Arctic Summer Cloud Ocean Study 2008 – Ocean turbulence data

General:

This data set contains mean temperatures, salinities, horizontal current velocities and turbulent fluxes of heat and salt in the upper ocean mixed layer during the Arctic Summer Cloud Ocean Study (ASCOS). The experiment consisted of a cruise in the high Arctic from Aug 1 - Sept 9 2008 on the swedish ice breaker Oden and contained a long ice drift, in which the Oden was moored to and drifted passively with an ice floe. More information on the project is found at www.ascos.se

Turbulence data are obtained using so called Turbulence Instrument Clusters (TICs) at several levels deployed through a hydro hole in the ice. Each TIC comprises an Acoustic Doppler Velocimeter, a 5 Mhz ADVOcean manufactured by Sontek/YSI, which measures 3-D velocity in a small volume close to the tip of the instrument. In addition, each TIC is equipped with a SBE-3 temperature sensor, a SBE-4 conductivity sensor and a SBE-7 micro-conductivity sensor, all manufactured by Seabird Electronics. TIC 2 (at 6 m depth) was setup with a SBE-5 pump for pumped measurements of conductivity and temperature. TIC 3 only contained one single ADVOcean. Figure 1 shows the setup and parameters measured at each depth.
Data are sampled at 2 Hz for TIC 1 and TIC 3, while TIC 2 sampled at 8 Hz. After the initial sampling, data are split in 15 min intervals in order to capture the covariance in the turbulent eddies with time scales on the order of minutes. Within each interval, velocity is rotated into a streamline coordinate system and fluctuating parts of temperature, salinity and the three velocity components are found within each interval. From the measurements average temperature, salinity, fluxes of heat and salt and friction velocity are presented in this data set. Heat fluxes, salt fluxes and friction velocities are calculated as:

$$F_H = \rho c_p \langle w'T' \rangle$$
$$F_S = \langle w'S' \rangle$$
$$u_* = \left(\langle u'w' \rangle^2 + \langle v'w' \rangle^2 \right)^{1/4}$$

where ρ and c_p are the density and specific heat of seawater, calculated for the temperature and salinity within each 15 min interval and $\langle w'T' \rangle$ and $\langle w'S' \rangle$ are covariances within the same time interval. Salt fluxes are calculated from the SBE-4 conductivity sensor, since further calibration of the SBE-7 conductivity sensor is required. *u'*, *v'* and *w'* are the deviatory velocity components.

Data are contained in ASCOS_TIC.mat and the general data structure is explained further below.

If you want to use this data in your work you are free to do so, but please contact me prior to submission and make sure to include a proper acknowledgement.

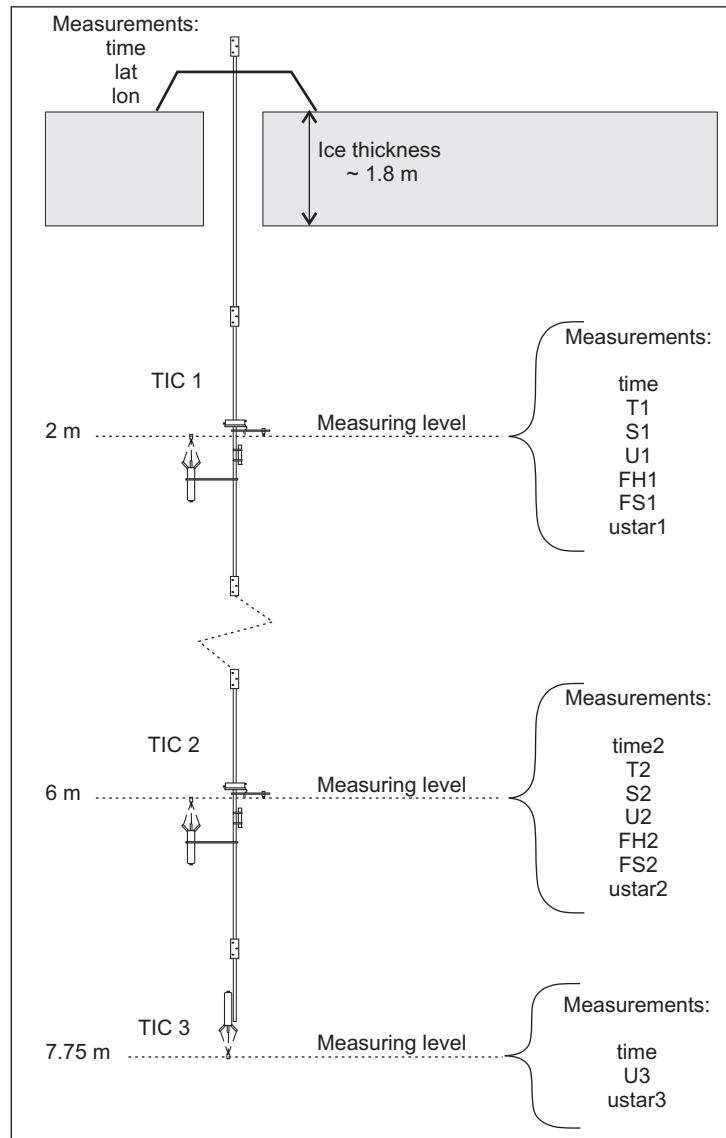For further information or questions, please contact anders.sirevaag@bjerknes.uib.no.

Figure 1. Setup of the ocean turbulence mast and data parameters obtained at each level.

Data structure:

In Matlab:

```
>> load ASCOS_TIC
>> TIC

TIC =

     HD: [1x1 struct]        - Header
   time: [1x1350 double]     - Time for TIC 1 and 3, yearday of 2008
    lat: [1x1350 double]     - Latitude in deg N
    lon: [1x1350 double]     - Longitude in deg E
     T1: [1x1350 double]     - TIC 1 temperatures, degC
     S1: [1x1350 double]     - TIC 1 salinity, psu
```

U1: [1x1350 double]   - TIC 1 horizontal velocity vector, ms^{-1}
FH1: [1x1350 double]   - TIC 1 heat flux, W m^{-2}
FS1: [1x1350 double]   - TIC 1 salt flux, psu ms^{-1}
ustar1: [1x1350 double] - TIC 1 friction velocity, ms^{-1}
time2: [1x1374 double]   - TIC 2 time
T2: [1x1374 double]   - TIC 2 temperature
S2: [1x1374 double]   - TIC 2 salinity
U2: [1x1374 double]   - TIC 2 horizontal velocity
FH2: [1x1374 double]   - TIC 2 heat flux
FS2: [1x1374 double]   - TIC 2 salt flux
ustar2: [1x1374 double] - TIC 2 friction velocity
U3: [1x1350 double]   - TIC 3 horizontal velocity
ustar3: [1x1350 double] - TIC 3 friction velocity

TIC 2 operated as a separate system from TIC 1 and 3. Interruptions and repairs/maintenance where different on the two systems, hence the time vector is different and in some periods one system could be logging without the other and vice versa.

Position data is obtained at the site of deployment of the turbulence mast and logged on the same system as TIC 1 and 3, hence latitude and longitude has the same time vector.

The horizontal velocity is a complex vector where the real axis is aligned West-East and the imaginary axis South-North. This way, e.g. a vector **U** = (1 + 0i) is an eastward current with speed 1 ms^{-1} and **U** = (0 + 1i) is a northward current with speed 1 m s^{-1}.