Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Fast response temperature and humidity sensors for measurements in high Reynolds number flows[1] YUYANG FAN, GILAD ARWATZ, MARGIT VALLIKIVI, MARCUS HULTMARK, Princeton University — Conventional hot/cold wires have been widely used in measuring velocity and temperature in turbulent flows due to their fine resolutions and fast response. However, for very high Reynolds number flows, limitations on the resolution appear. A very high Reynolds number flow is the atmospheric boundary layer. In order to accurately predict the energy balance at the Earth's surface, one needs information about the different turbulent scalar fields, mainly temperature and humidity, which together with velocity, contribute to the turbulent fluxes away from the surface. The nano-scaled thermal anemometry probe (NSTAP) was previously developed at Princeton and has proven to have much higher spatial and temporal resolution than the regular hot wires. Here we introduce new fast-response temperature and humidity sensors that have been developed and tested. These sensors are made in-house using standard MEMS manufacturing techniques, leaving high flexibility in the process for optimization to different conditions. The small dimensions of these novel sensors enable very high spatial resolution while the small thermal mass allows significant improvements in the frequency response. These sensors have shown promising results in acquiring un-biased data of turbulent scalar and vector fields.

[1]Supported under ONR Grants N00014-12-1-0875 and N00014-12-1-0962 (program manager Ki-Han Kim)

Yuyang Fan
Princeton University

Date submitted: 02 Aug 2013 Electronic form version 1.4