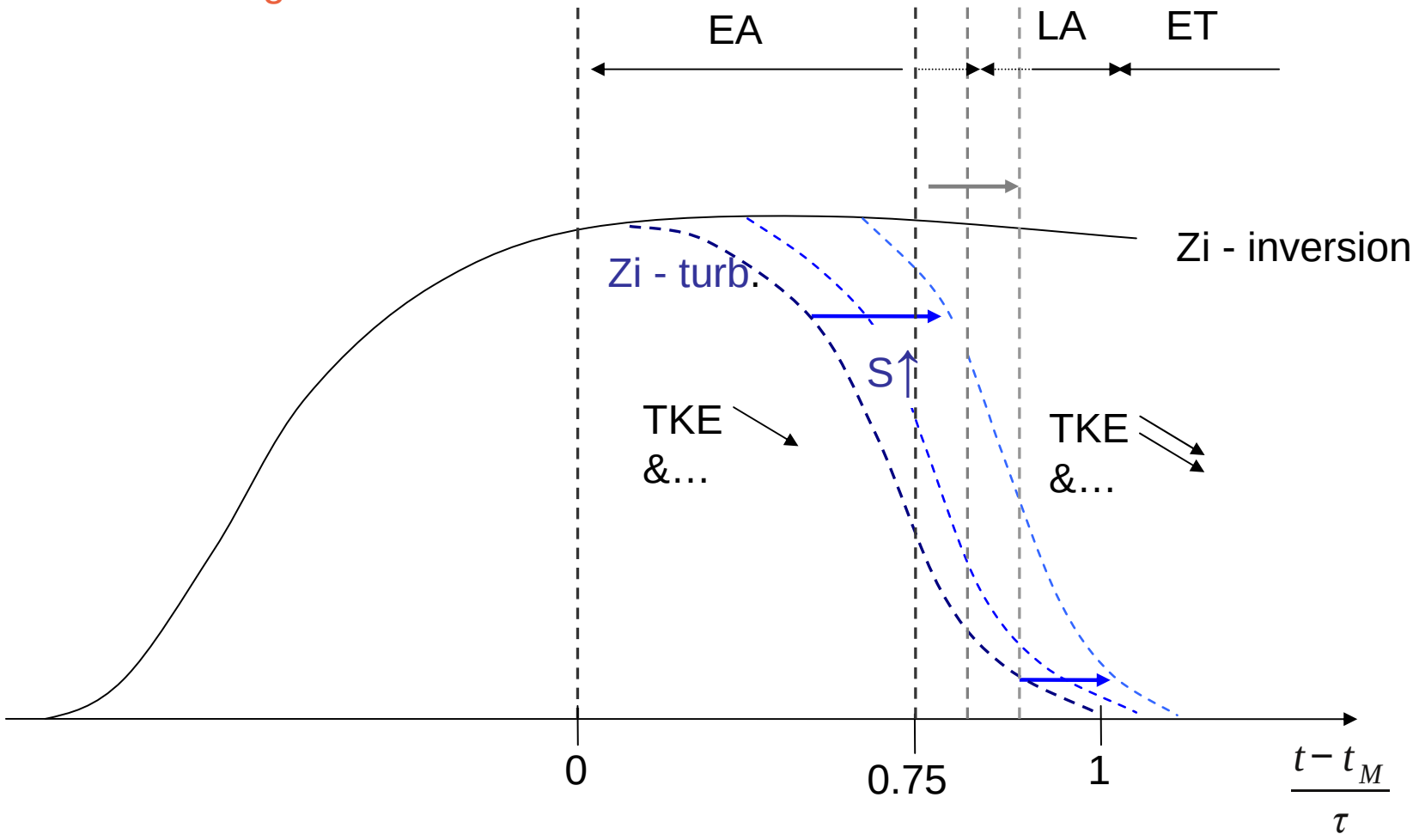
TKE decrease

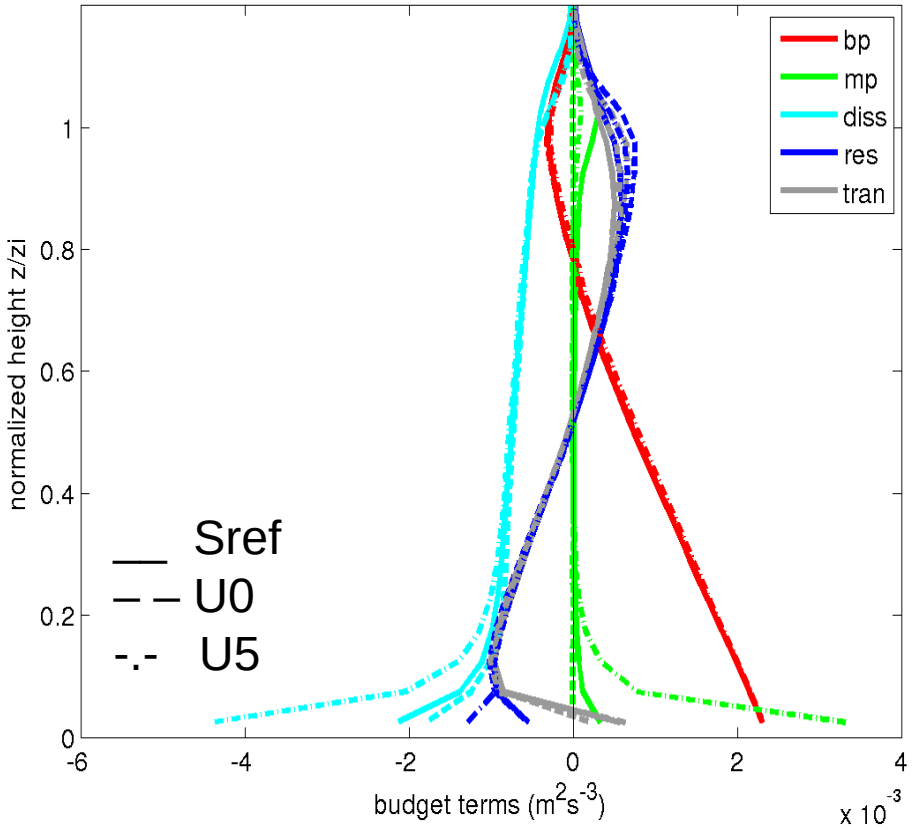
Bottom-up or Top-down ?

