Cup & Vane Wind Data Processing Within ASOS

Cup & Vane
Wind Sensor

DCP

ACU

At the sensor:

1) Every 1 second, the wind direction and speed are sampled

2 Every 5 seconds, the average of the most recent 5 seconds of data is computed*, producing a discrete "5 second average"

**** To the nearest degree and tenth of a knot***

At the Data Collection Package (DCP):

1) Every 5 seconds, the 5 second average is collected from the sensor and sent to the ACU. NOTE: The DCP acts as a "pass through", i.e. data is not altered by the DCP.

At the Acquisition Control Unit (ACU):

1) Every 5 seconds, the 5 second average is received from the DCP. Wind speed data are received to the nearest tenth of a knot and are truncated by the ACU to the nearest knot (i.e. 22.8 kts becomes 22 kts).

*****At this point, the algorithm to compute the observed wind (average direction, speed and peak wind direction and speed) will begin*****

2) Every 5 seconds, the average speed and direction is computed using the most recent 24 (i.e. 2 minutes) 5 second samples. The peak wind is the 5 second sample with the highest speed.

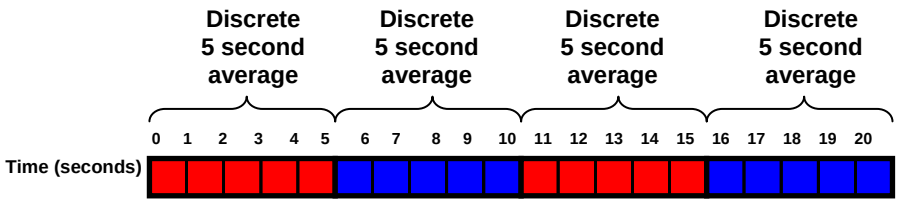
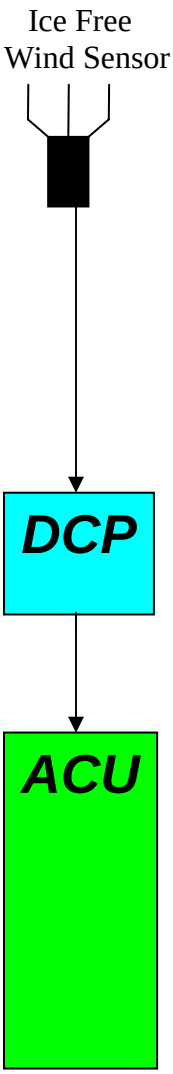


Figure 1

IFWS Wind Data Processing Within ASOS



At the sensor:

1) **Every 1 second, the wind direction and speed are sampled**

2) **Every 1 second, a running average of the most recent 3 seconds of data is computed*, producing the "3 second peak"****

3) **Every 5 seconds, the average of the most recent 5 seconds of data is computed*, producing a discrete "5 second average"**

**** To the nearest degree and tenth of a knot***

***** The running 3 second average is assigned to the 5 second block in which it ends***

At the Data Collection Package (DCP):

1) **Every 5 seconds, the 5 second average and the highest 3 second peak collected during the past 5 seconds are collected from the sensor and sent to the ACU.**
NOTE: The DCP acts as a "pass through", i.e. data is not altered by the DCP.

At the Acquisition Control Unit (ACU):

1) **Every 5 seconds, the 5 second average and the 3 second peak are received from the DCP. Wind speed data are received to the nearest tenth of a knot and are truncated by the ACU to the nearest knot (i.e. 22.8 kts becomes 22 kts).**

*****At this point, the algorithm to compute the observed wind (average direction, speed and peak wind direction and speed) will begin*****

2) **Every 5 seconds, the average speed and direction is computed using the most recent 24 (i.e. 2 minutes) 5 second samples. The peak wind is the 3 second peak wind value from the 5 second sample with the highest 3 second peak wind speed.**

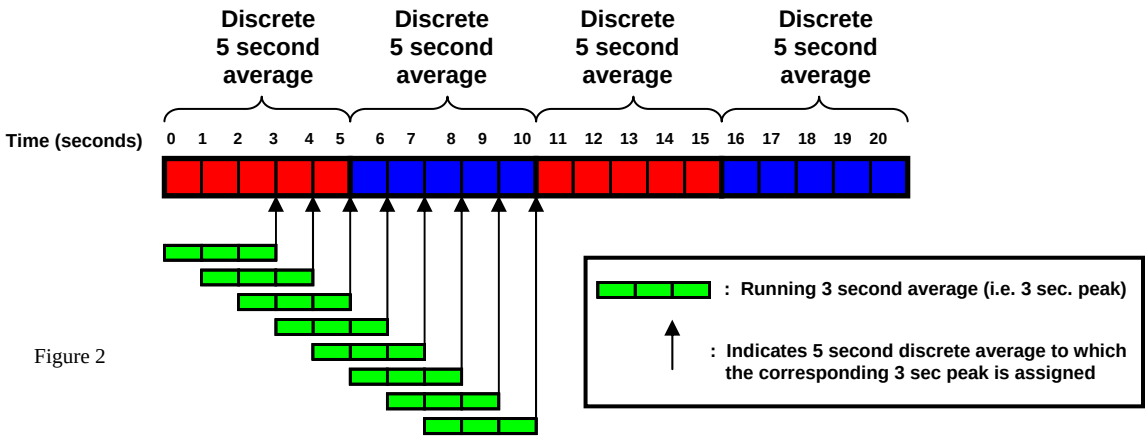


Figure 2

Comparison of IFWS Algorithm to Cup & Vane Algorithm:

