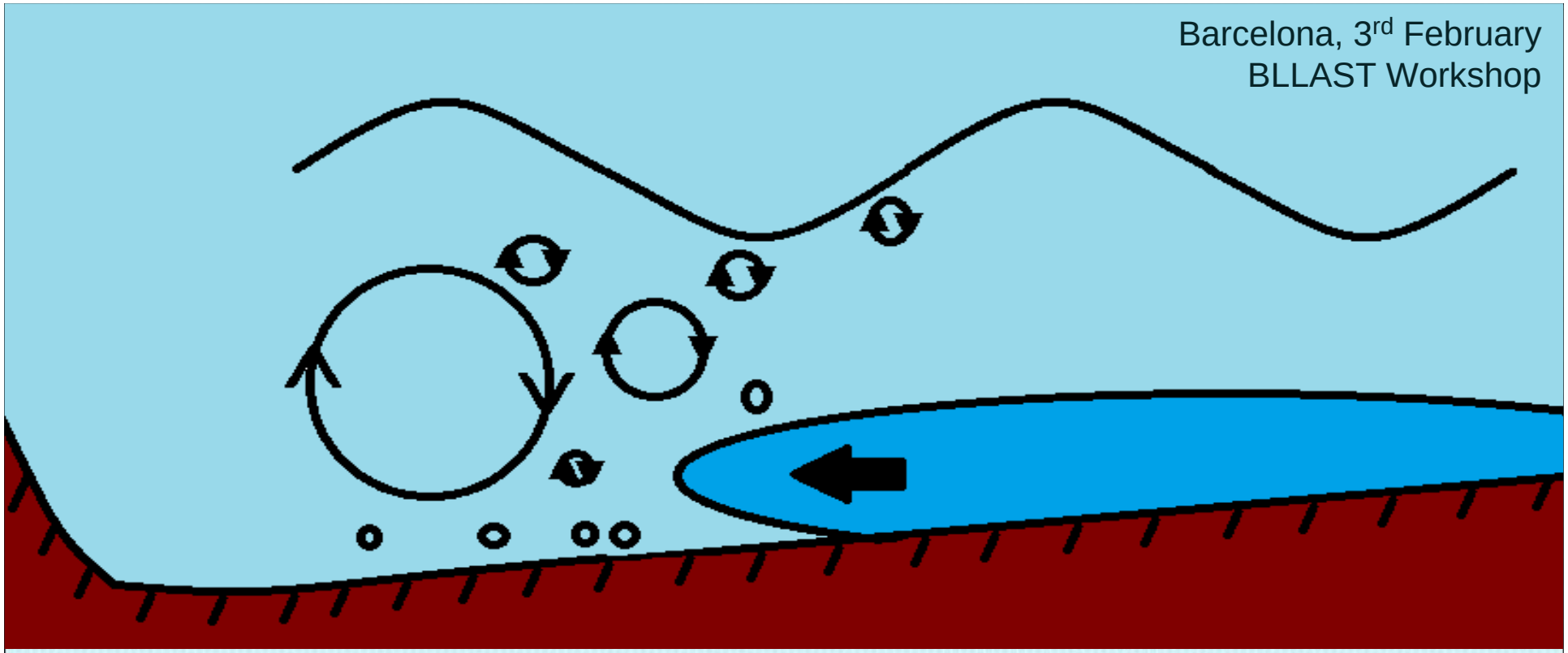
Barcelona, 3rd February
BLLAST Workshop



C. Román-Cascón, C. Yagüe, L. Mahrt, M. Sastre,
G-J. Steeneveld, E. Pardyjak, A. van de Boer

INTERACTIONS AMONG DRAINAGE FLOWS, GRAVITY WAVES AND TURBULENCE: 2ND JULY

INTRODUCTION & MOTIVATION

- 2nd July (IOP 10) → Special transition

- Shallow drainage flows
- Katabatic winds
- Gravity waves

} Interaction with TURBULENCE

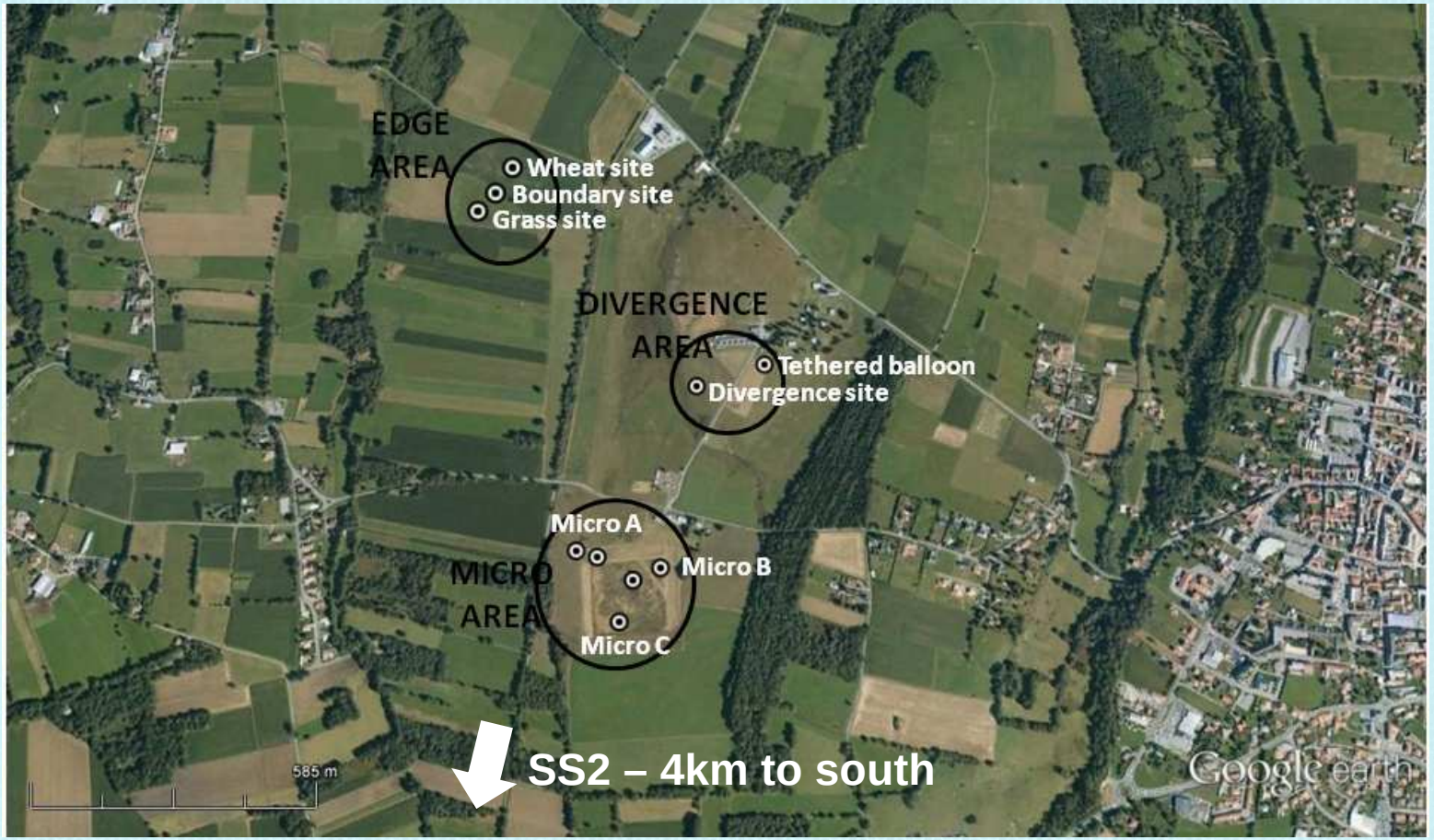
OUTLINE

- General Analysis (**DRAINAGE FLOWS**)
- **GRAVITY WAVES**
- **Surface Fluxes**
  - HEIGHTS differences
  - SITES differences

  → (MRFD)