Link between demixing / entrainment / shear



TKE budget

1/ TKE budget terms simple model



TKE budget

1/ TKE budget terms simple model

----> Importance of the whole boundary layer parameters near the surface !

TKE budget

1/ TKE budget terms simple model

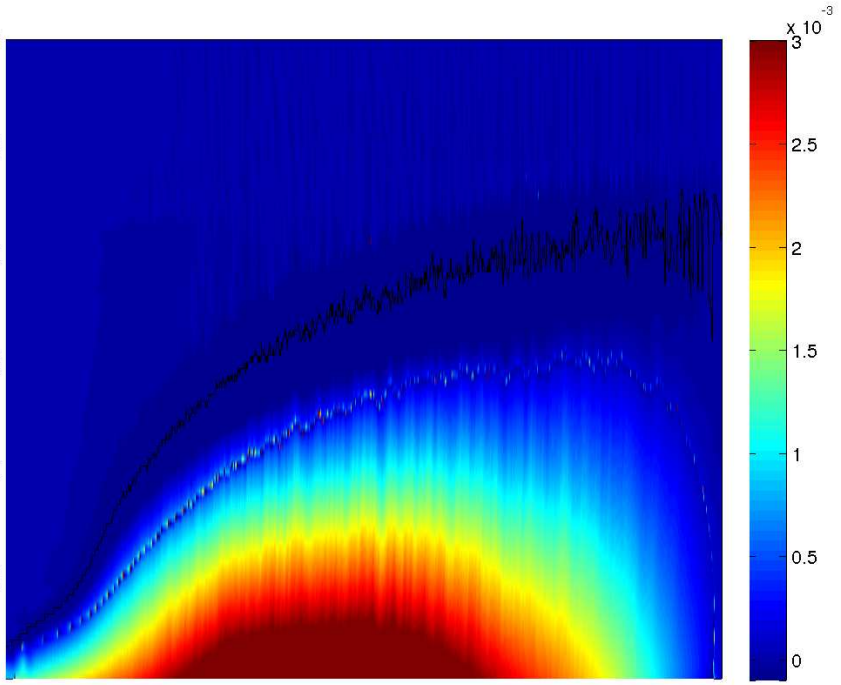
----> Importance of the whole boundary layer parameters near the surface !

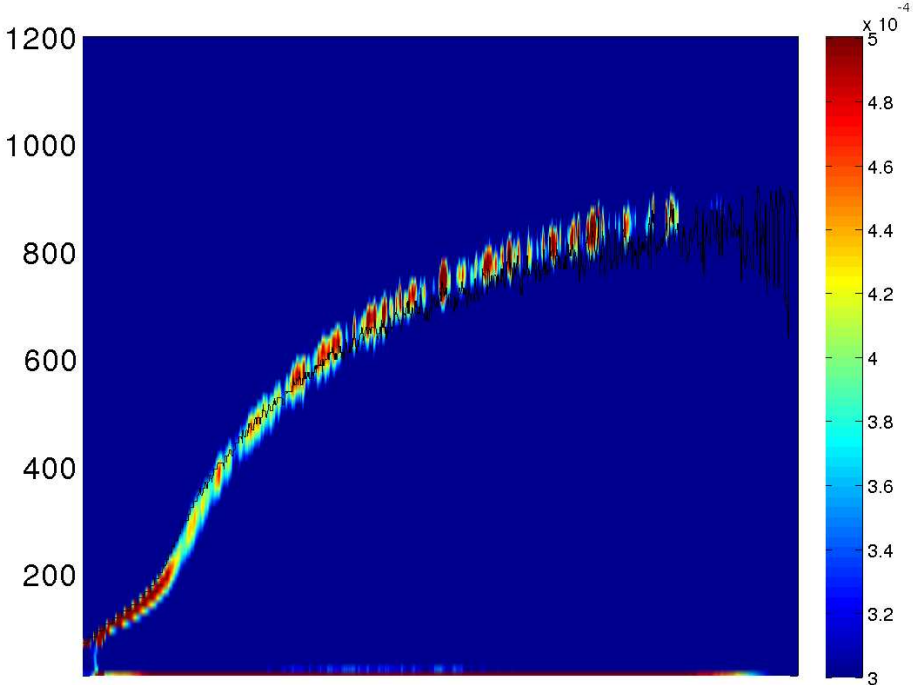
2/ Are the different steps of the TKE decrease visible on the TKE budget terms or explained by them ?

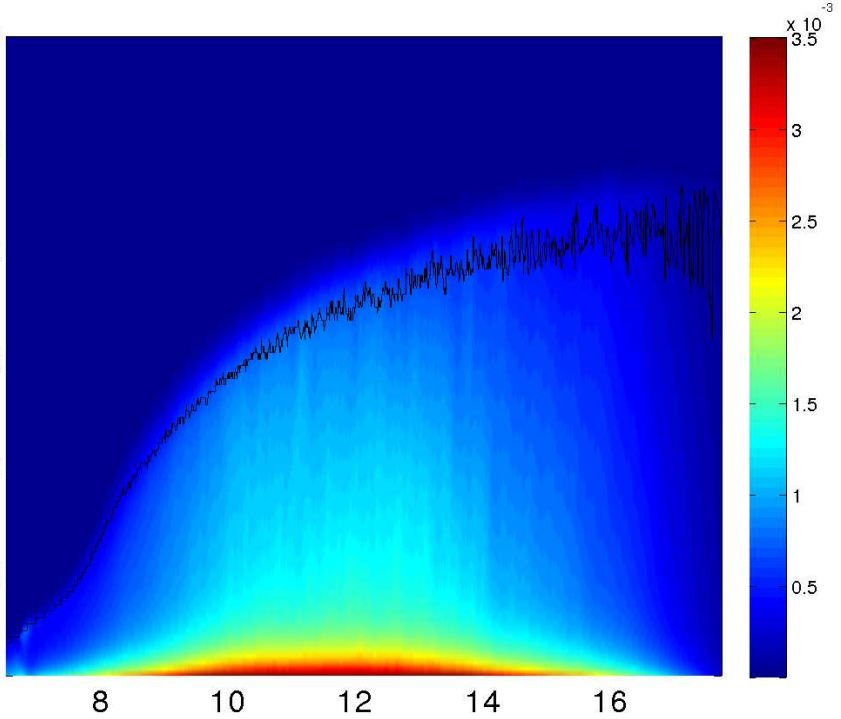
* All the terms seem to tend toward zero with a similar tendency ---> which is wrong !
* TKE tendency two order smaller than the other terms.

