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# Structure of a wind field in stably stratified atmospheric boundary layer: results of numerical modeling

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# Study Motivation

1. INITIAL OSCILLATION AS APPEARANCE CROSS-ISOBARIC FLOW

2. LOW LEVEL JET

# Low Level Jet: Computational Experiment

➔The boundary layer is driven by an imposed geostrophic wind, with a specified surface cooling rate.

→ A vertical domain of 400 m is used, with a grid mesh of 6.25m (64 vertical levels), and a timestep of 2.5 s.

→ A constant geostrophic wind with height, of 8 m/s in the x-direction, is prescribed.

→ The initial potential temperature equals 265 K up to 100 m, and then it increases at a rate of 0.01 K/m until the domain top, where a value of 268 K is reached.

➔Surface boundary conditions:

→ The turbulent values are computed using the MOST according to the noniterative procedure of Louis (1979)

→ <u>The surface temperature is decreasing at a constant rate of 0.25 K/h.</u>

# CROSS-ISOBARIC FLOW AND INITIAL OSCILLATION

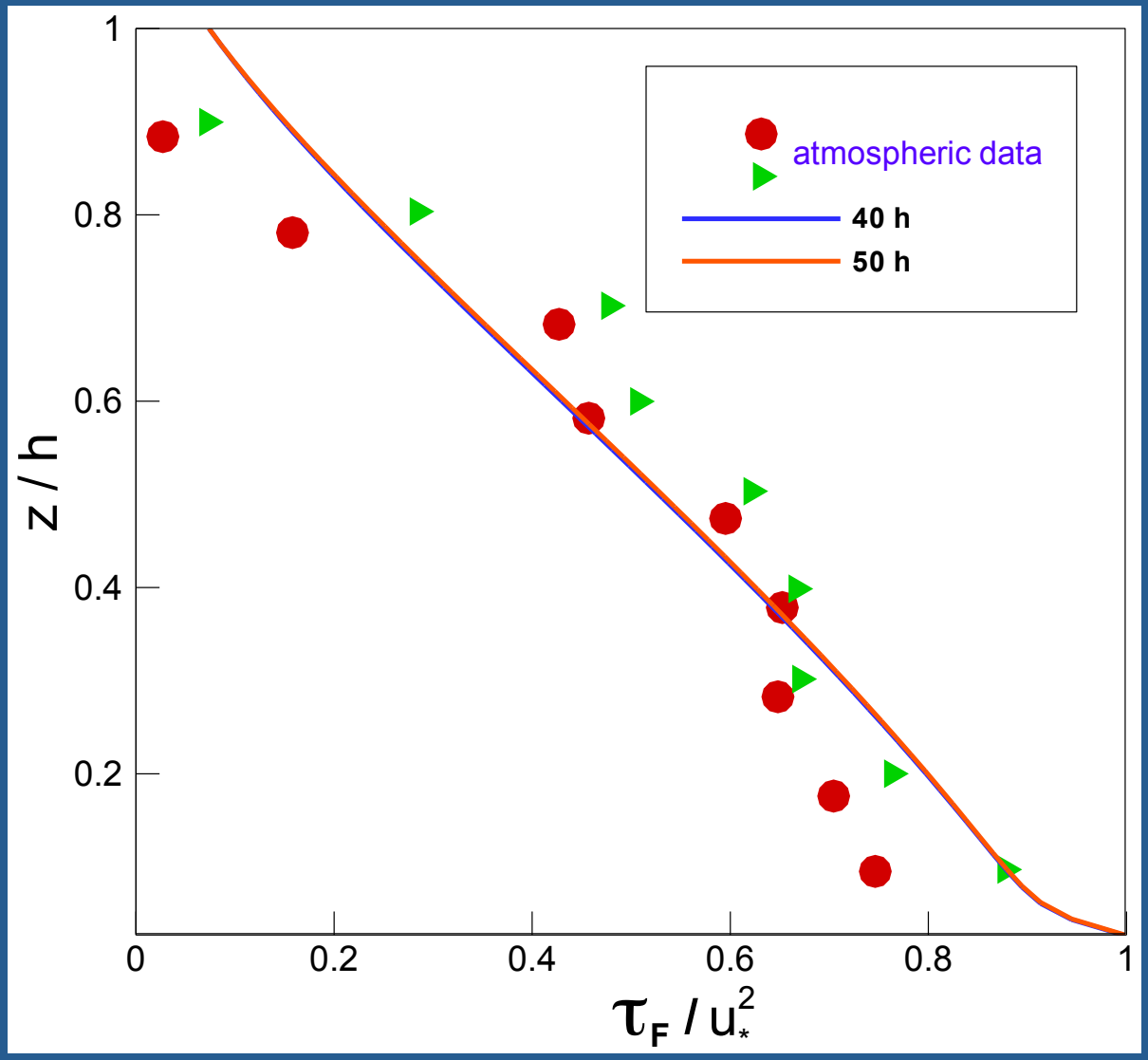
$$\frac{dU}{dt} = f(V - V_g) - \frac{\partial \overline{uw}}{\partial z} \quad (1)$$

$$\frac{dV}{dt} = -f(U - U_g) - \frac{\partial \overline{vw}}{\partial z}, \quad (2)$$