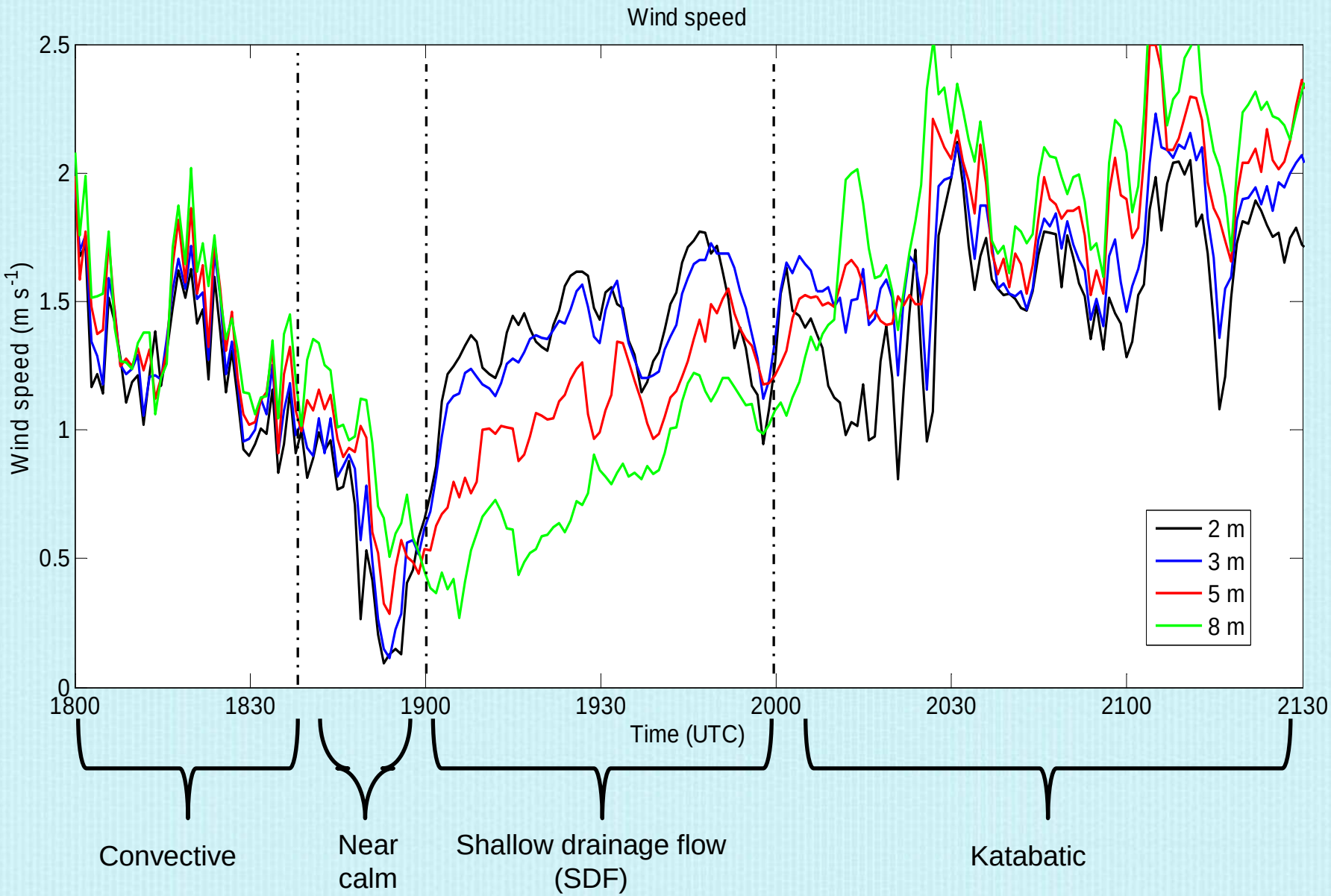
GENERAL ANALYSIS

SITES

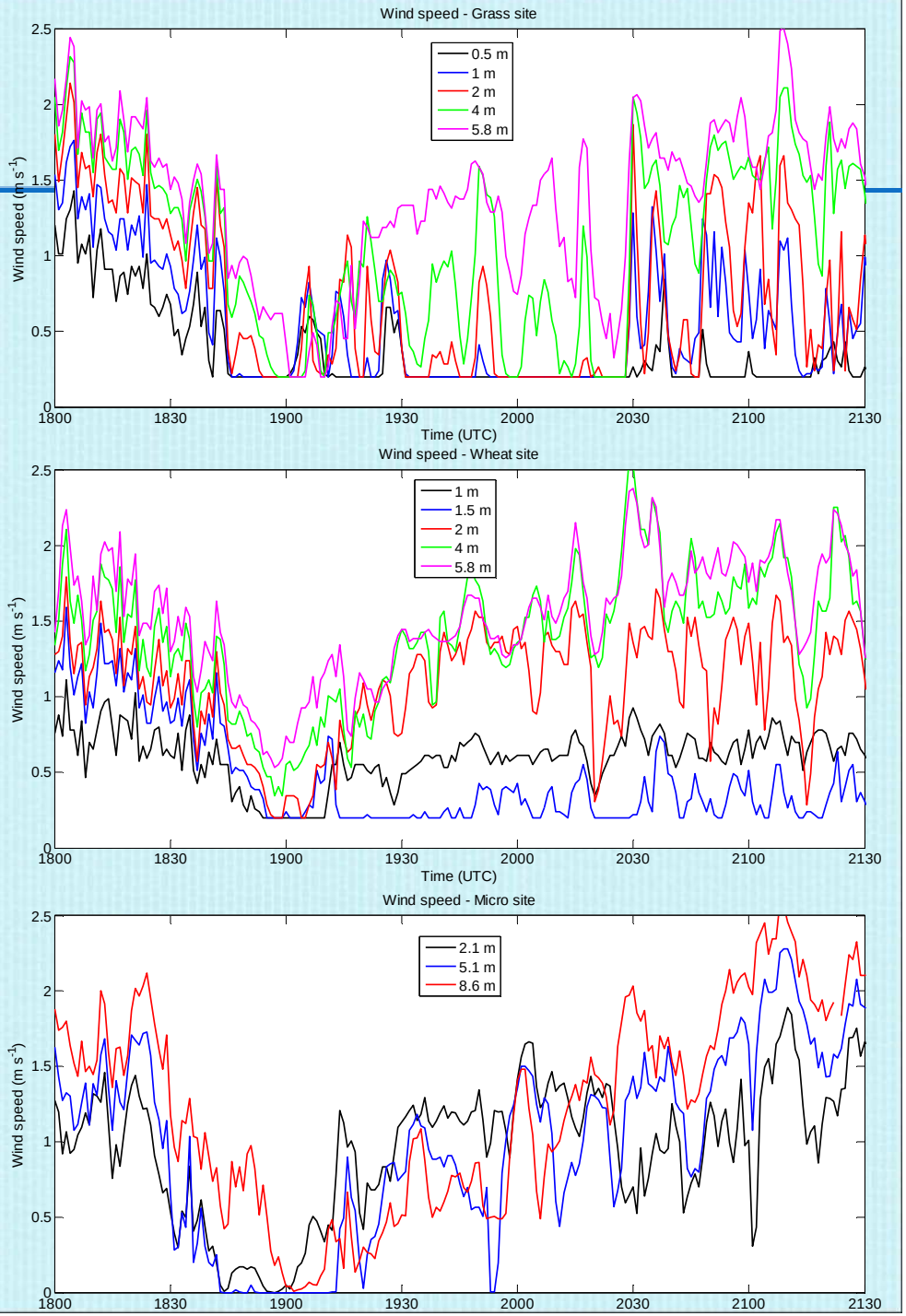


GENERAL ANALYSIS

WIND SPEED



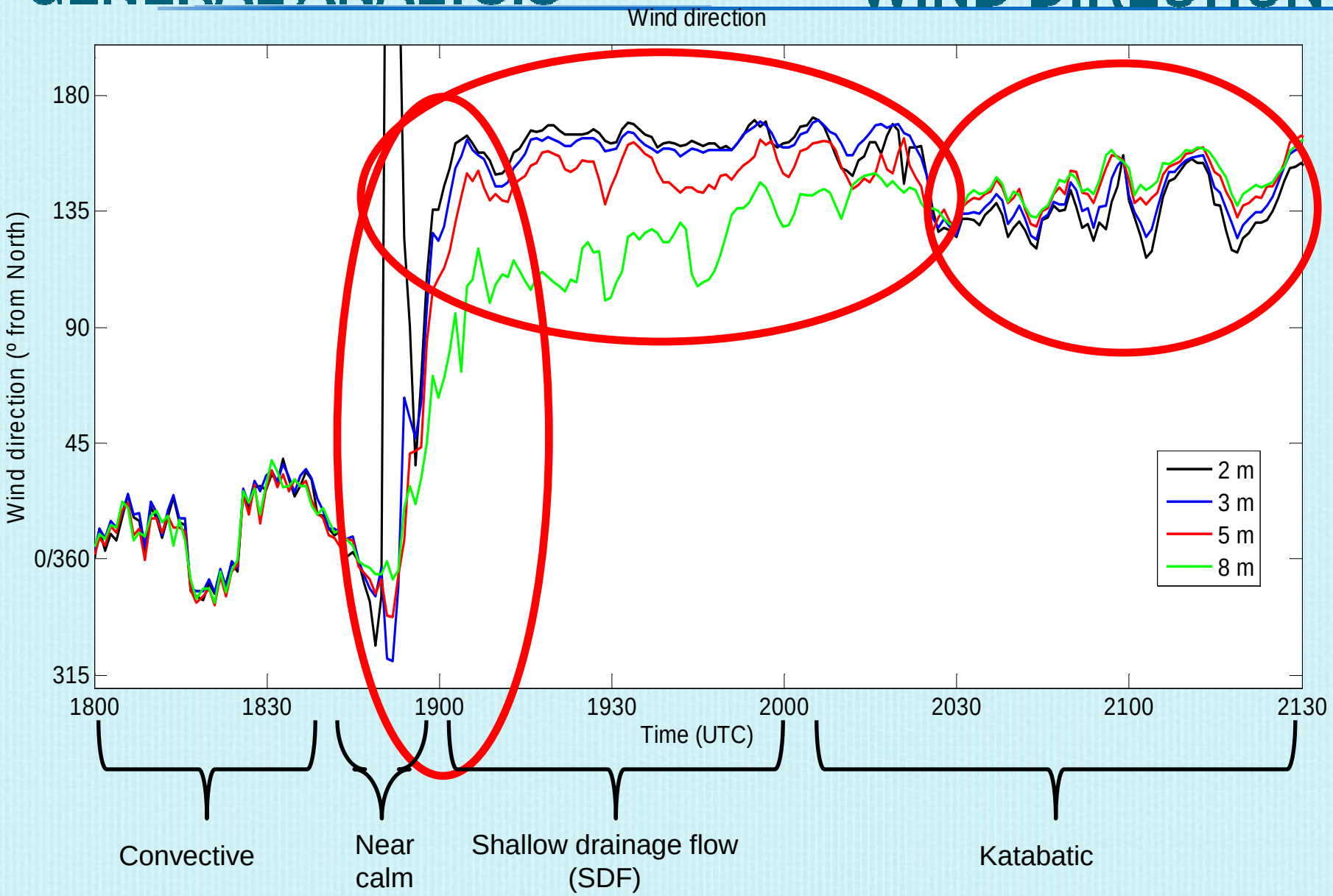
SDF AT DIFFERENT SITES