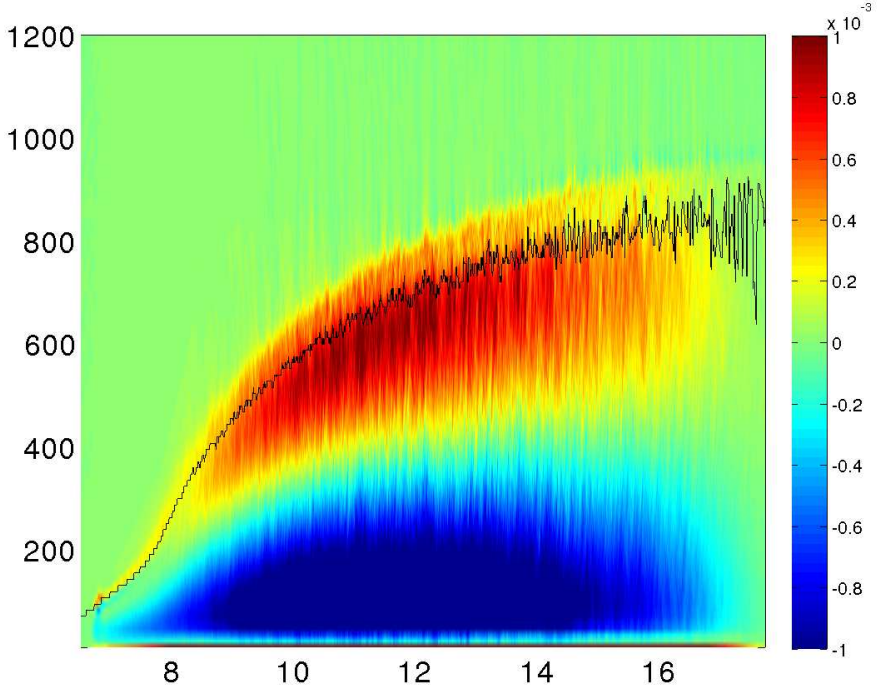
----> TKE tendency is hard to explain with the TKE budget !

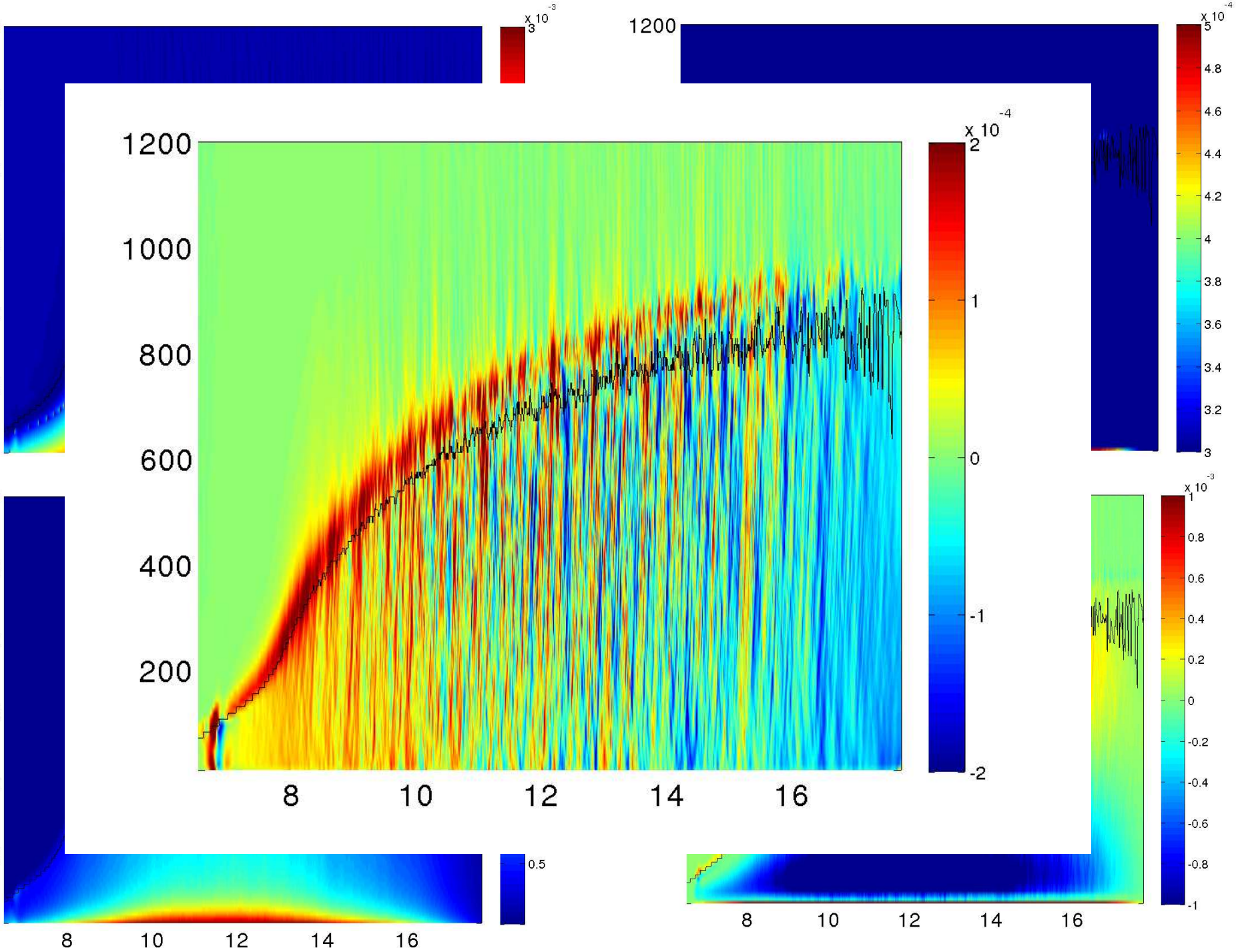
---- > prognostic equation in LES model!