***Note: This is a comparison of the <u>algorithms only</u>, not the sensors.**

- **Both algorithms compute the 2 minute average exactly the same way: by averaging 24 discrete 5 second samples.**

- **The 2 minute peak wind using the cup & vane configuration is the 5 second sample within the 24 used to compute the 2 minute average with the highest speed.**

- **The 2 minute peak wind using the IFWS (i.e. sonic) configuration is the value of the 3 second peak from the 5 second sample containing the highest 3 second peak wind speed.**

- **Since the 3 second peak is a running mean, in many cases the 1 second samples that went into it have occurred towards the end of the previous discrete 5 second sample (figure 2). Therefore, it is possible to have a 3 second peak wind value lower than the 5 second average speed.**

NOUS41 KWBC 252021
PNSWSH
PUBLIC INFO. STATEMENT...TECHNICAL IMPLEMENTATION NOTICE 02-30A
NATIONAL WEATHER SERVICE HEADQUARTERS WASHINGTON DC
420 PM EST MONDAY MARCH 10 2003

TO: FAMILY OF SERVICES */FOS/* SUBSCRIBERS...NOAA WEATHER
WIRE SERVICE */NWWS/* SUBSCRIBERS...EMERGENCY MANAGERS
WEATHER INFORMATION NETWORK */EMWIN/* SUBSCRIBERS...
OTHER NATIONAL WEATHER SERVICE */NWS/* CUSTOMERS OF
AVIATION DATA AND FORECASTS...NWS EMPLOYEES

FROM: RAINER DOMBROWSKY
CHIEF...OBSERVING SERVICES DIVISION

SUBJECT: AUTOMATED SURFACE OBSERVING SYSTEM WIND SENSOR
REPLACEMENT

THE FOLLOWING CHANGES HAVE NO DIRECT IMPACT ON NOAA WEATHER WIRE
SERVICE SUBSCRIBERS
THE AUTOMATED SURFACE OBSERVING SYSTEM */ASOS/* PRODUCT IMPROVEMENT
PROGRAM WILL SOON DEPLOY A REPLACEMENT WIND SENSOR. THE NEW SENSOR
WILL REPORT WIND INFORMATION USING THE 3-SECOND WORLD METEOROLOGICAL
ORGANIZATION */WMO/* GUST STANDARD.
THE CURRENT ASOS WIND SENSOR /BELFORT 2000 / USES ROTATING CUPS
TO MEASURE WIND SPEED AND A VANE TO MEASURE WIND DIRECTION. OVER
A 2-MINUTE PERIOD...ASOS USES TWENTY-FOUR 5-SECOND AVERAGES TO
DETERMINE THE 2-MINUTE AVERAGE WIND SPEED AND DIRECTION. EVERY
MINUTE ASOS STORES THE HIGHEST 5-SECOND AVERAGE SPEED FOR THE
PAST MINUTE... ALONG WITH ITS DIRECTION... IN THE 12-HOUR ARCHIVE
FOR ADDITIONAL PROCESSING. THIS HIGHEST SPEED VALUE IS USED TO
DETERMINE IF A GUST AND/OR A PEAK WIND REMARK WILL BE REPORTED.
THE NEW ASOS WIND SENSOR /VAISALA 425NWS / IS A SONIC ANEMOMETER.

IT HAS NO MOVING PARTS AND WILL OPERATE BETTER IN WINTER WEATHER CONDITIONS. AS WITH THE BELFORT SENSOR...OVER A 2-MINUTE PERIOD...ASOS USES TWENTY-FOUR 5-SECOND AVERAGES TO DETERMINE THE 2-MINUTE AVERAGE WIND SPEED AND DIRECTION. BUT THE HIGHEST 3-SECOND RUNNING AVERAGE SPEED IS STORED FOR GUST AND PEAK WIND PROCESSING.

WHILE THERE WILL BE LITTLE DIFFERENCE IN 2-MINUTE AVERAGE WIND SPEED AND DIRECTION REPORTING...THE CHANGES IN GUST AND PEAK WIND REPORTING MAY BE SIGNIFICANT. WE CAN EXPECT TO SEE MORE GUSTS AND PEAK WINDS REPORTED WITH THE NEW SENSOR. THE MASS OF THE MOVING PARTS IN EXISTING SENSORS LIMITS RESPONSIVENESS. THE NEW SENSOR WILL BE MORE RESPONSIVE TO SHORT TERM GUSTS.