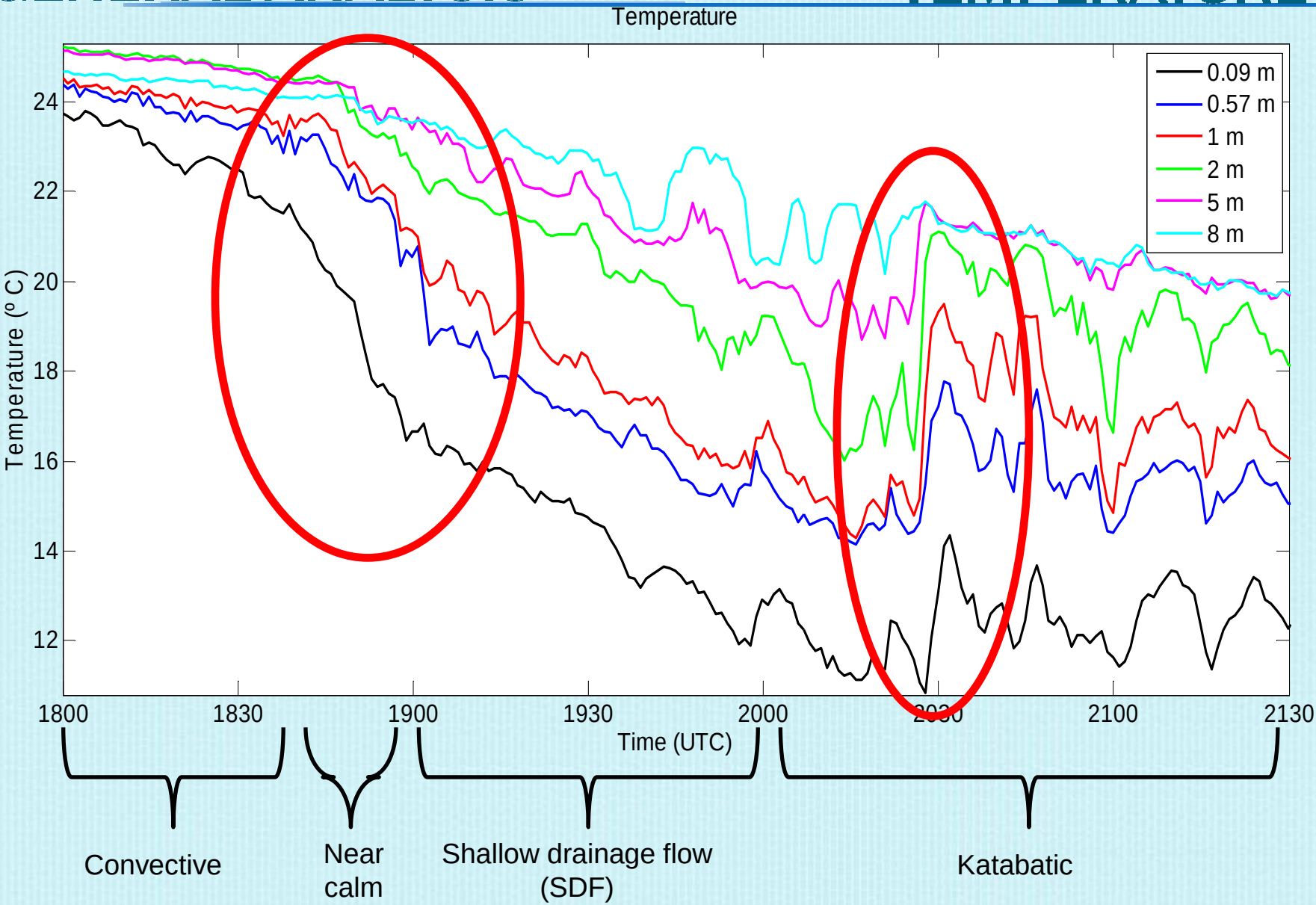
Secondary slide

GENERAL ANALYSIS

WIND DIRECTION

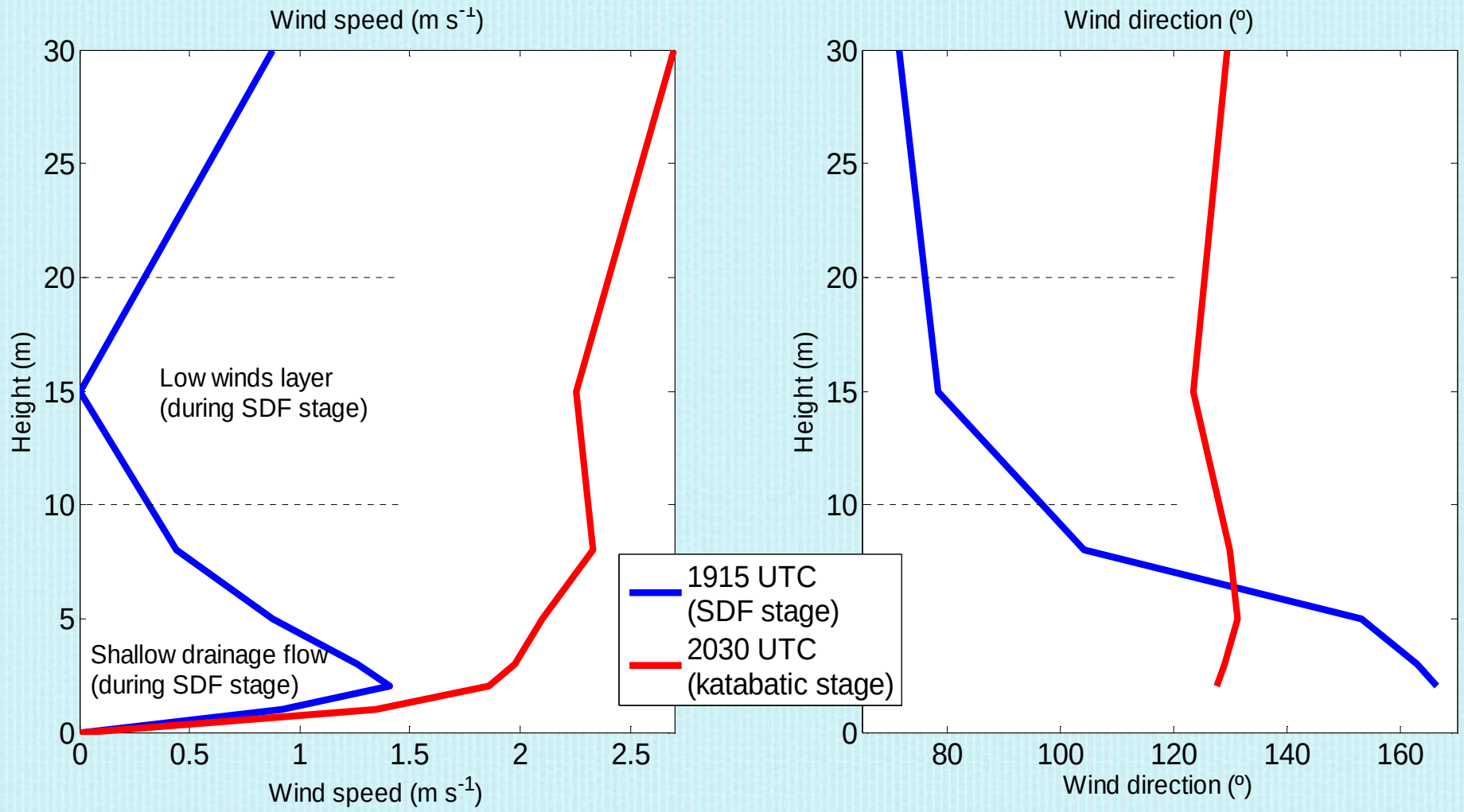


GENERAL ANALYSIS TEMPERATURE



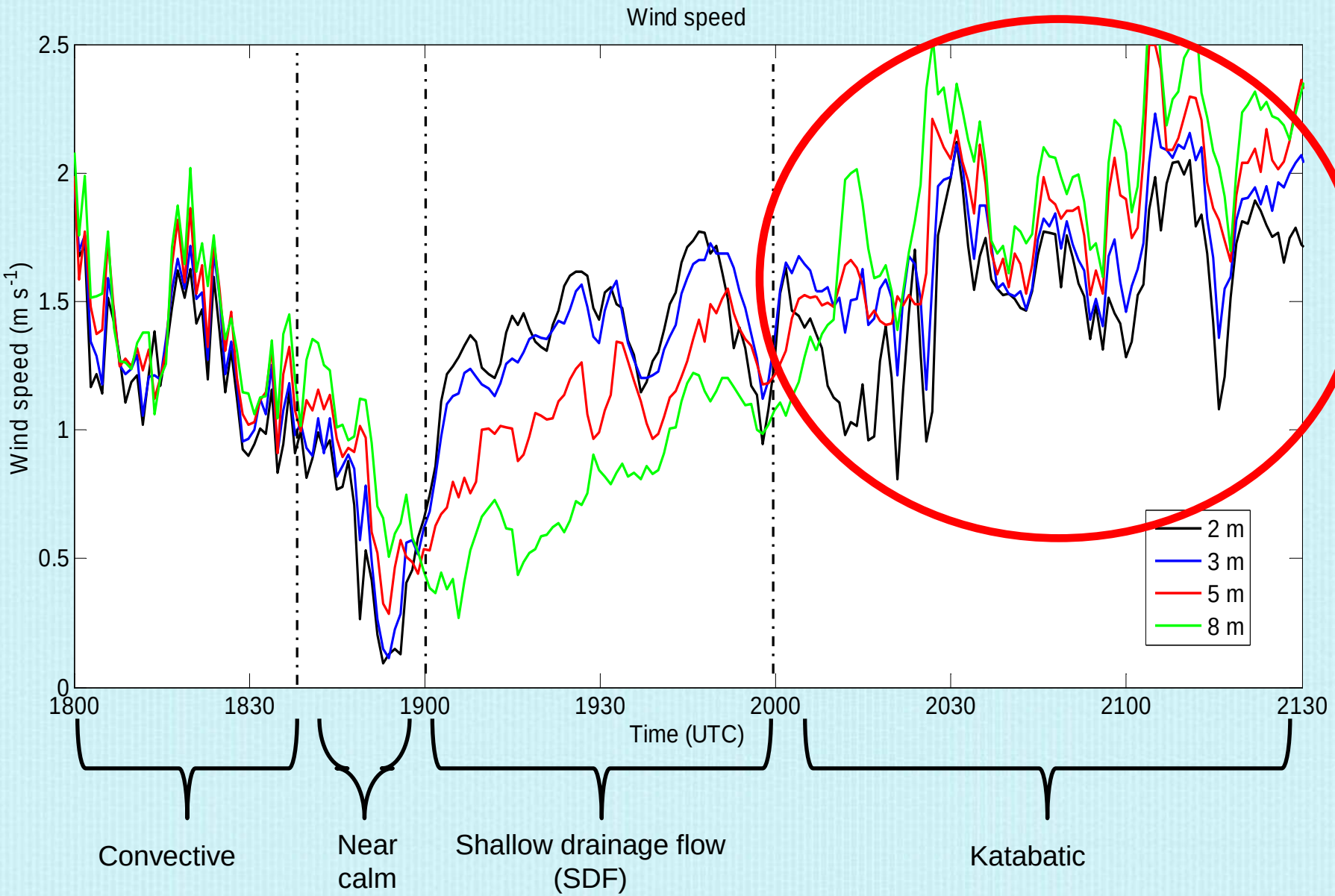