x 10^-3
3
2.5
2
1.5
1
0.5
0


1200
1000
800
600
400
200
x 10^-4
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3


x 10^-3
3.5
3
2.5
2
1.5
1
0.5
8
10
12
14
16


1200
1000
800
600
400
200
x 10^-3
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
8
10
12
14
16


x 10^-3
3
1200
x 10^-4
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
1200
1000
800
600
400
200
x 10^-4
2
1
0
-1
-2
8
10
12
14
16
x 10^-3
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0.5
8
10
12
14
16

TKE budget

1/ TKE budget terms

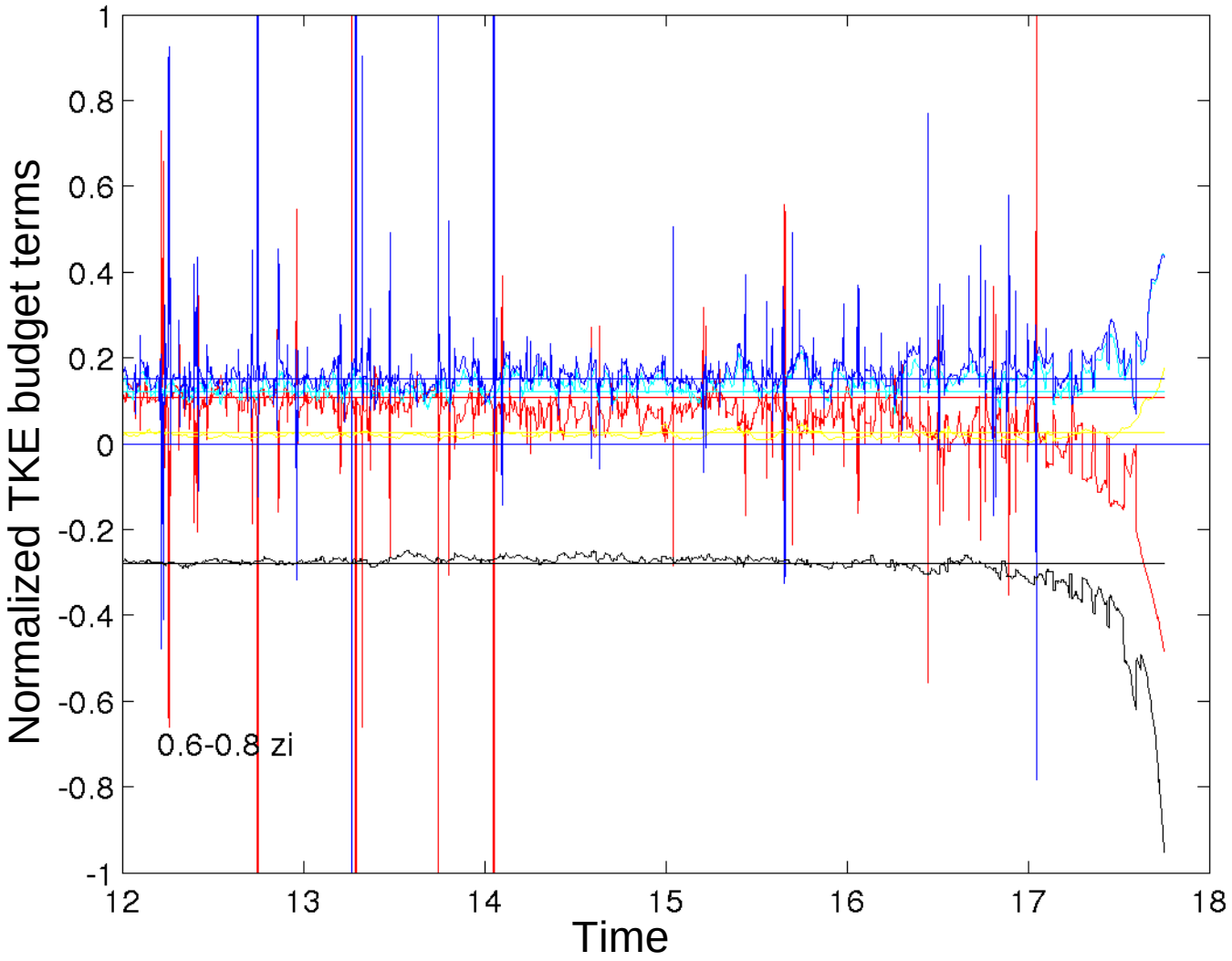
----> Importance of the whole boundary layer parameters near the surface !

2/ Are the different steps of the TKE decrease visible on the TKE budget terms or explained by them ?

----> TKE tendency hard to explain with the TKE budget !

3/ Quasi steady state or transition – which normalization ?

TKE budget


Normalized TKE budget terms
Time
0.6-0.8 zi
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
12
13
14
15
16
17
18

TKE budget

1/ Models TKE budget terms

----> Importance of the whole boundary layer parameters near the surface !

2/ Are the different steps of the TKE decrease visible on the TKE budget terms or explained by them ?

----> TKE tendency hard to explain with the TKE budget !

3/ Quasi steady state or transition – which normalization ?

----> How to define a steady state with unrelevant normalization during the LA ?