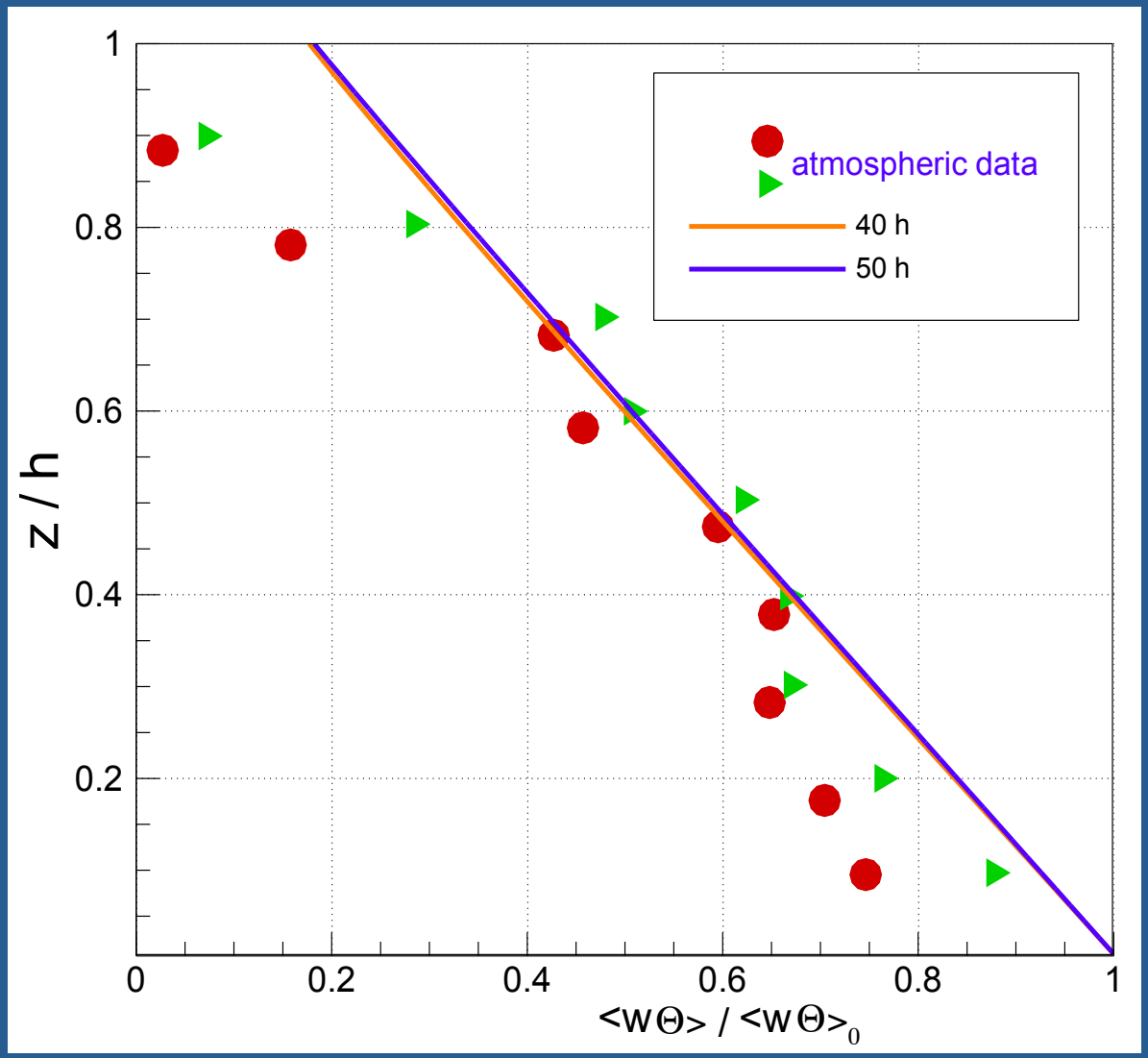
$$fV = \frac{\partial \overline{uw}}{\partial z} \Rightarrow f\int_0^\infty V dz = -(\overline{uw})_0$$

