



Corrections of wind measurements on a moving boat with a smartphone

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Wind is one of the main driving forces for circulation in lakes. Various studies concerning Lake Constance (northern foot of the Alps) used hydrodynamic models which rely on this meteorological variable as input. However, while wind measurements on shore are available, there is hardly any information about wind on Lake Constance itself. Furthermore the installation of measurement buoys is expensive and can lead to conflicts with fishery or shipping for example.

The latter provides a solution for this problem, because ships can be used as platforms for measurements. In our case, we used a 3D ultra-sonic anemometer (USA) on a research vessel of the Institute for Lake Research (ISF) in Langenargen (Germany) to conduct wind measurements. Since the USA provides data with a time resolution of up to 32Hz and the wavering motion of the boat was visible in the velocity measurements, there was a need to correct the data. This was done by using the 3D accelerometer of a smartphone with the same measurement frequency of the USA, which was attached just below the anemometer. The apparent wind speed was also corrected for the speed and heading of the vessel using GPS and digital compass data.

In principle, measured object velocity vectors, obtained by integrating the measured acceleration, are diametrically opposed to the apparent wind caused by the movement of the instrument. This means that the correction is simply a matter of adding the corresponding velocity vectors. While a first test under "laboratory"-conditions confirmed the idea of the method, the application in the field turned out to be not as straight forward.