Validation of TKE in the meso-scale models

* Arome/Arpege: same parametrization

Technical questions about TKE budget terms estimates

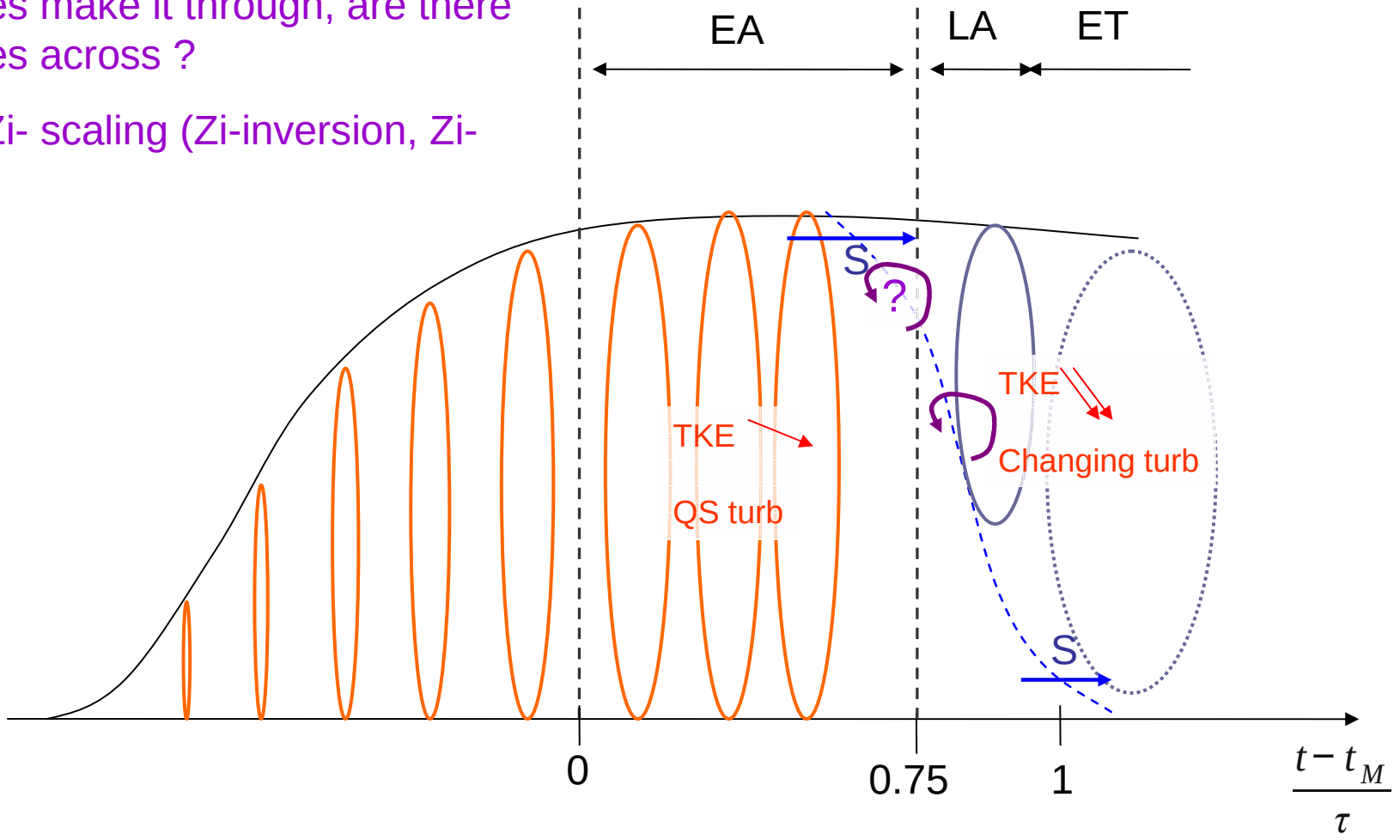
* Methods for terms estimate
* Relevant comparisons between different measurements and models
* TKE data base

- Role of shear in the change of scales, according to height ?

- Decoupling ? Or wrong picture ?

-Do eddies make it through, are there exchanges across ?

-Test of Zi- scaling (Zi-inversion, Zi-turb)



Taylor et al, 2014

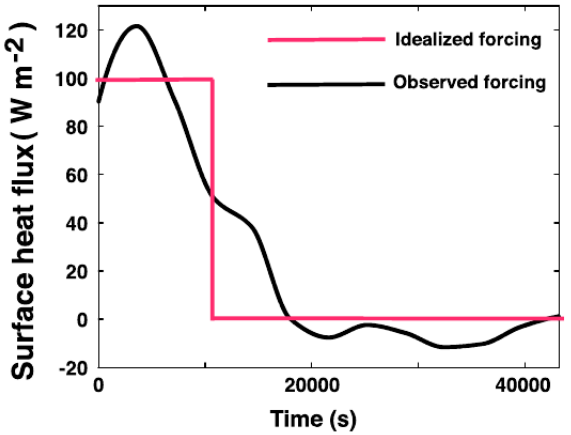


Fig. 1 Surface sensible heat flux plotted against time from the start of the simulation for the idealized forcing (*red*) of Nieuwstadt and Brost (1986) and the observed forcing (*black*) from the Cardington site for the evening of 23 September 2003

