Evolution of the turbulence structure during the afternoon transition

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- What changes in turbulence structure do we observe within the CBL ?
- Can a LES represent them correctly ?
- Can we explain them ?

- Analysis of 20 June turbulence decay, vertical structure of turbulence
- Simulation with an LES, and sensitivity analysis (shear)
- Extension to several other days (aircraft observations)

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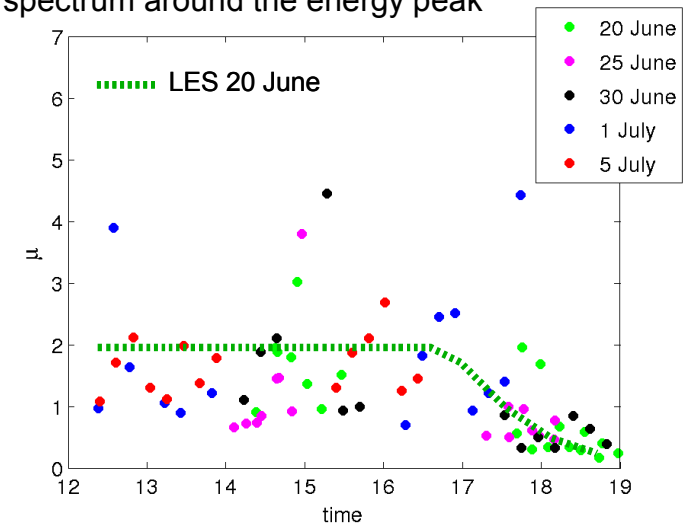
'Steady' evolution until 1h before zero buoyancy flux
Shear delays the change of curvature

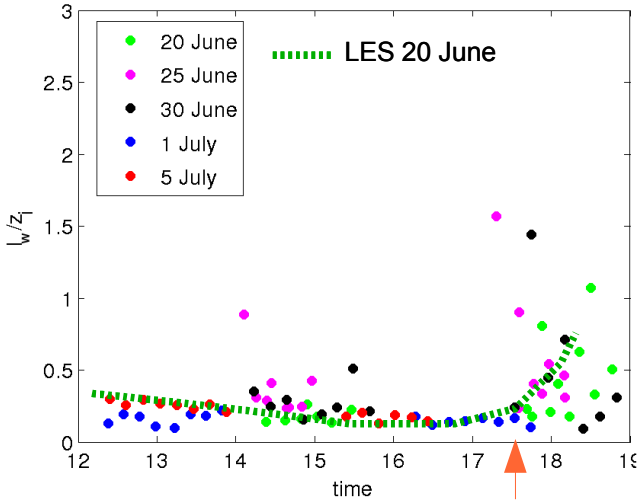
Rapid change in late afternoon and before sunset
Shear enhances the change of scales (increase within the CBL, decrease in surface layer)
Potential effect of entrainment not confirmed (demixing process suspected)

A suspected role of anisotropy and coherent structure on curvature and inertial subrange slopes during this transition