GENERAL ANALYSIS

SDF & KATABATIC



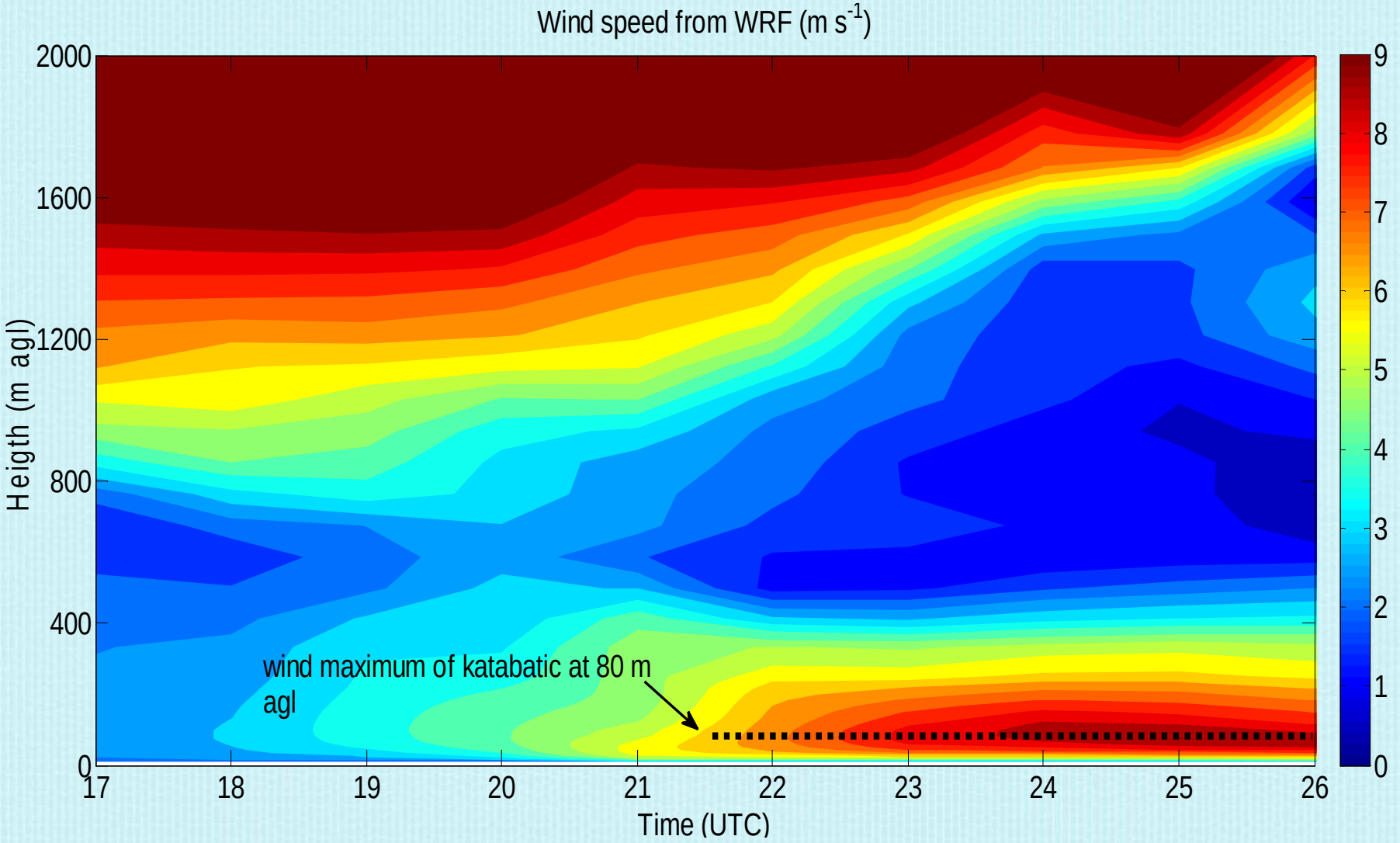
GENERAL ANALYSIS

WIND SPEED



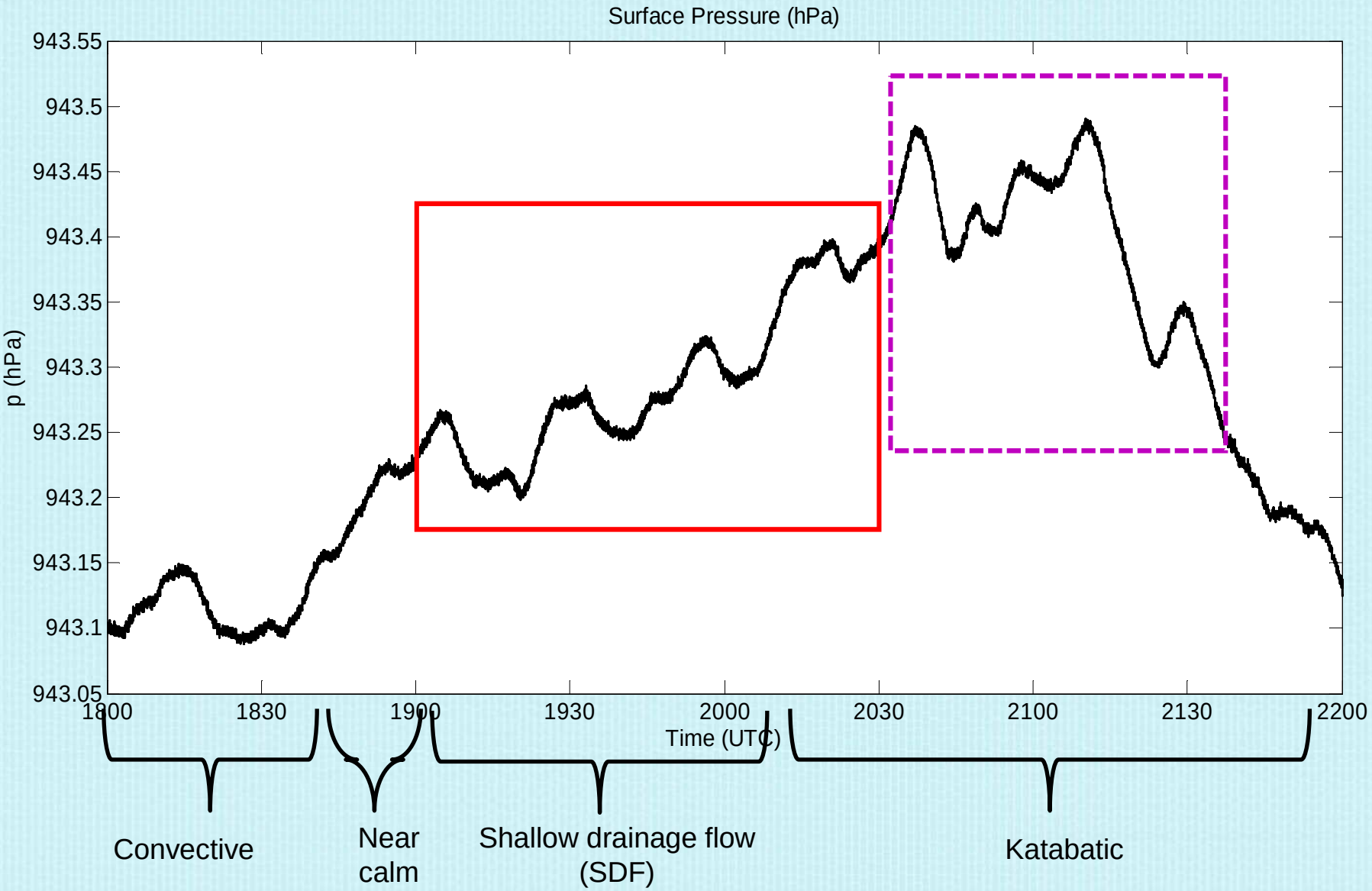
GENERAL ANALYSIS

WIND SPEED KATABATIC (WRF)



