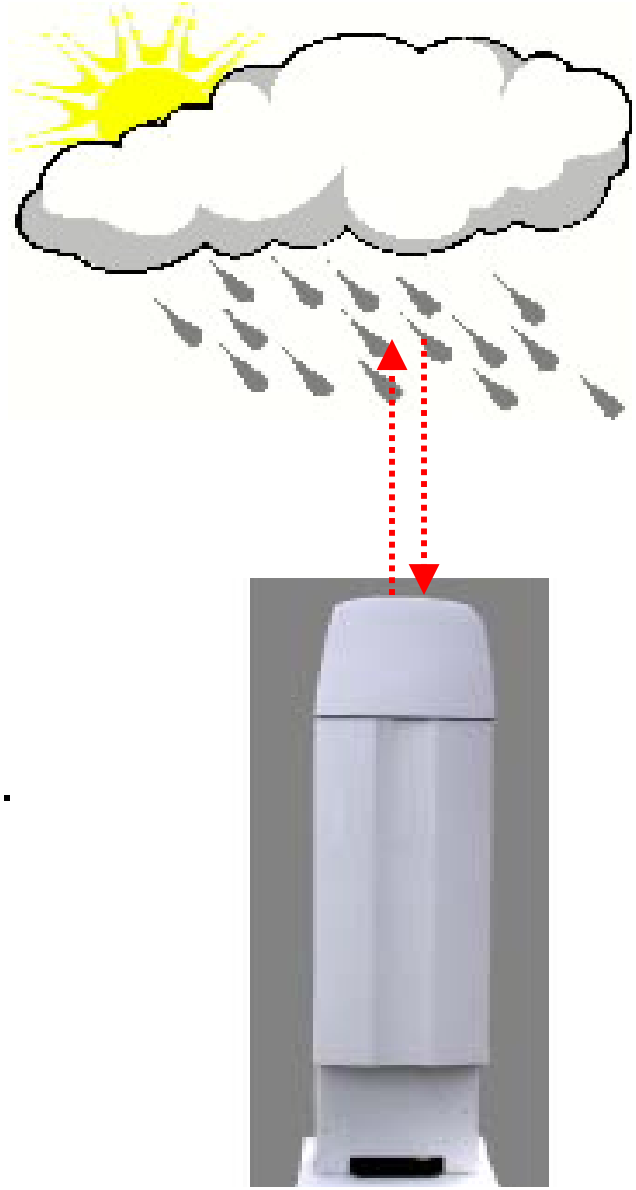
Automated vs. Human observations

- Humans and automated systems observe differently:
  - Algorithms see smaller area but use sampling and averaging over longer periods of time.
  - Observer sees wider area for shorter time (typ. 10 min./hr)
  - Especially affects sky condition and visibility observation.

- AWOS advantages:
  - 24/7, no vacation, but occasional sick days.
  - Consistent in measurement, reporting standards
- AWOS limitations:
  - AWOS is most accurate when weather is homogeneous. In rapidly changing conditions of sky cover and visibility, observations lag behind actual weather.
  - AWOS will not report tornadoes, funnel clouds (or any cloud type), snow depth, smoke – unless reports augmented by observer.

Sensors vs. Senses

Laser Beam Ceilometer only sees one spot. But 30-min. average creates accurate observation in *stable* conditions.

