QUICK GUIDE – CLEANING DATA WITH FLAGGING IN METEO

Purpose:

The purpose of this quick guide is to help you use flags to assist you in screening and cleaning wind measurement data in Meteo.

Outline of Guide:

1. **What is a flag?**

2. **Setting up a flag**

3. **Screening and cleaning**

4. **Sharing expressions**

5. **Miscellaneous**

1.   WHAT IS A FLAG?

A flag is a set of logical expressions which can be used to define certain measurement phenomena such as icing, spiking and faulty sensors (or any other required trigger) It is a complement to the normal data screening process that previously could only be achieved manually.

Flags do not directly influence or change the data in any way but are stored as metadata. Flagging, however can be used to disable some or all the triggered periods. Any changes to the original data only occur when you actively decide to disable data.

2.   SETTING UP A FLAG

In this quick guide, as an example a flag will be created to highlight and clean possible **icing** incidents.

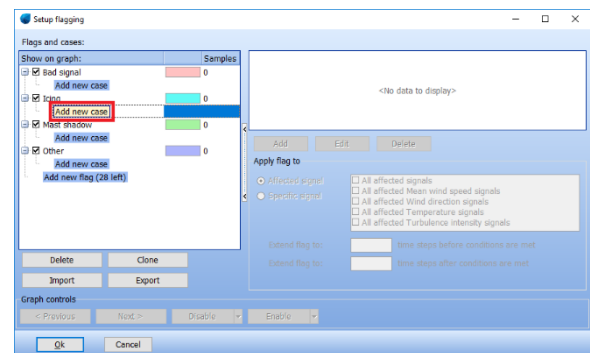To add a new flag, open your Meteo object from the object list or the map.
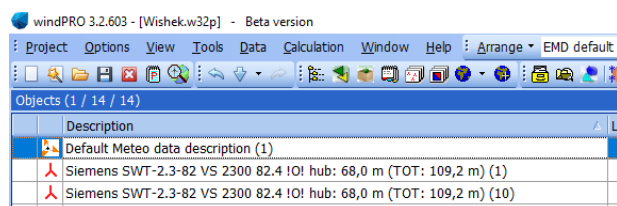
Currently in windPRO 3.2, flags are only viewable in the timeseries graph and in the timeseries table in Meteo and Meteo Analyzer.

Select the "Graphics" tab and click on the "Edit flags" button.
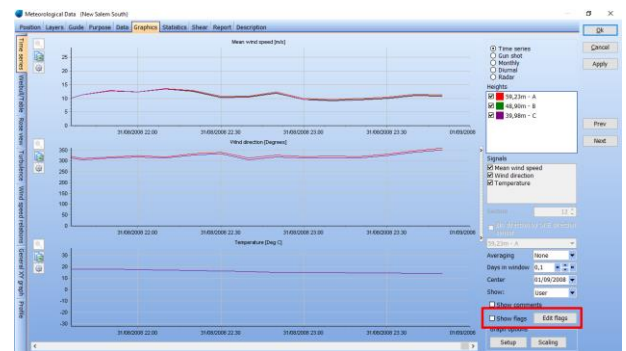
This will open the flag editor window.

windPRO comes with four pre-defined flags; Icing, Bad signal, Mast shadow and Other. You can edit these flag categories or create your own.

The structure of a flag is the following:

A flag can contain many cases, which are combined together using the Boolean operator OR (each case is triggered independently). Cases which have many conditions, can be combined together using the Boolean operator AND (all conditions must be fulfilled to trigger the specific case).

Adding new cases

To start defining our icing flag, click "Add new case" in the flag tree to the left.

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This will create a new case which defines a set of climatic situations to create expressions for. These cases are logically combined together using OR (inclusive disjunction). This means you can create multiple cases, and the flag will be applied if the conditions of just one of the cases are met.