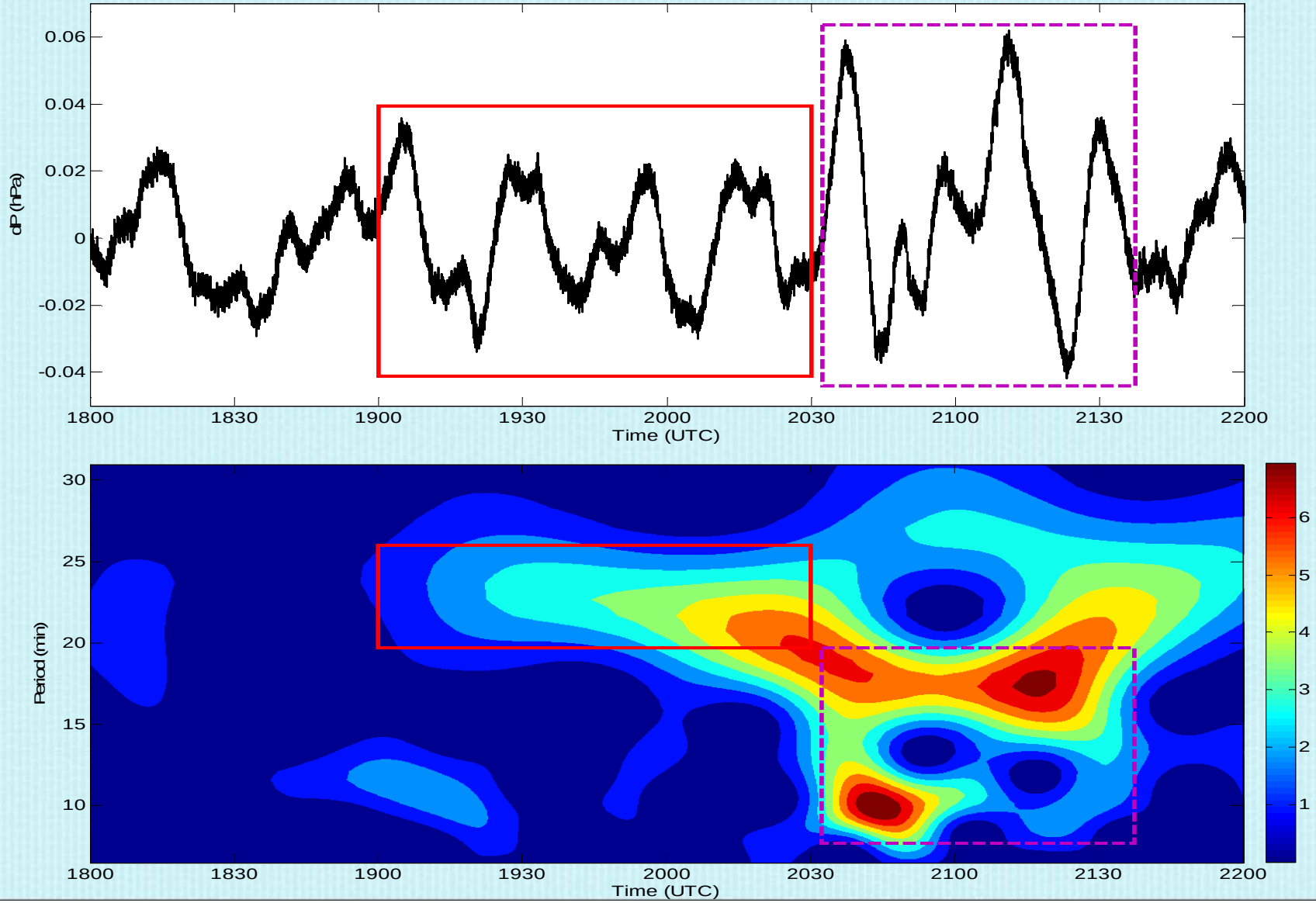
GRAVITY WAVES

SFC PRESSURE



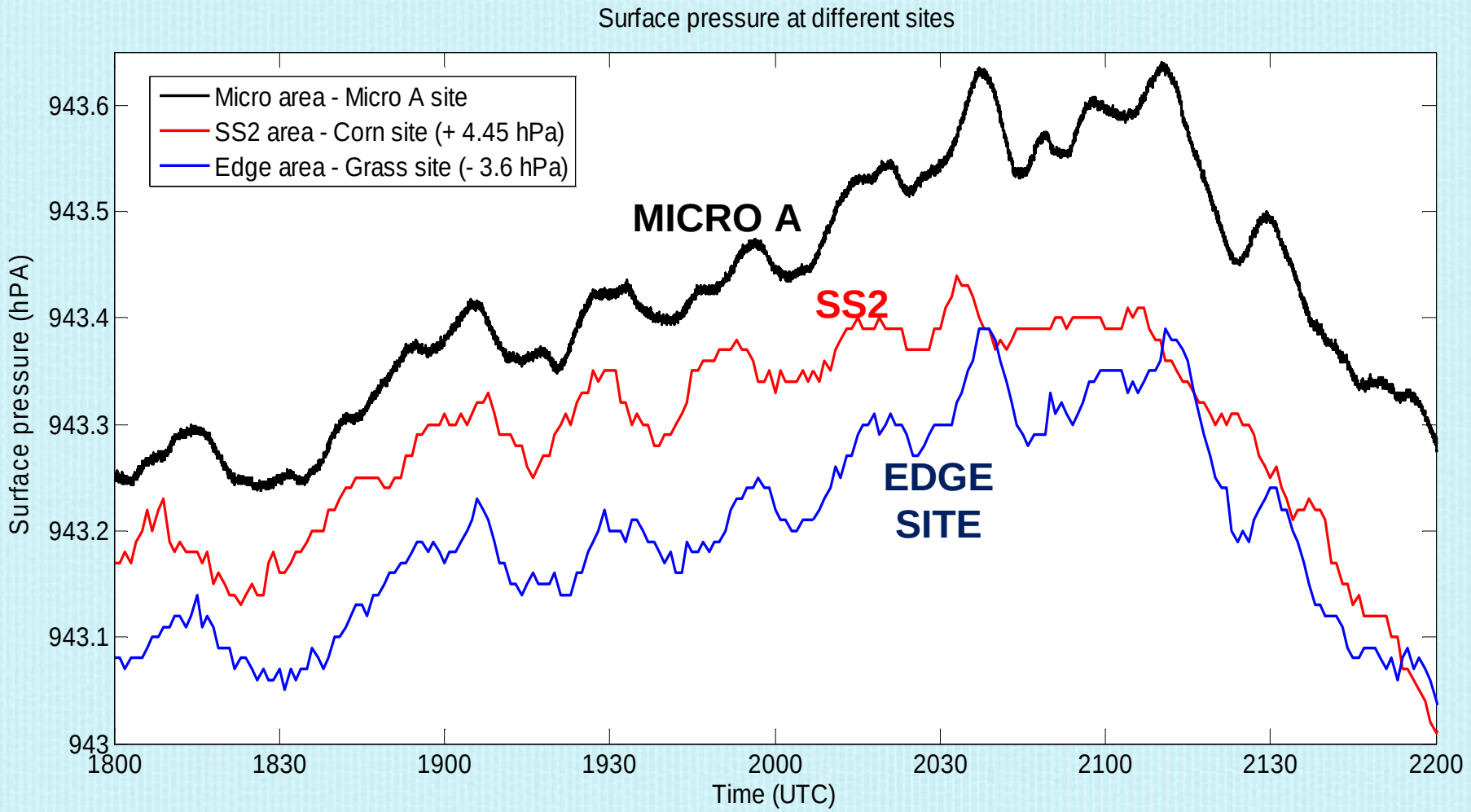
GRAVITY WAVES

FILT PRESSURE & WAVELET



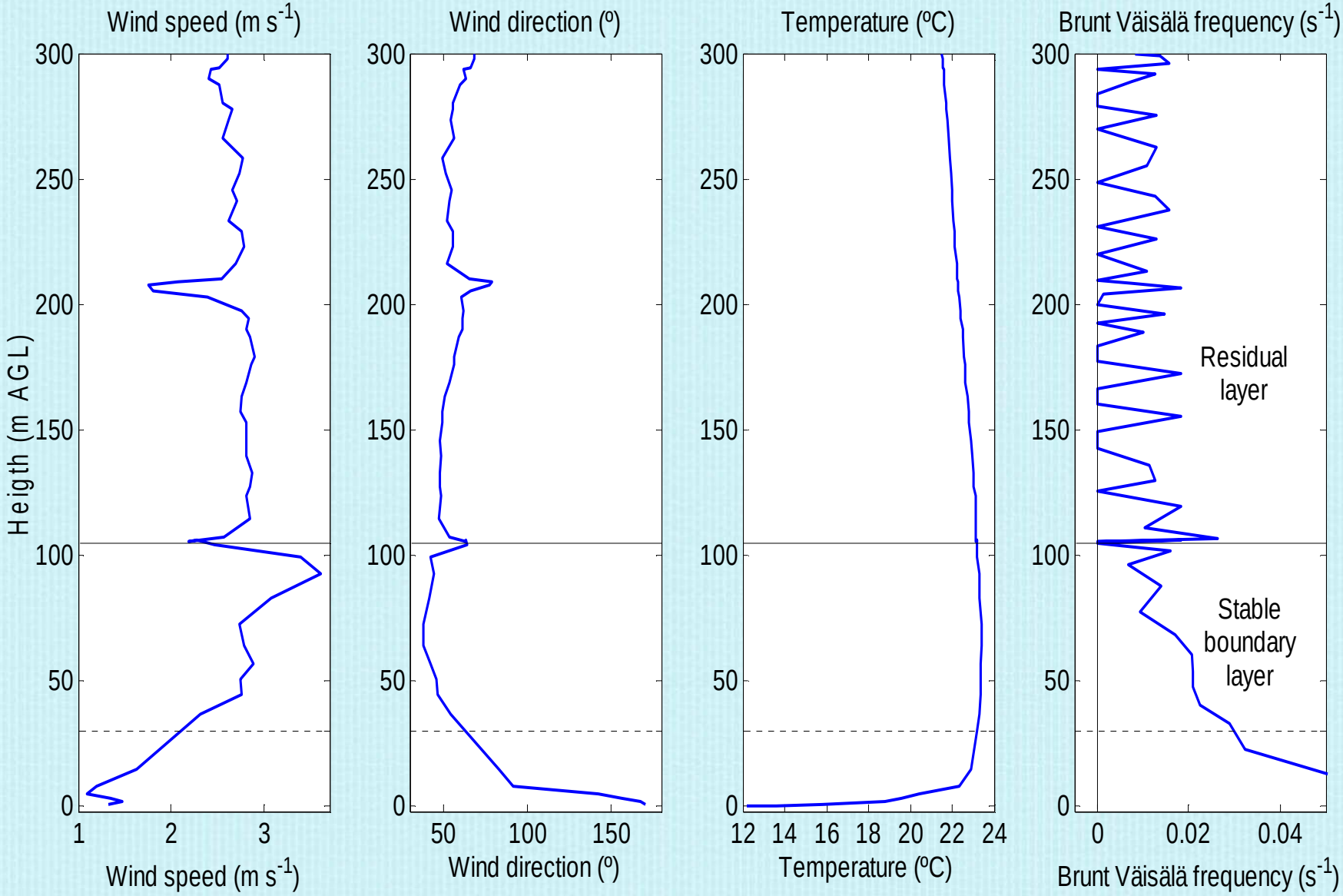
GRAVITY WAVES

SURFACE PRESSURE AT OTHER LOCATIONS

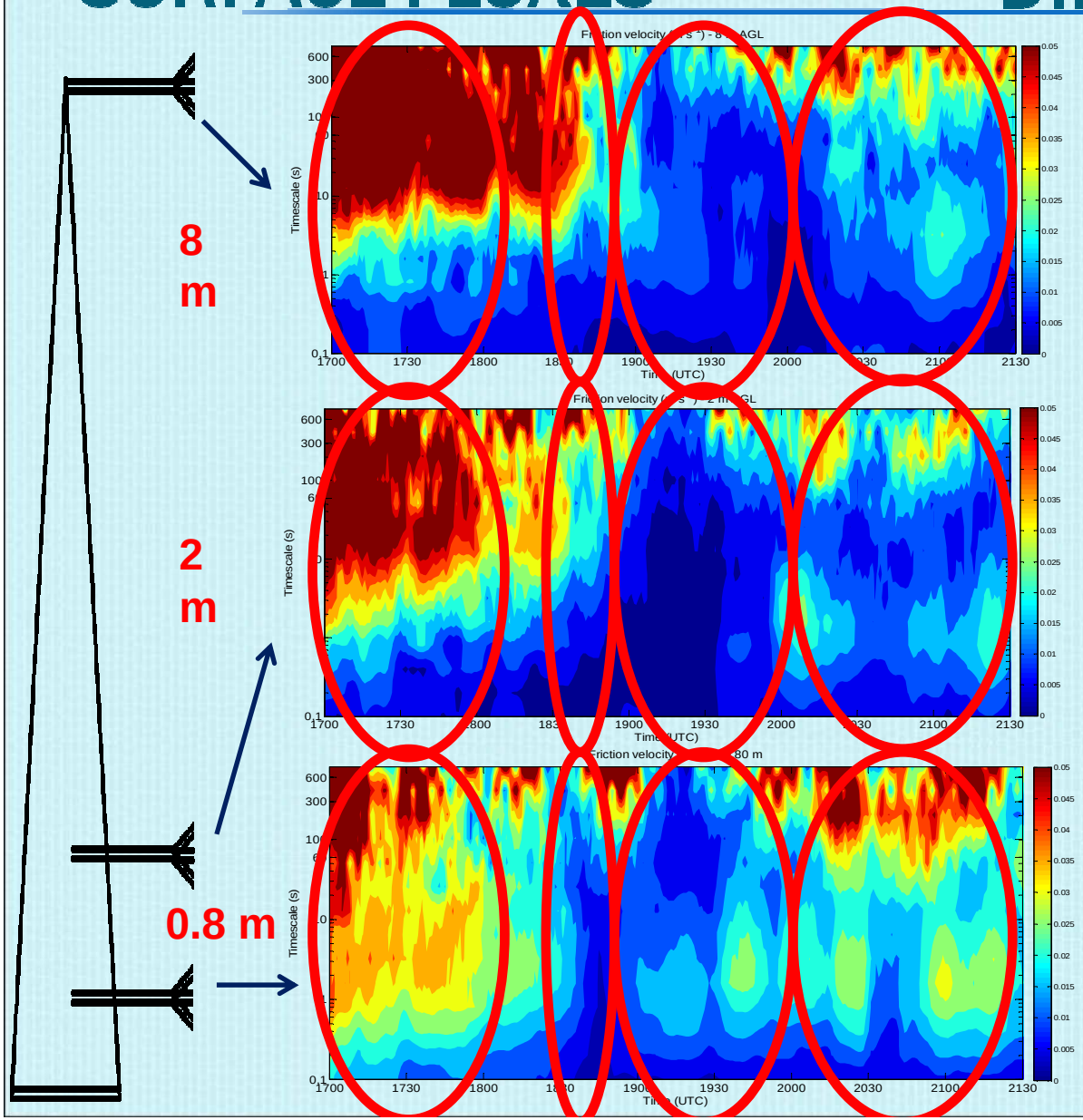


(from tethered balloon at CRA and tower measurements)