Curvature of vertical velocity turbulence spectrum around the energy peak



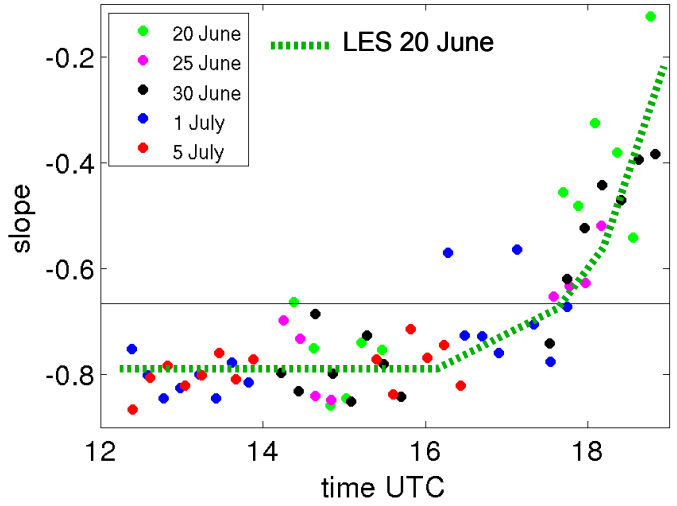
Normalized ('Zi') integral lengthscale



19h40 sunset

Zero buoyancy flux

Slope of turbulence spectrum in inertial subrange



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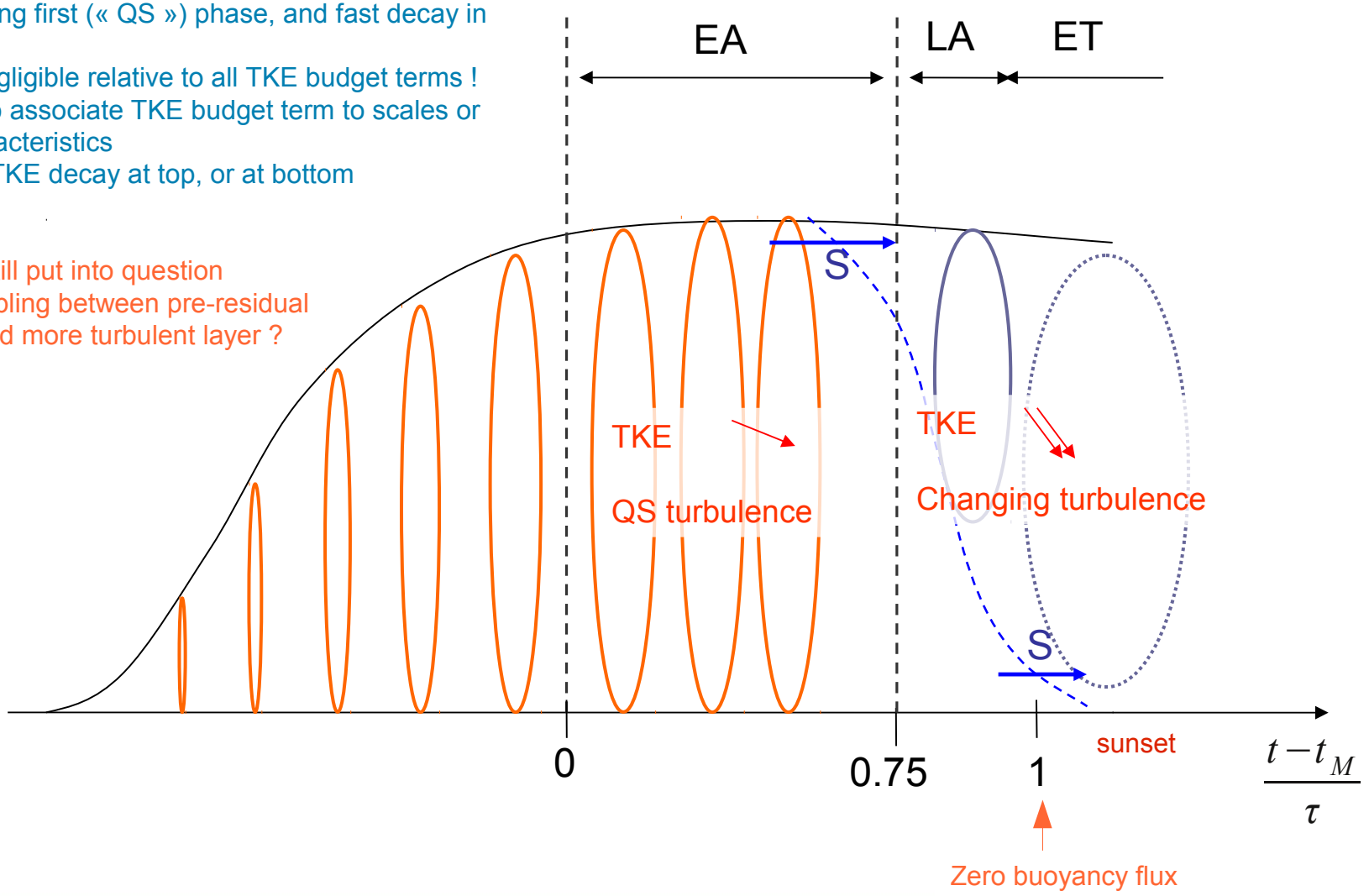
- Subtil top-down decay of TKE (vertical velocity contribution)
Slow decay during first (« QS ») phase, and fast decay in second phase
- TKE trends negligible relative to all TKE budget terms !
- Not possible to associate TKE budget term to scales or turbulence characteristics
- Shear delays TKE decay at top, or at bottom