Multiple cases can independently show signs of icing. If, for example, the wind vane is stuck for a long period, or the heated sensor shows different results than the unheated sensor. If any of these cases are true, an icing flag should be applied.
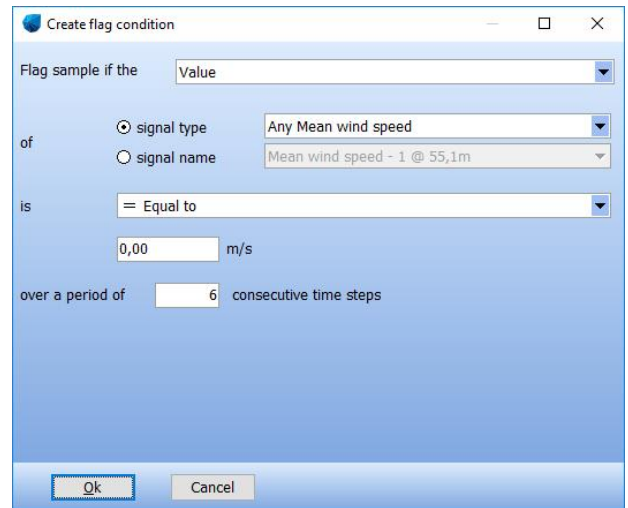
Name your new case e.g. "Anemometer stuck"
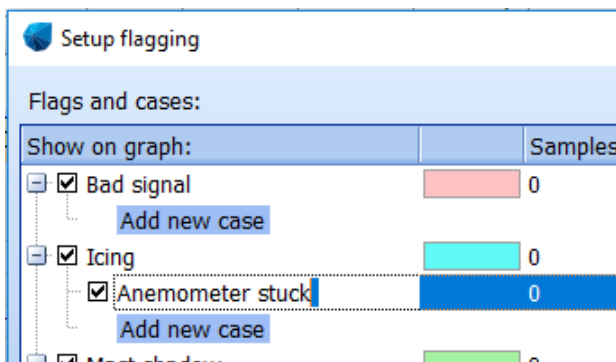
Then create a new condition by clicking the green "Add" button.
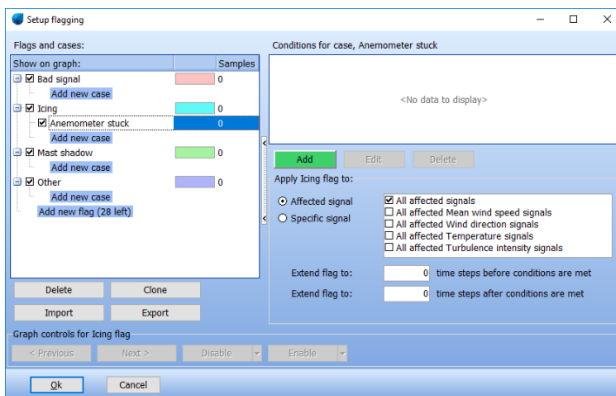
Creating conditions

When clicking "Add" button, the condition builder is opened:

Specify the climatic conditions which would define the "Anemometer stuck" case. That could be when the wind speed is equal to 0 m/s.

An icing event typically lasts for more than 10 minutes at a time. Therefore, you can specify that the wind speed should remain 0 m/s for 6 consecutive time steps. If the resolution of the measurements is 10 minutes, the condition will thus have to be met for 60 minutes to be considered an icing event.

Click "OK"

Now we have one condition
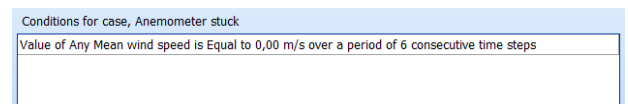
But we must also think about temperature. So, we add another temperature condition in conjunction to the first condition by clicking "Add".

This time we specify that when any temperature sensor has a value between -5° C and 0° C for 60 minutes, the condition is met.

Click "OK".

When both conditions are met the data will be flagged.

Apply flag to data

Now the conditions have been defined, and windPRO knows when the defined climatic situations occur.

By default, the signals used to build conditions will also be flagged in the graph.
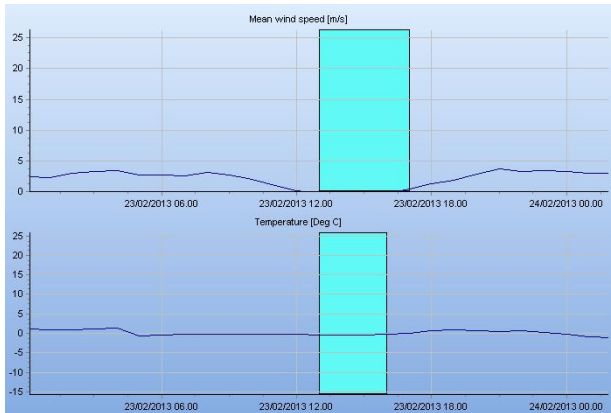
However, just because we identified icing using the temperature signals does not mean the temperature data is faulty. We only want to flag the icing prone wind speed data.

To do this, simply select the "All affected wind speeds" from the list of "Apply Icing flag to". Since the flag is

triggered if "<u>Any</u> wind speed" signal is = 0 m/s, then any wind speed signal which satisfies this condition for 60 minutes is flagged on the graph when any temperature signal is between -5° C and 0° C. The temperature signals will thus not be flagged.


Alternatively, you can select a specific signal to control exactly which signal gets flagged.

Since icing does not occur instantaneously, we should be suspicious about the data surrounding the icing event. This can be handled by extending the flag before and after the event. In this case we set it to 3 timesteps, i.e. 30 minutes either side of the event

3.   SCREENING AND CLEANING

Once the desired flags have been defined, it's time to screen the data.