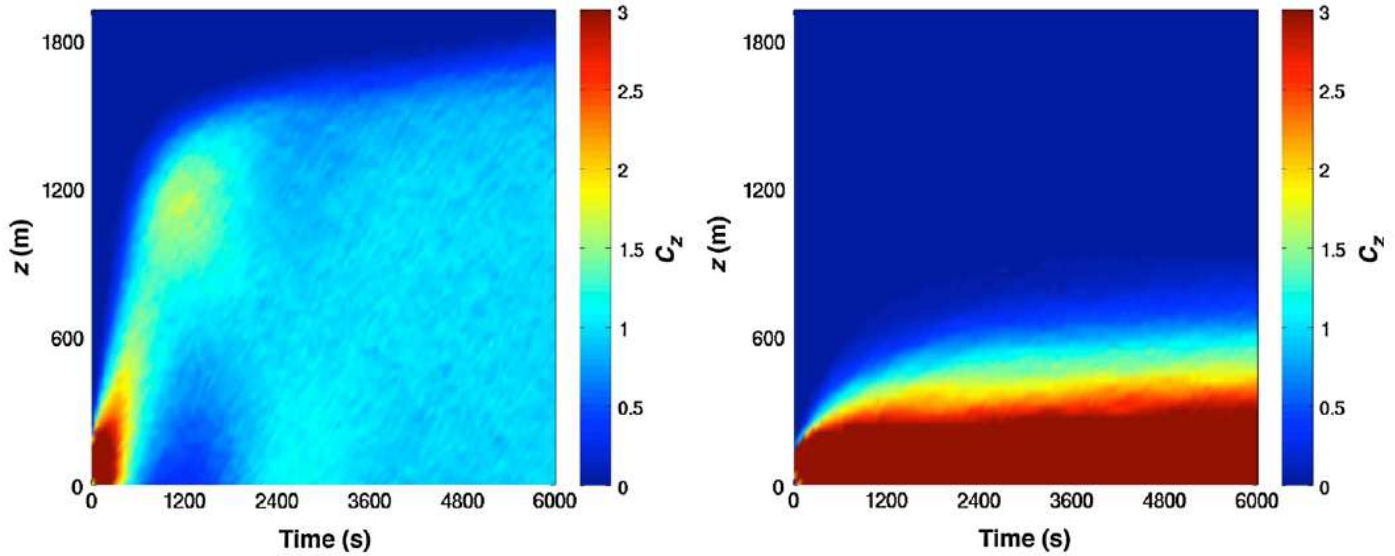


Fig. 6 Particle concentration (C_z) from a near-surface release occurring at **a** $t_d = -1{,}200$ s, and **b** $t_d = 1{,}200$ s where t_d is the time after the switch-off of surface heat flux. Particles are released at height $z = 100$ m for the idealized forcing. Note that the time of the release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

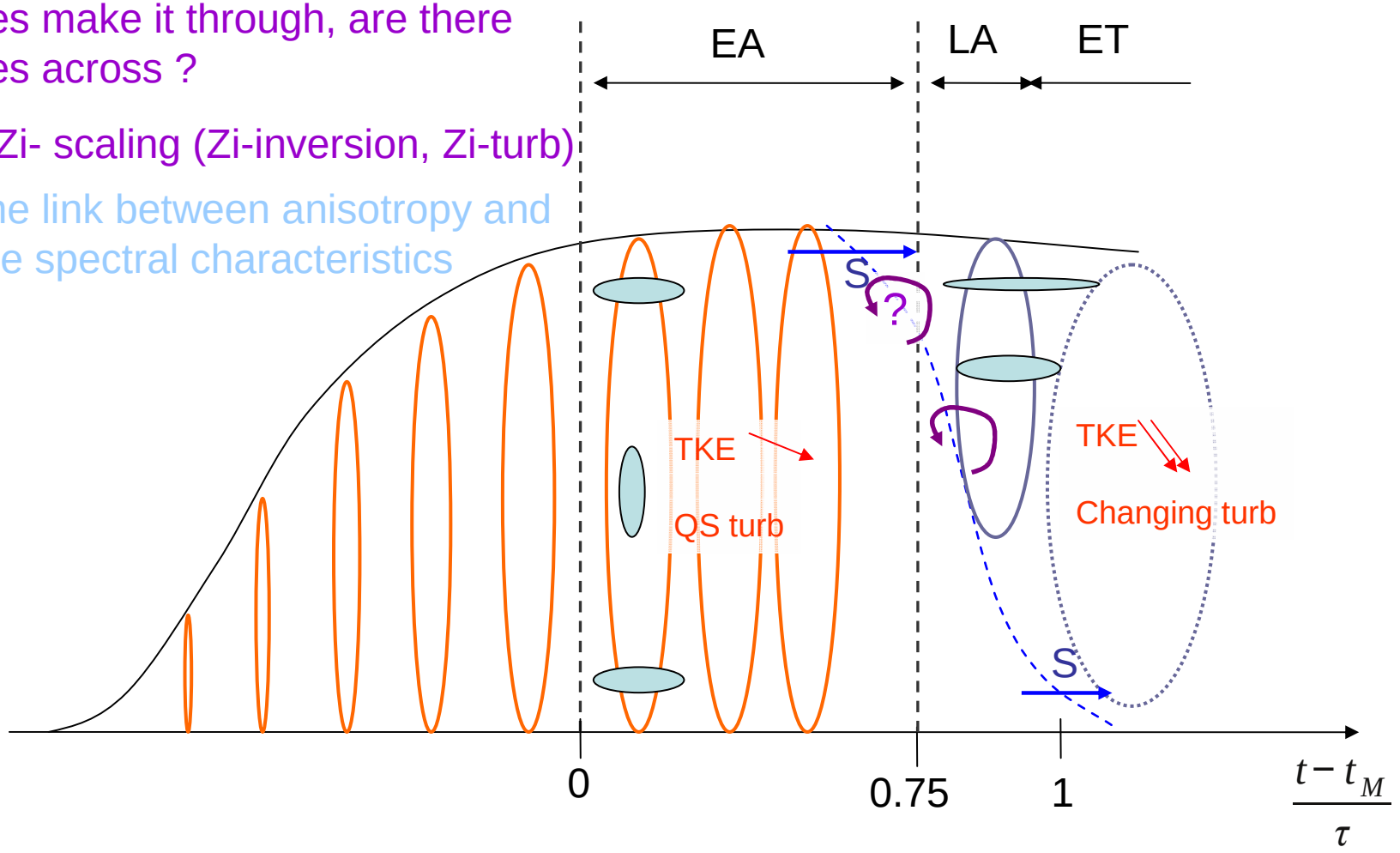
- Role of shear in the change of scales, according to height ?

- Decoupling ? Or wrong picture?

-Do eddies make it through, are there exchanges across ?