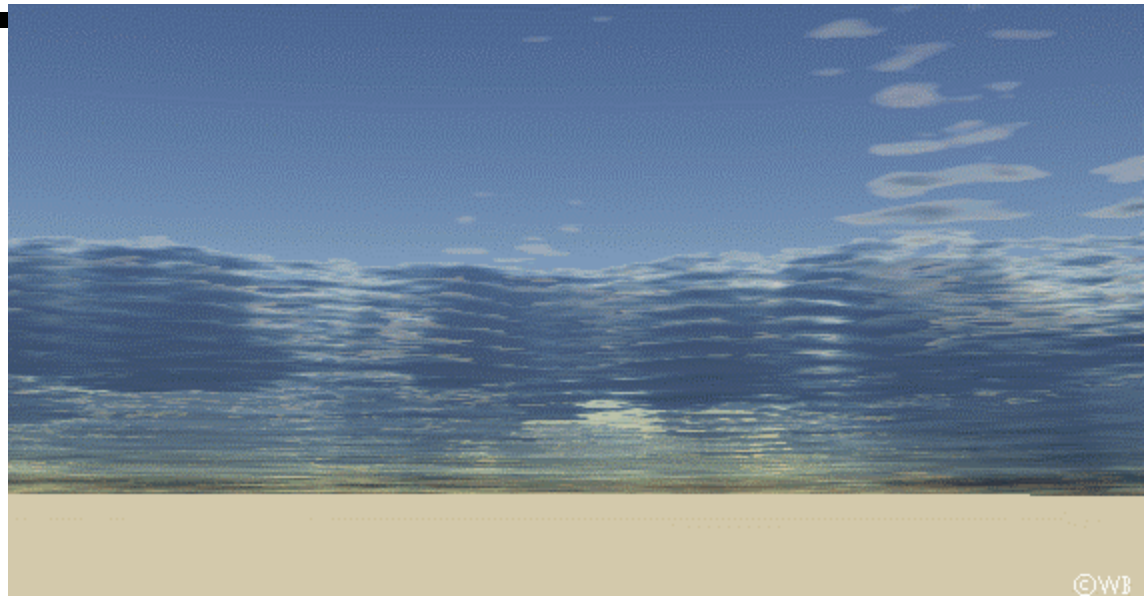


Limitations:

- In frontal or convective weather, AWOS may lag actual weather due to rapid changes.
- False coverage if cloud “parks” above sensor
- When obscuration or precipitation is present, may report *lower* than actual cloud height/ceiling.

But pilots have said that the lower ceilings actually closer to heights they need to get below to see airfield clearly

Sensors vs. Senses



Limitations:

• Cannot report cloud *types,* therefore cannot anticipate changes in weather based on hazardous or impending cloud conditions.

By the numbers:

• When ceilings <5000ft., ASOS agreed with observer 78% of the time.

• With fog, agreement reaches 84%.

• With rain, agreement = 69%.

• With snow, agreement = 74%

(Source: http://205.156.54.206/asos)

Sensors vs. Senses

Visibility sensor sees .75 cu. ft sample volume. 10-min. average gives accurate visibility *except*…

Limitations

- Isolated fog causes most problems:
  - Lower visibility if fog localized to sensor
  - Fog confined to runway may go unreported
- When visibility changes rapidly, AWOS observation will lag actual weather (several minutes). Algorithm responds more quickly to rapidly decreasing visibility than rapidly increasing visibility.

- On bright, sunny days with haze, sensor will report higher visibility than observer. NWS advises: Reduce reported vis ***50%*** if it's bright enough to wear sunglasses and there's haze or thin fog with clear sky above. (http://205.156.54.206/asos/vsby.htm)

By the numbers:

- Visibility disagreements between sensor and observer occur as much as 40% of time, down to 15% with sky cover.

Sensors vs. Senses

Lightning

Comparison to Natl. Lightning Detection Network:

- NLDN detects only 80-90% of total CG, no CC strikes (Normal ratio of CC/CG can be 4:1 in a supercell)

By the numbers:

- In 1997 test at 10 sites, 88% agreement w/ observers
- But: ASOS reported 28% more events, 17% more minutes of thunderstorm activity than observers. Possible reasons:
  - Observers did not hear all thunderstorms in 10-mile radius
  - ASOS detects CC strikes outside 10 mile radius
  - ASOS reports more TS begin/end than observer. Observers tend to group TS cells together in one observation, while ASOS generated report for each cell.

(Source: www.wrh.noaa.gov/wrhq/97TAs/TA9733/TA97-33.html)

Sensors vs. Senses

Freezing Rain Sensor

In 98 case studies covering icing events from around the U.S. during winter of 1998-99, the following statistics were derived:

- Observer and Automated System concurrently reported freezing precipitation 85% of the time.
    - Observers reported 73% of freezing precip as freezing rain
    - Automated system reported 62% as freezing rain (mainly because more sensitive to freezing drizzle occurrences than observers)

(Source: Final Report: Freezing Drizzle Algorithm Development, prepared for NWS by Raytheon, 9/21/99)

Sensors vs. Senses

Bottom line: Know your tools

AWOS is most accurate when stable VFR weather prevails.

Weather Observer adds most value when:

- Frontal/convective weather occurs and sky cover and visibility are changing rapidly.
- Cloud type remarks add valuable information
- Present weather phenomena not reported by AWOS: hail, funnel clouds, etc.
- Attentive to visibility on bright, hazy days

THE END