GRAVITY WAVES VERTICAL PROFILE

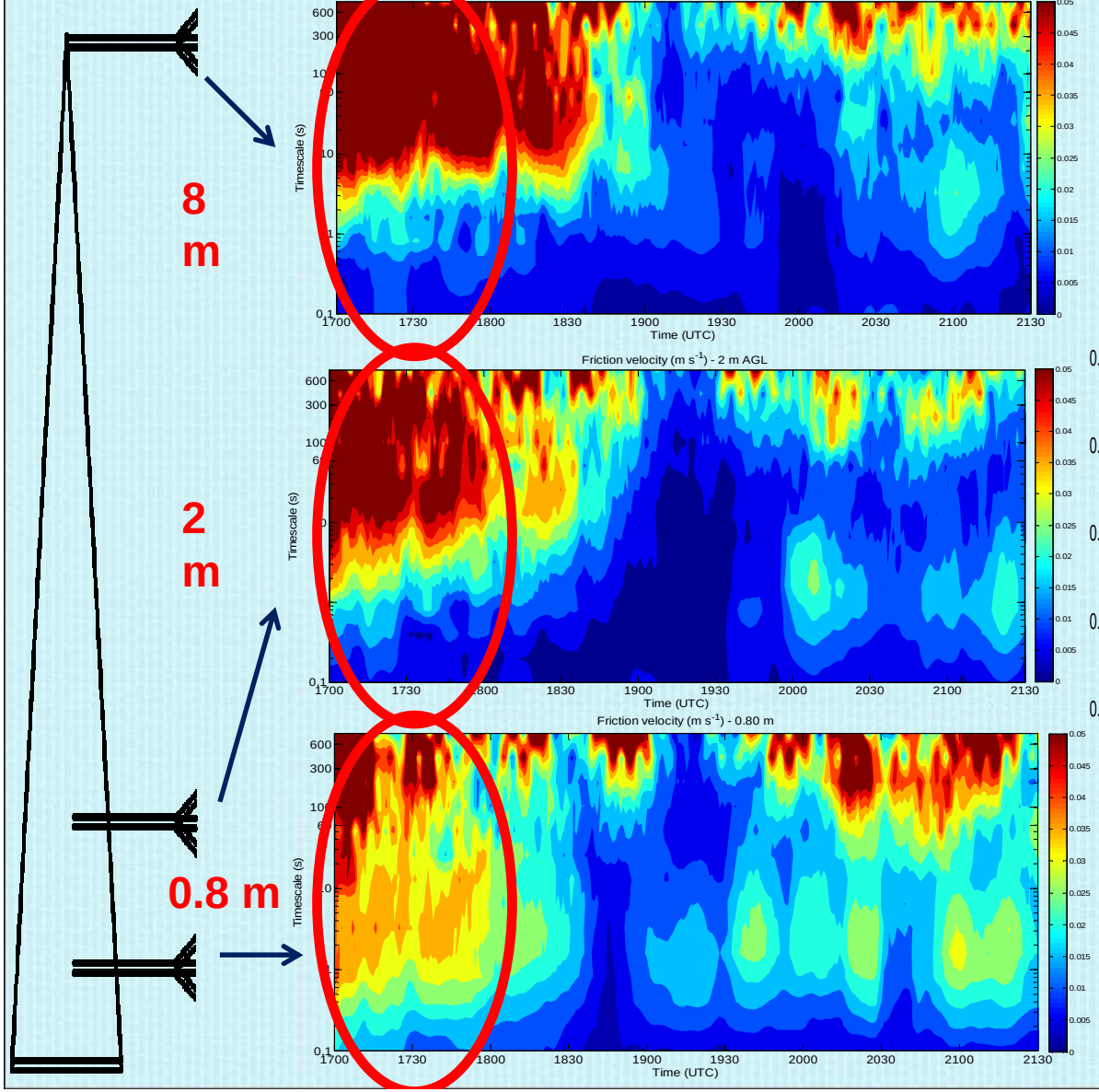


SURFACE FLUXES DIFFERENT HEIGHTS



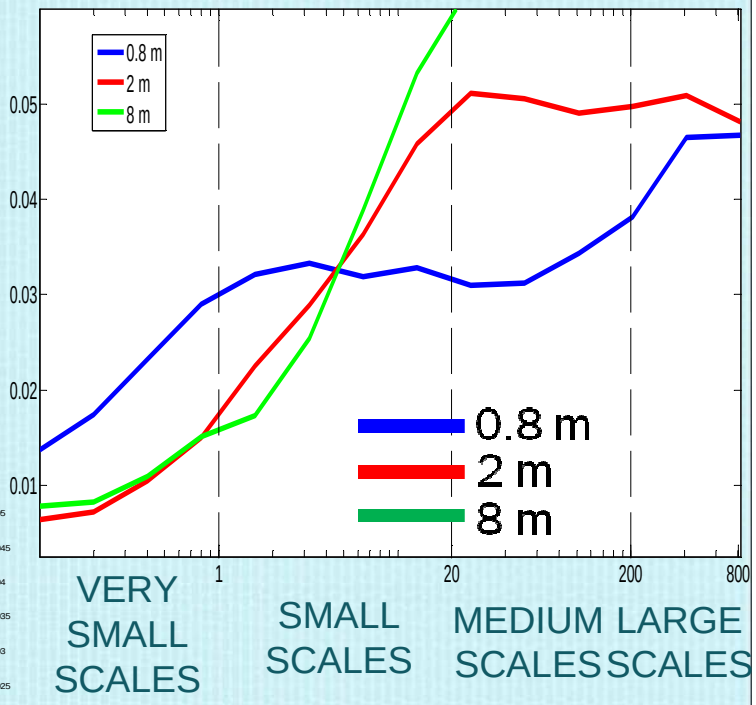
Friction velocity

SURFACE FLUXES DIFFERENT HEIGHTS

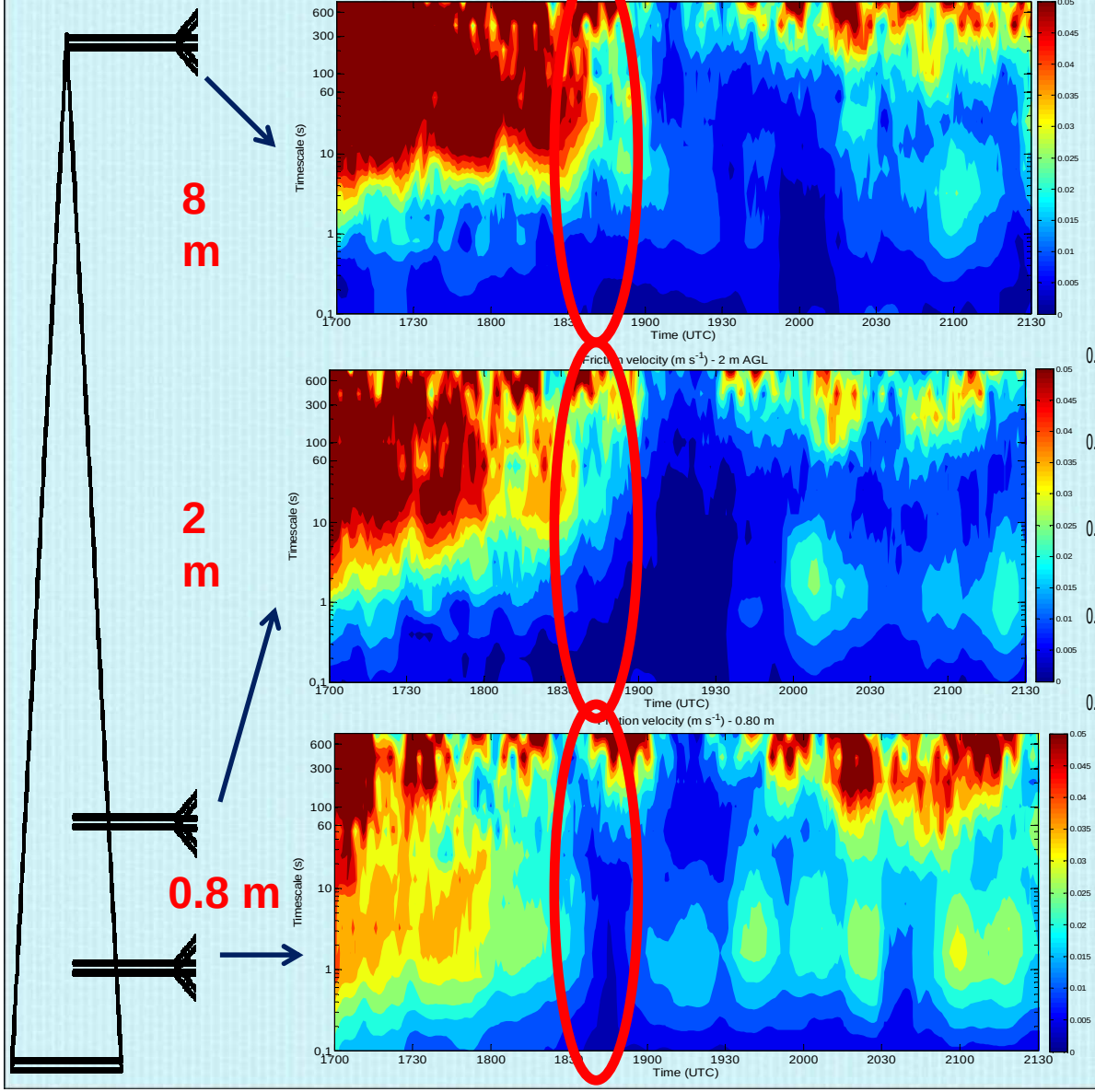


Friction velocity

CONVECTIVE STAGE

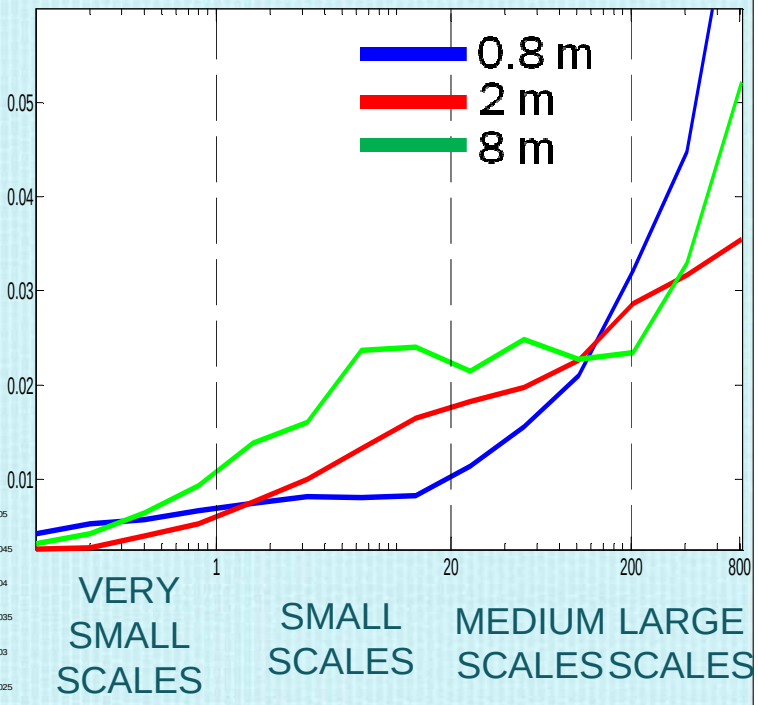


SURFACE FLUXES DIFFERENT HEIGHTS



Friction velocity

NEAR-CALM STAGE



VERY SMALL SCALES

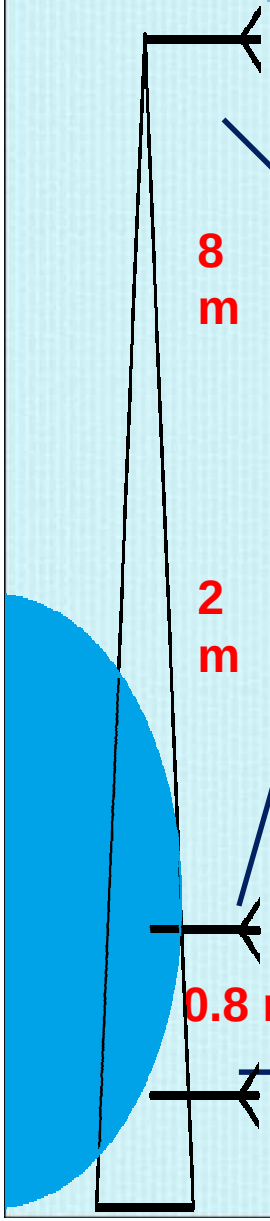
SMALL SCALES

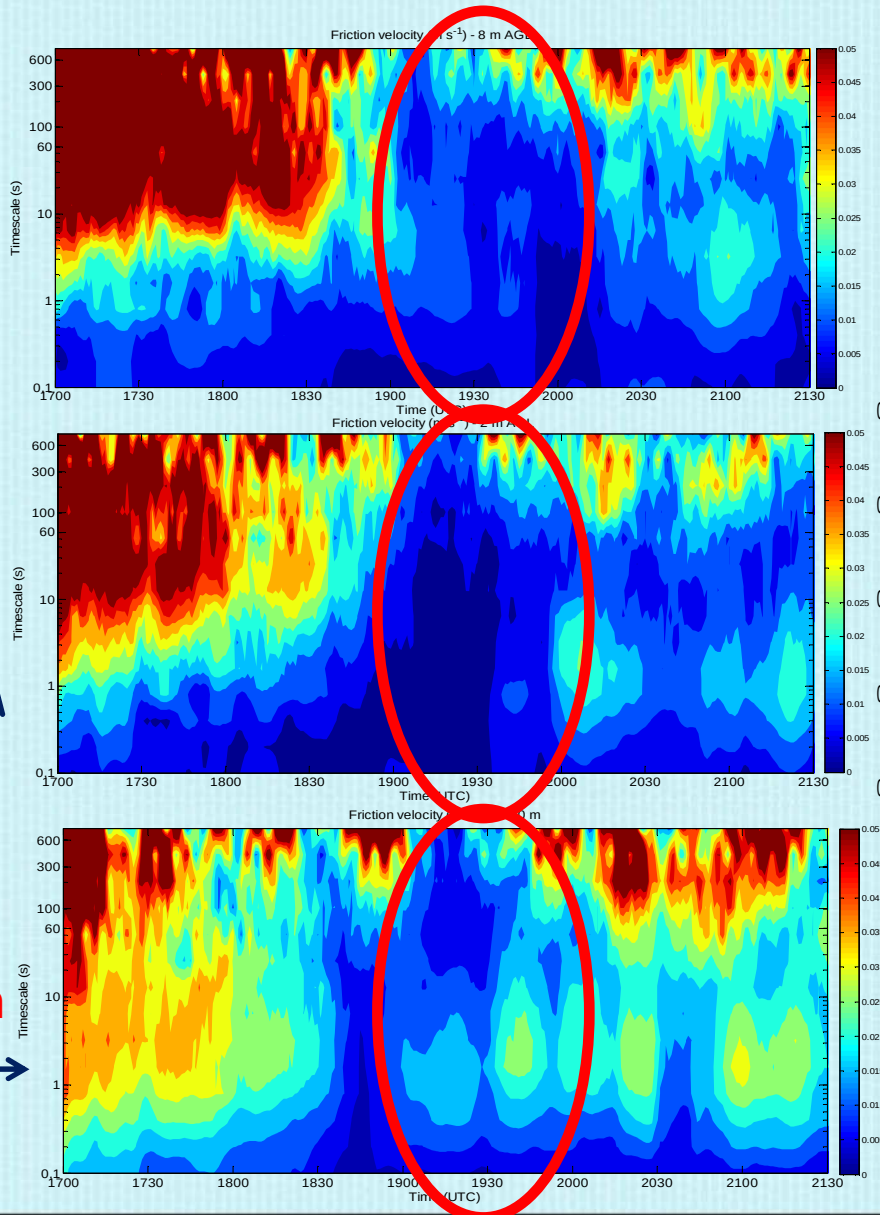
MEDIUM SCALES

LARGE SCALES

SURFACE FLUXES

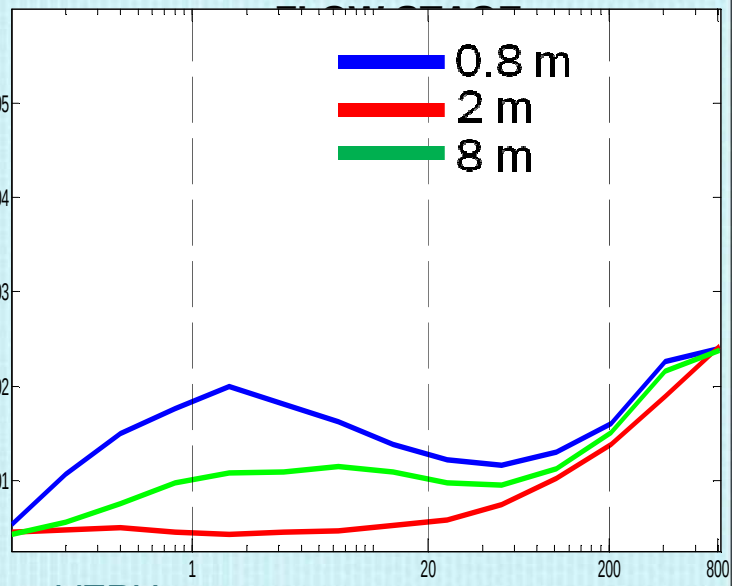
DIFFERENT HEIGHTS





Friction velocity

SHALLOW DRAINAGE



VERY SMALL SCALES

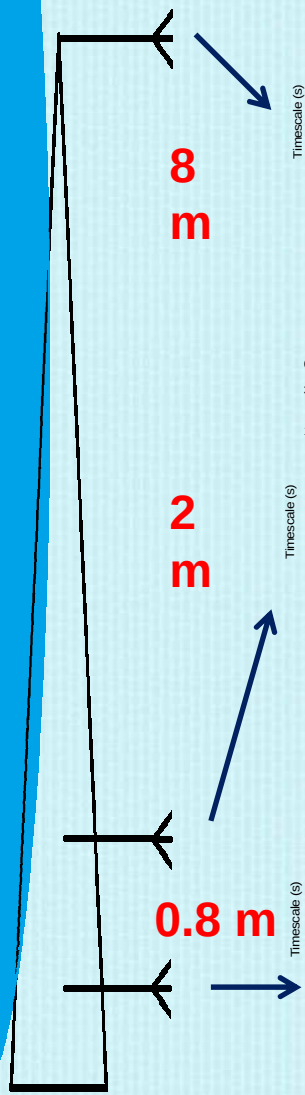
SMALL SCALES

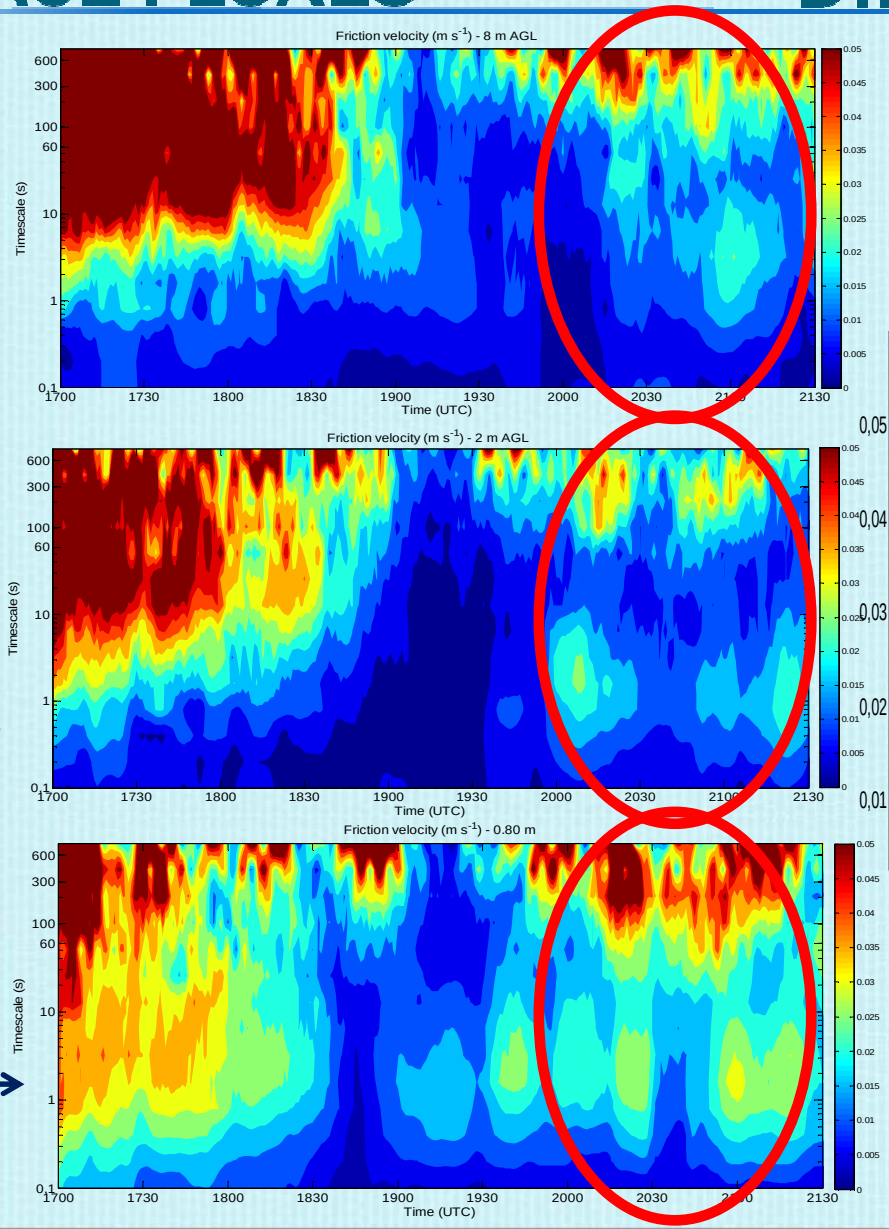
MEDIUM SCALES

LARGE SCALES

SURFACE FLUXES

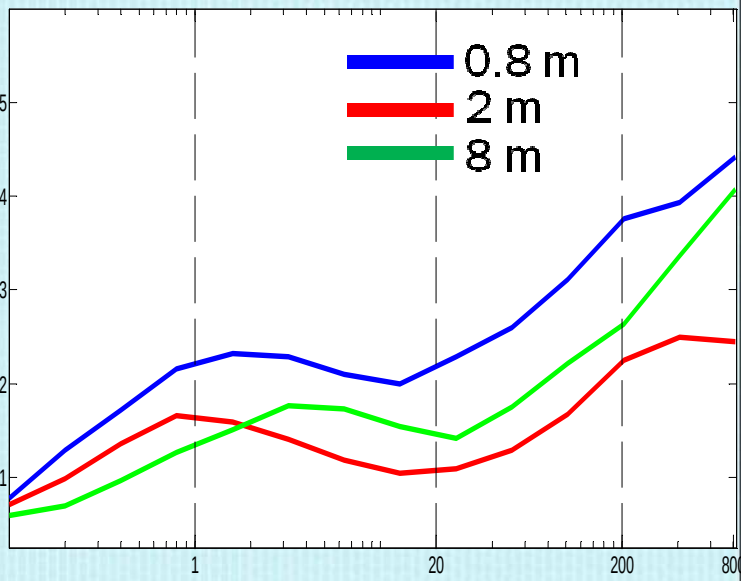
DIFFERENT HEIGHTS





Friction velocity

KATABATIC STAGE



VERY SMALL SCALES

SMALL SCALES

MEDIUM SCALES

LARGE SCALES

CONCLUSIONS 2ND JULY (IOP 10)

- SDF
  - Wind maximum at 2-3 m agl
  - Very local (not at all places)