- Test of Zi- scaling (Zi-inversion, Zi-turb)

- Verify the link between anisotropy and turbulence spectral characteristics

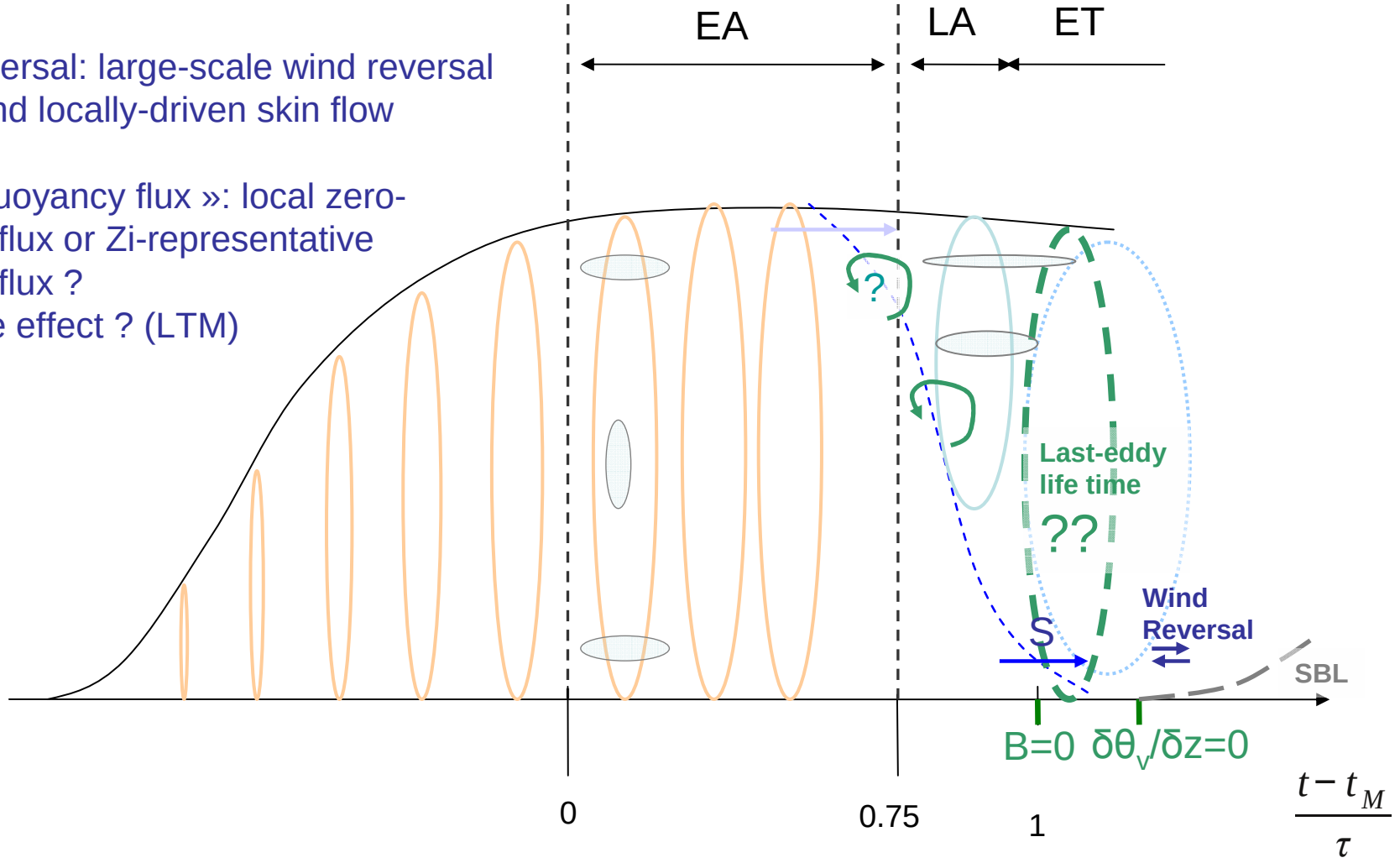


- Counter-gradient theory issues

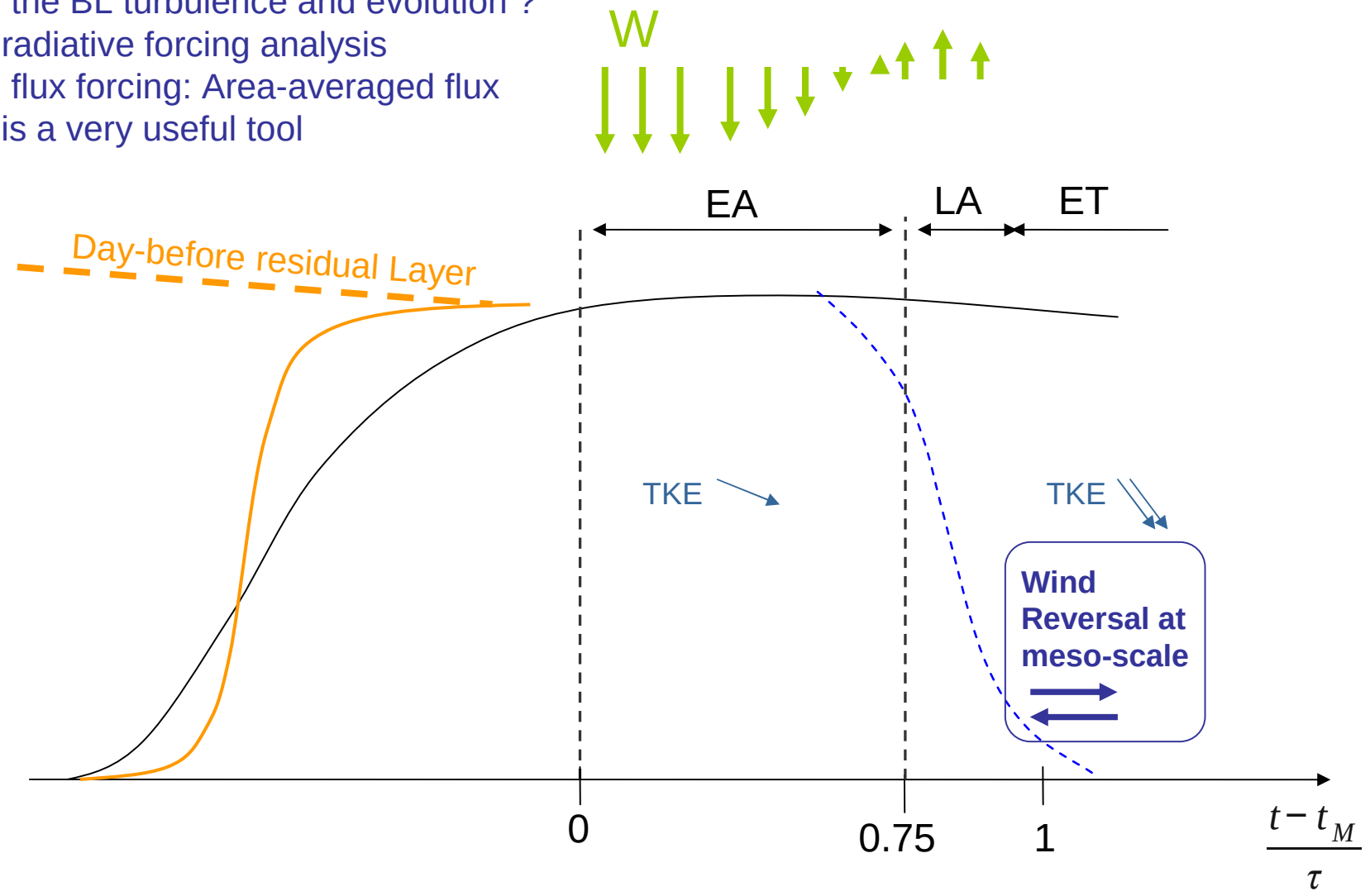
- Scaling by Zi-inversion seemed more relevant than Zi-turb (dissipation
- scaling, lengthscale scaling,…)