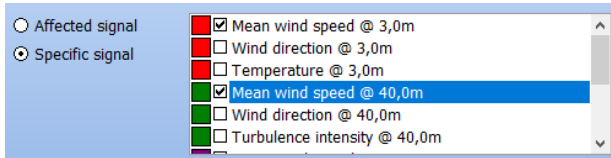It is possible to use the time series graph while the flagging window is open.
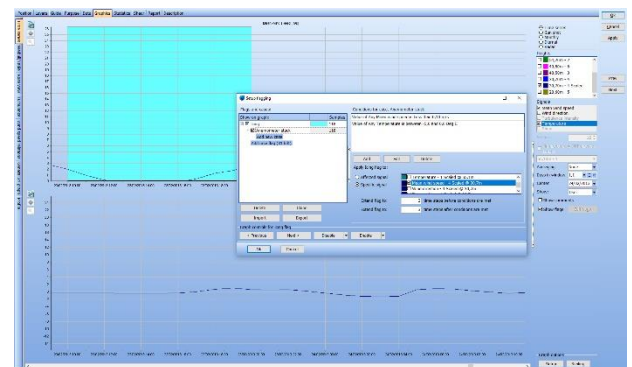
In the bottom of the flagging window, there are four buttons which control the graph:


Click "Next" to jump to the next flag. The signals flagged are specified in the "Apply flag to" list

Evaluate if the highlighted flag is indeed an icing event. If it is, simply click the "Disable" button and the data highlighted will be disabled. (If you want to enable previously disabled data, simply click the "Enable" button.) Now go through your time series clean all periods which could be identified as a actual icing event.

If you want to speed up your screening, click on the Disable menu and select "Automatically jump to next flag when disabling"
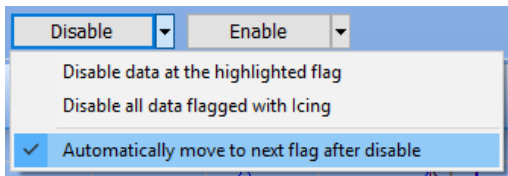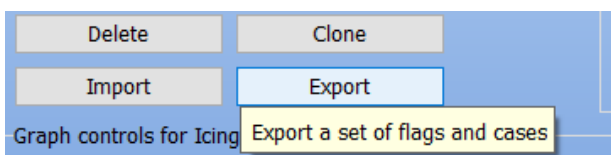

The graph will then jump to the next flag, whenever you hit disable.

In case you want to disable more data than is flagged, you can use the Advanced disabling by right-clicking and dragging directly on the graph.

4. SHARING EXPRESSIONS

Flags can be imported and exported from/to other Meteo objects. Simply click the Export or Import button.

If you import flag definitions from a Meteo object which does not have the same signals as the Meteo object you are exporting to, you will be asked to re-assign the signals:
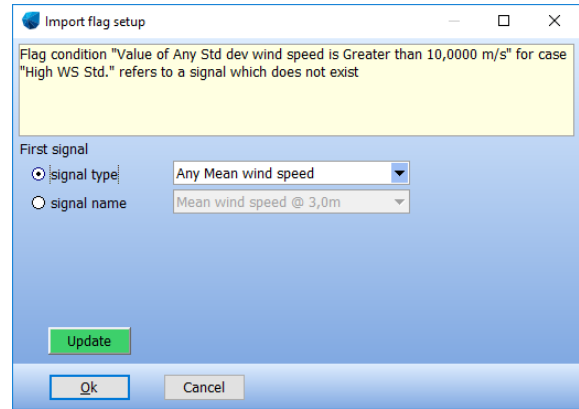
5. MISCELLANEOUS

How do I use flags to compare data between datasets?
Open Meteo Analyzer from the toolbar. Go to the Graph tab and select "Edit flags". Now you can create flags with the signals selected in the Data tab. If a Meteo object is later deselected in the Data tab, any flags using this Meteo object will have to be re-assigned.

Flags in Meteo Analyzer are not added to the individual Meteo objects. Flags from the individual Meteo objects are not added in Meteo Analyzer. Any disabling is however always applied to the individual Meteo object.

What happens to my flags if I clone a Meteo object?
The flag definitions will be cloned as well. Any changes to the new flag definitions will not influence the original Meteo object flags.
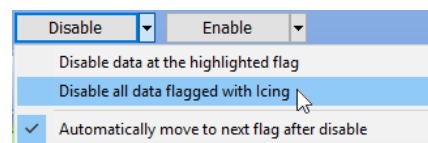
How do I hide a specific flag?
In the list of flags and cases, you can un-tick the checkbox for the flag (or case) to hide in the graph.
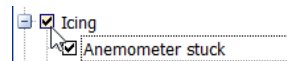
How do I disable all data in one go?
While it is ill-advised to blindly disable all flagged data, it is possible by clicking the Disable menu and selecting "Disable all data flagged with"

What happens if I disable data with one flag, and then enable all data flagged with another flag?
Enabling data flagged with one flag will also enable any data which has previously been disabled by other overlapping flag. So be careful when enabling.