  - Due to small slopes
- KATABATIC
  - Wind maximum at 80 m agl (from WRF)
  - Observed everywhere at the campaign (canalized in valleys)
  - Due to Pyrenees scale
- GRAVITY WAVES
  - Clear oscillations in P. Related with oscillation in T, ws, w
  - Propagation in SBL and in the horizontal (everywhere)
  - Due to wind shear &/or terrain effect
- SFC FLUXES
  - Different scales involved in turbulence depending the stage
  - Minimum in turbulence in wind maximum in SDF
  - Contribution of waves (are they contributing to turbulence??)

MORE... 2ND JULY (IOP 10)

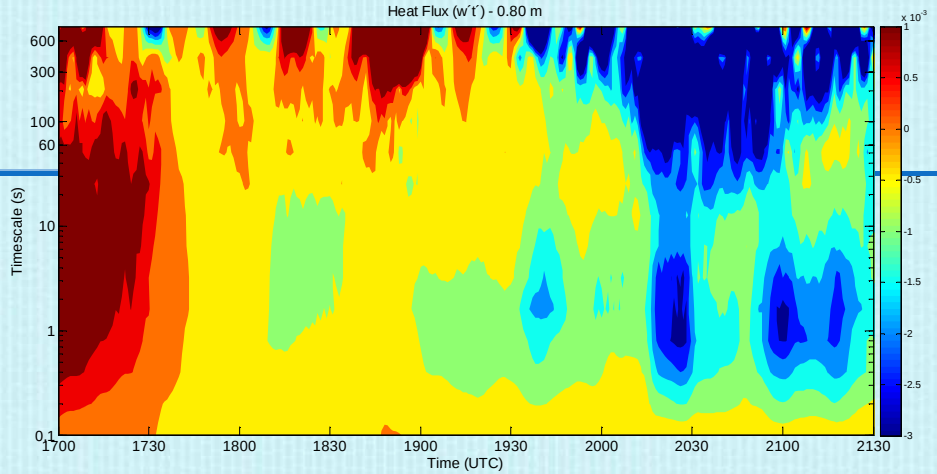
- HEAT FLUX ANALYSIS (MRFD)
  - More difficult to analyse
  - Changes in T profile due to these phenomena
  -- Counter-gradient fluxes discussion.....

- FLUXES AT DIFFERENT SITES
  - EDGE SITE
  - Grass - Border - Wheat
  - Important effect of the border (creating turbulence during SDF)

ADDITIONAL SLIDES

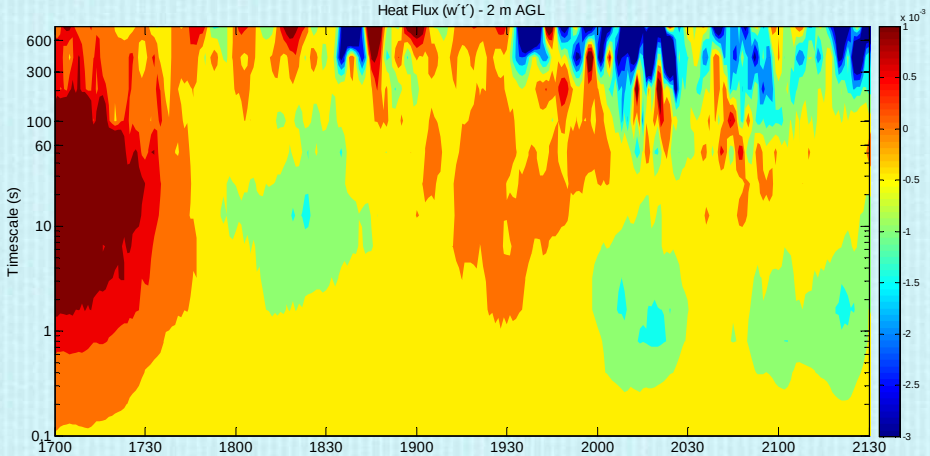
MRFD HEAT FLUX

0.8 m

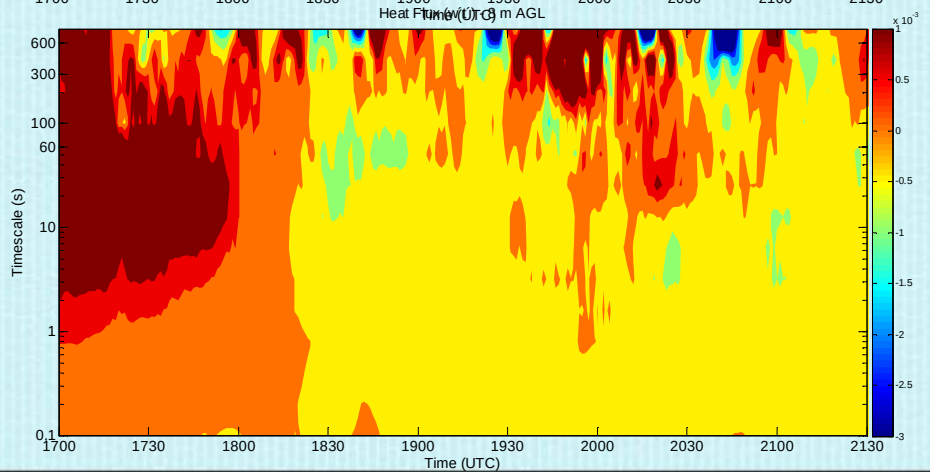


0.8; 2 and 8m at the DIVERGENCE SITE

2 m



8 m



Secondary slide

EDGE SITE (MRFD U*)

