EVALUATION OF KINEMATIC VERTICAL EDDY FLUXES FOR MULTIPLE WINTER BORA EVENTS

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GOALS
- vertical kinematic eddy momentum and heat fluxes haven’t been yet obtained for the bora wind event (downslope windstorm, east Adriatic coast)
- estimation of the averaging interval based on the gap in the wind velocity spectra
- initial assumption: all three eddy fluxes \((\mathbf{u}'\mathbf{w}', \mathbf{v}'\mathbf{w}', \mathbf{w}'\mathbf{w}')\) are nearly constant with height; however, results show the opposite (especially for momentum fluxes)

DATA AND BORA CRITERIA
- the measurements used from 1 Jan – 31 Mar 2011
- site of Pometeno brdo (600 m ASL) on the eastern mid-Adriatic coast (Fig.1.)
- WindMaster Pro ultrasonic anemometers (5 Hz sampling rate) -> \(u, v, w, T\) @ (10, 20, 40) m ASL
- Total horizontal speed \(\geq 4.5\) ms\(^{-1}\)
- Wind direction \(\in [25^\circ, 85^\circ]\)
- Duration \(\geq 10\) h
- 17 bora events registered, ranging from 10 up to 123 h in duration (cumulative duration = 539 h) (Fig.2.)

FLUX ANALYSIS
- all 17 bora events have been classified into three groups based on length (short (10), semi-long(6) and long(1))
- eddy fluxes are initially assumed to be constant within 20% at two mid-levels (15 and 30 m), according to
  \[
  K_{50} = \left| \frac{\mathbf{u}'\mathbf{w}'}{\mathbf{u}'\mathbf{u}'} \right| \leq 0.2, \quad K_{50} = \left| \frac{\mathbf{v}'\mathbf{w}'}{\mathbf{v}'\mathbf{v}'} \right| \leq 0.2 \quad (1)
  \]
- very similar flux behavior has been observed across all events, hence a case study of only the longest and most complex event (123 h) is conducted

REYNOLDS’ AVERAGING INTERVAL
- Based on Fig.3., an averaging interval of 15 min is used in further calculations (primarily to define turbulent perturbations \(\mathbf{u}'\mathbf{w}', \mathbf{v}'\mathbf{w}', \mathbf{w}'\mathbf{w}'\))
- Eq. 4 in bottom left-plots of all three traces; 30-min blocks of \(\mathbf{u}'\mathbf{w}'\); 10-min blocks of \(\mathbf{w}'\mathbf{w}'\). Momentum flux \(\mathbf{u}'\mathbf{w}'\) shows similar behavior as \(\mathbf{w}'\mathbf{w}'\) (not shown).

CONCLUSION
- crucial in explaining the observed momentum flux behavior is the \(\mathbf{u}'\mathbf{w}'\) spectra @ 20 m (Fig.3., rightmost panel) and the fact that the area under the graph (which is proportional to the variance, i.e. energy) is the largest on the 20 m
- heat flux (Fig.4.) shows rather weak variability with height (except during night, where some upward heat transport, typical for daytime, still occurs)