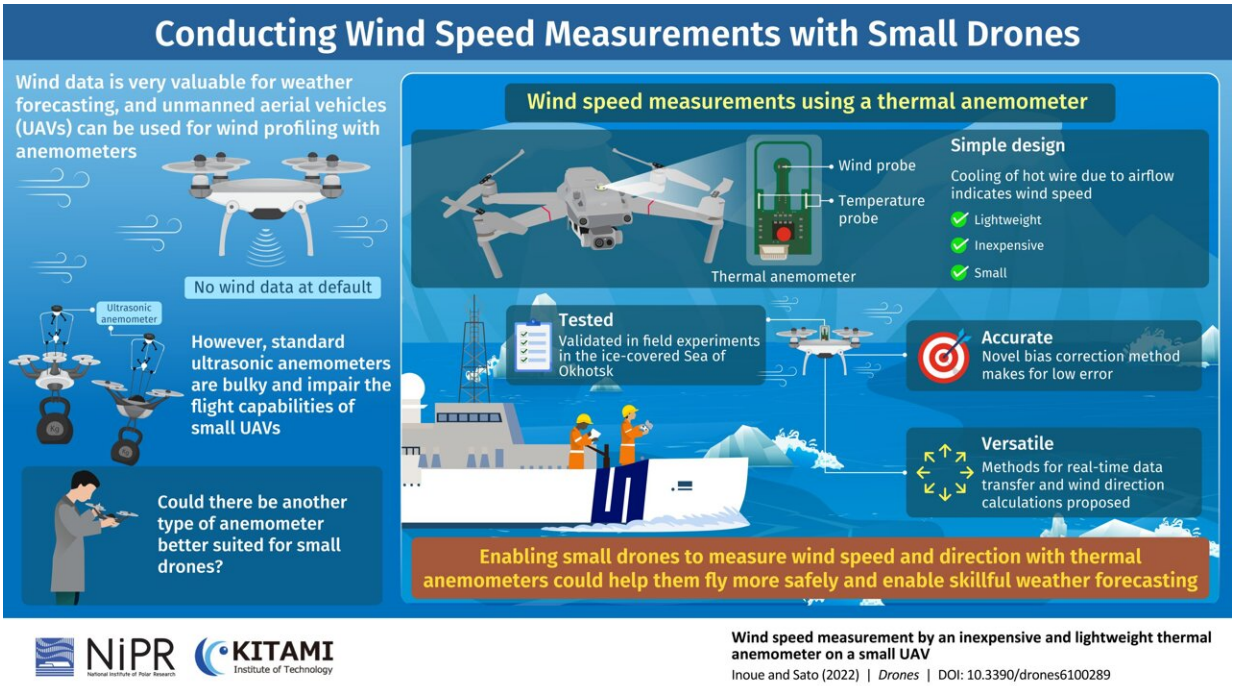
Using small drones to measure wind speeds in the polar regions

October 27 2022



Drones are extremely useful for conducting wind speed measurements over regions where it is difficult to set up or maintain weather stations, such as the Arctic region. However, conventional measurement devices, called ultrasonic anemometers, are too bulky for small drones, raising drone costs. Now, researchers from Japan find a way around this problem, using lightweight thermal anemometers, which can be mounted on small drones for accurate wind speed profiling. Credit: Jun Inoue from National Institute of Polar Research, Japan

Drones and similar small unmanned aerial vehicles (sUAVs) have seen a massive surge in popularity over the past few years due to their innovative applications, such as crop monitoring, search and rescue operations, and coast profiling. The potential of sUAVs in atmospheric science and meteorology has not gone unnoticed either as drones offer an efficient way to place various kinds of sensors up above in the lower atmosphere.

As evidenced by pioneering studies led by the National Institute of Polar Research, Japan, small drones bearing meteorology sensors can be useful for weather forecasting in places where weather stations are scarce or costly to set up and maintain, such as the polar regions. With the use of drones, invaluable data could be gathered for making numerical weather predictions and improving climate models.

However, several practical challenges remain to be addressed on this front. One clear example is measurement of wind speeds for wind profiling. While a few companies are commercializing drones for conducting wind speed measurements, these drones tend to be large and expensive. This is because the ultrasonic anemometers that they carry are heavy and bulky. On the other hand, although wind speed could in theory be calculated from the drone's internal flight log data, there is no way to access these data in most commercial drones. Thus, with no alternative methods to measure wind speed, application of sUAVs remain limited.

To tackle this issue, Associate Professor Jun Inoue of the National Institute of Polar Research and Assistant Professor Kazutoshi Sato of the Kitami Institute of Technology, both in Japan, have recently conducted a study in which they tested and validated a new wind speed measurement device compatible with sUAVs: thermal anemometers.

As explained in their paper published in MDPI's *Drones* published on

October 3, 2022, thermal anemometers, also called "hot-wire anemometers," are small electronic devices that can indirectly measure wind speed based on how fast a heated wire cools down over time due to air flow. These sensors are ideal for sUAVs as they are extremely lightweight (~ 1 g) and inexpensive (