Normalization still put into question
A kind of decoupling between pre-residual and more turbulent layer ?



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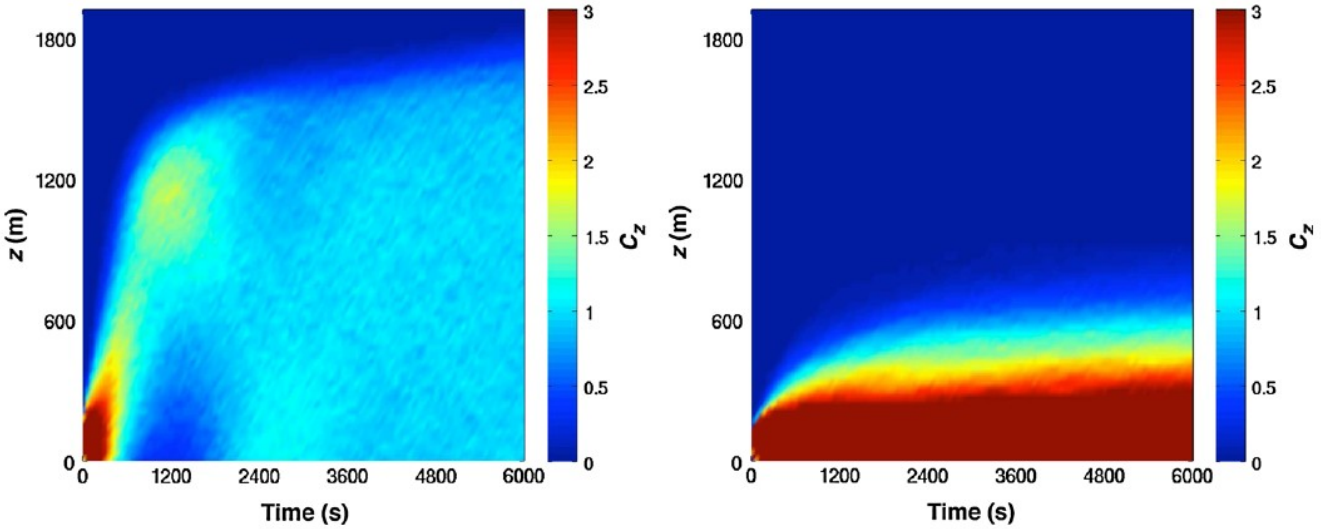
Taylor et al, 2014. Release of tracers in the convective or stable layer, with sudden decay from positive to zero flux



(a) Release before transition **(b)** Release after transition

Fig. 6 Particle concentration (C_z) from a near-surface release occurring at **a** $t_d = -1{,}200$ s, and **b** $t_d = 1{,}200$ s where t_d is the time after the switch-off of surface heat flux. Particles are released at height $z = 100$ m for the idealized forcing. Note that the time of the release shown in frame **a** is earlier than the time $t_d = 0$ used in the other figures

Prospectives : the release of tracers within the CBL in the context of a realistic flux decay, at several places (from bottom to top), and several times (before, during and after the transition)