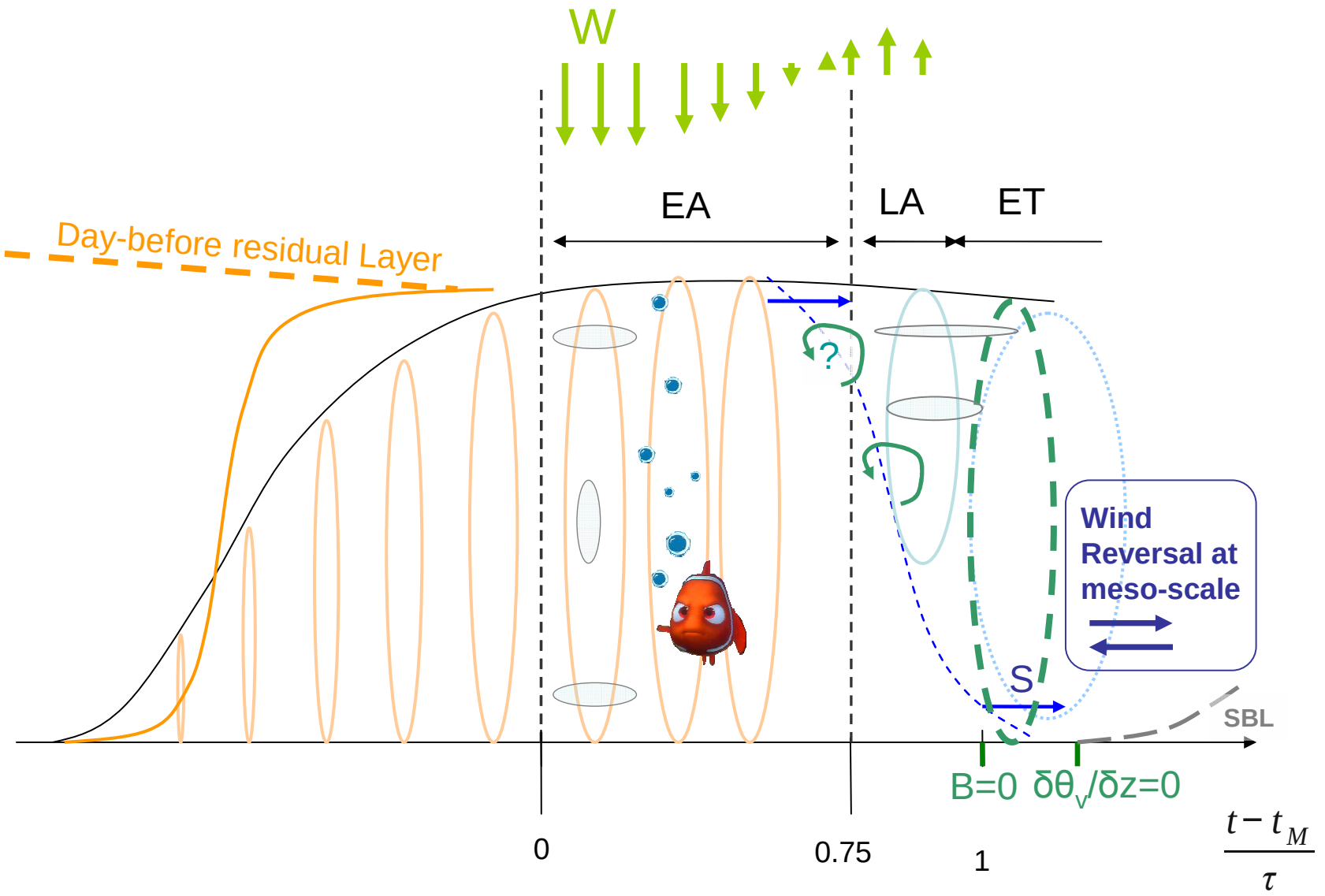
- Homogeneous surface / heterogeneous surface

- Wind-reversal: large-scale wind reversal system, and locally-driven skin flow reversal
- « Zero-buoyancy flux »: local zero-buoyancy flux or Zi-representative buoyancy flux ?
- Radiative effect ? (LTM)



- Can we link our understanding of the meso-cale circulation and motion to the forcings that apply to the BL, in order to better catch their impact of the BL turbulence and evolution ?
- Lack in radiative forcing analysis
- Surface flux forcing: Area-averaged flux estimate is a very useful tool




W
EA
LA
ET
Day-before residual Layer
?
Wind
Reversal at
meso-scale
S
SBL
B=0 δθv/δz=0
0
0.75
1
t − tM
τ

Ideas to help addressing those questions

- Release of tracers in a LES, at different time during EA, LA and ET
  and at different height (surface, top, and several heights in between)
- Testing the Zi-scaling (ZI-hom, Zi-inversion, Zi-turb), and that of van Driel et al 2011
- Working with ML sensitivity test on the 12 days, with estimated forcings