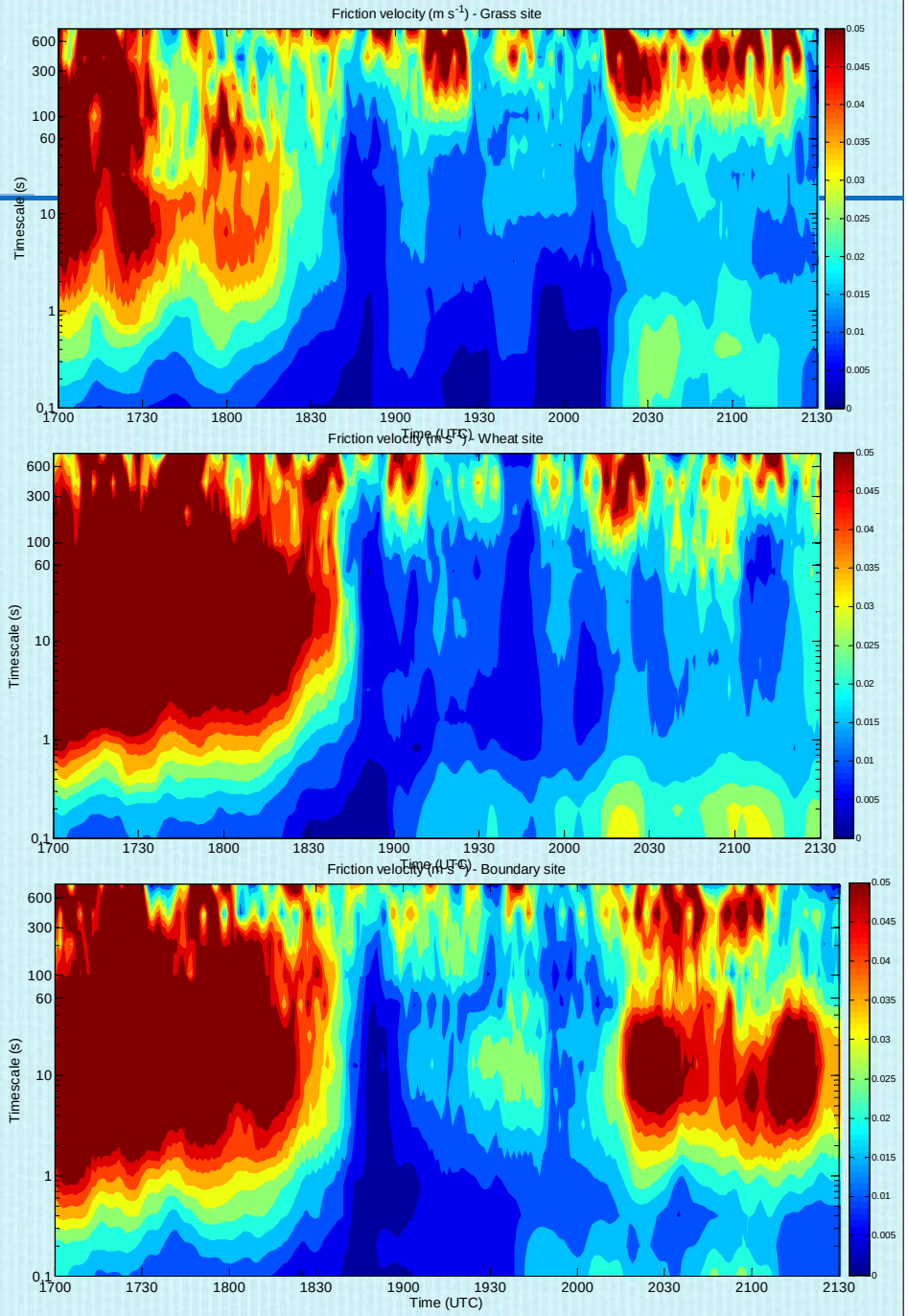
Grass

Grass, wheat and Border at the EDGE AREA

Wheat

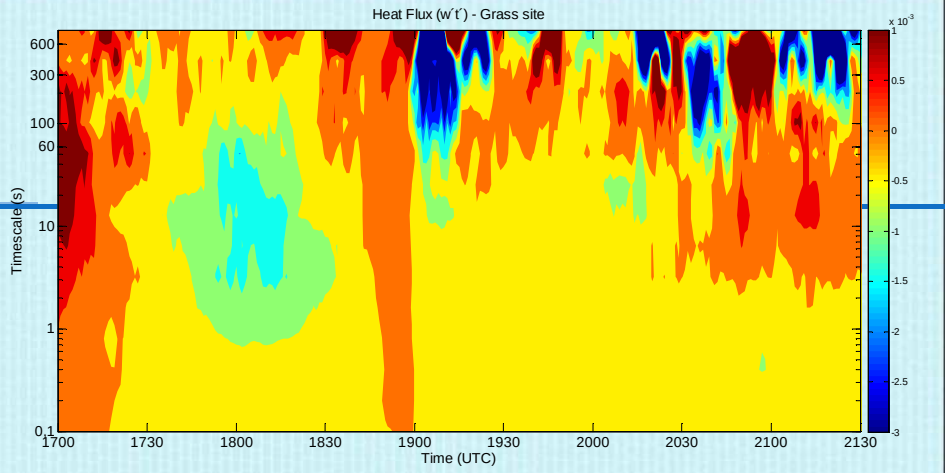
Border

Secondary slide



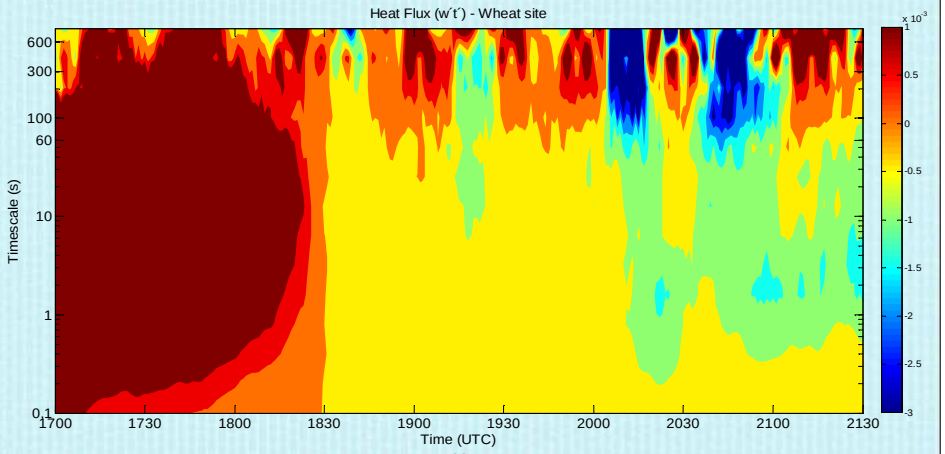
EDGE SITE (MRFD HEAT FLUX)

Grass

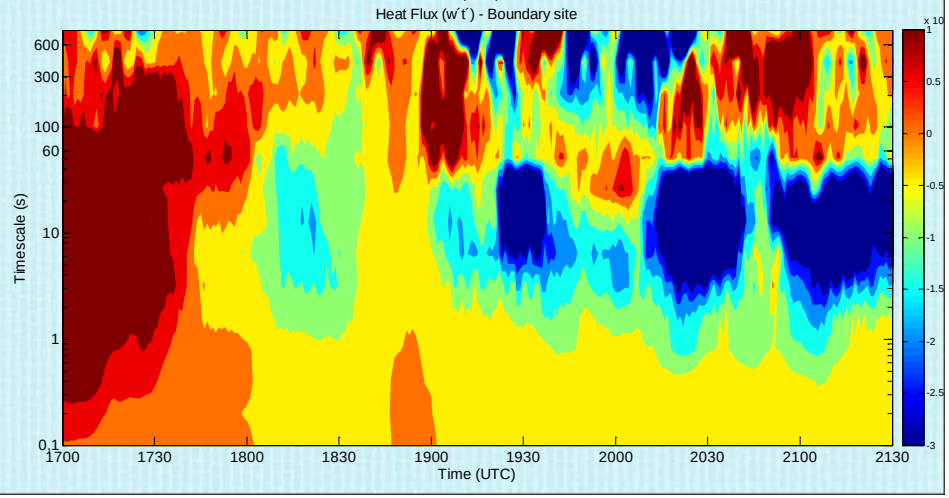


Grass, wheat and Border at the EDGE AREA

Wheat



Border

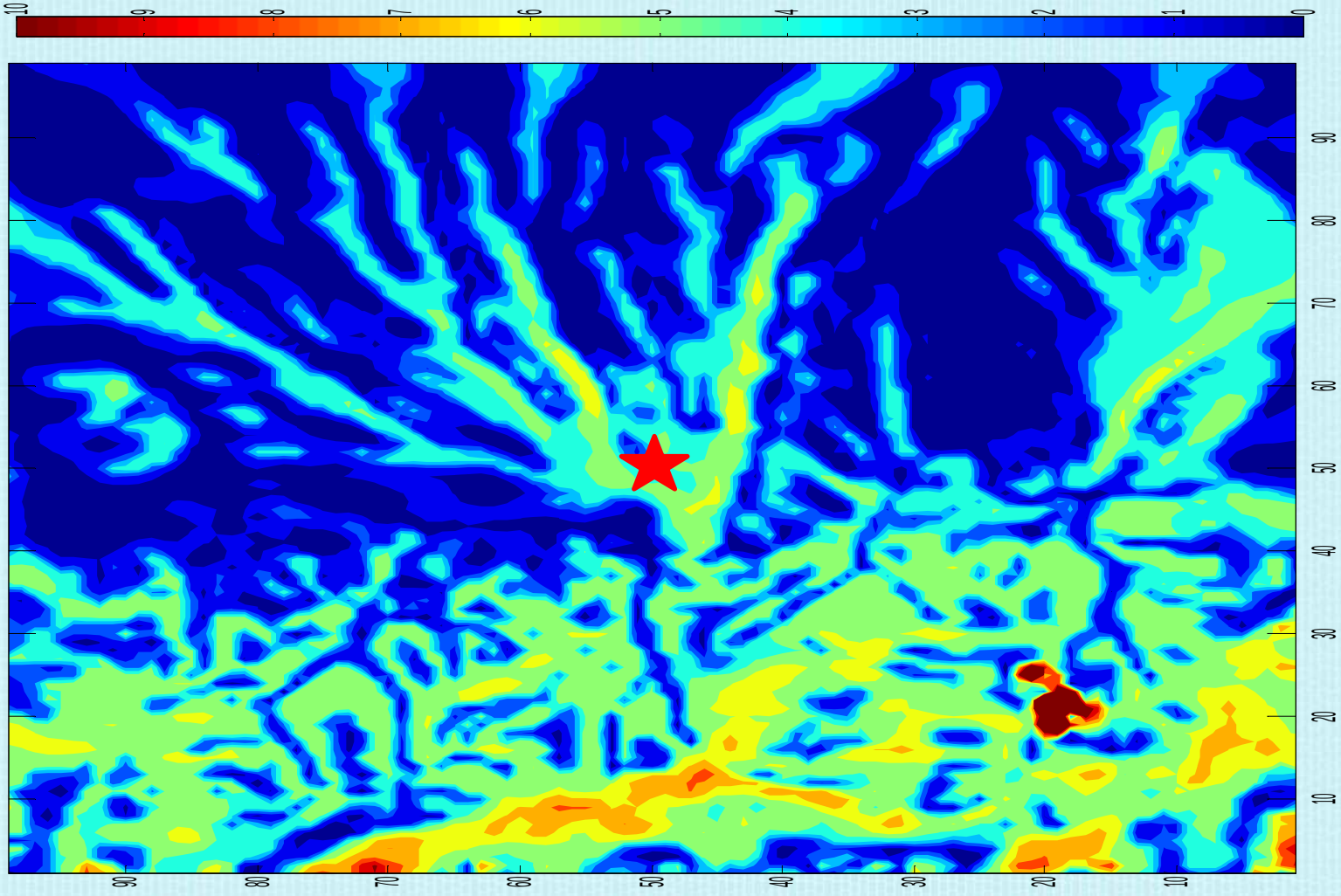


Secondary slide

THANKS!

carlosromancascon@uc

WIND FROM WRF



Secondary slide

WRF CONFIGURATION

- 3 two-way nested domains (9, 3, 1 km)
- 50 vertical levels, NCEP data (1º)
- PBL → YSU
- SFC → MM5 sim.
- L-S → Noah (USGS)
- MP → WRF SM3-class
- SW & LW → Dudhia & RRTM

Secondary slide