Для диспергирующих атмосферных выбросов требуется аккуратное моделирование поворота ветра в устойчиво стратифицированном атмосферном пограничном слое. Важную роль для распространения загрязнений имеет направленный сдвиг ветра в нижних слоях атмосферы. Поэтому важно, чтобы модели корректно воспроизводили величину кросс-изобарического (агеострофического) течения вместе с толщиной турбулентного слоя. В работе анализируются возможности мезомасштабной модели в определении поворота ветра внутри устойчивого пограничного слоя и проинтегрированной по высоте плотности агеострофического потока массы.

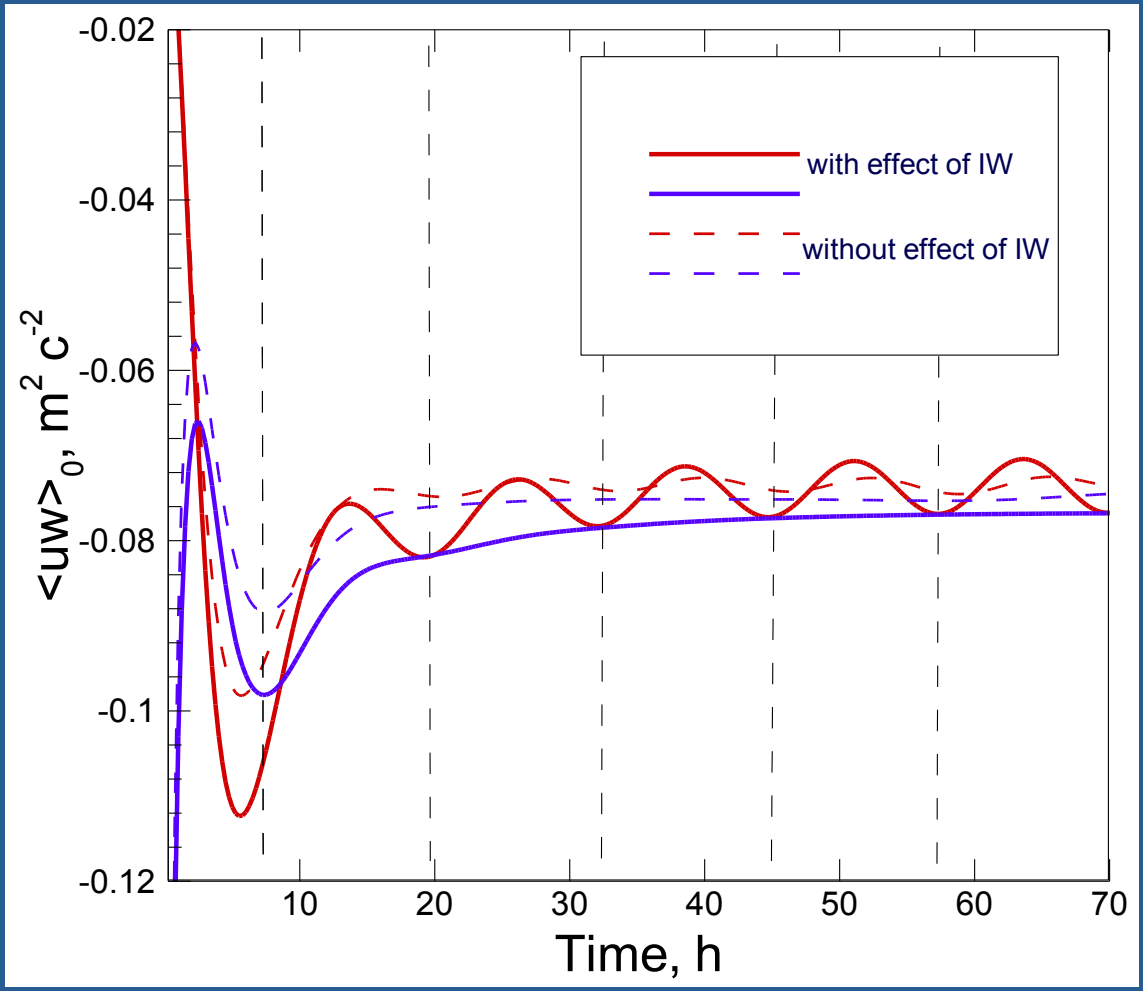
# Turbulent flux of momentum



# Turbulent flux of heat



# INITIAL OSCILLATION
# AS APPEARANCE CROSS-ISOBARIC FLOW

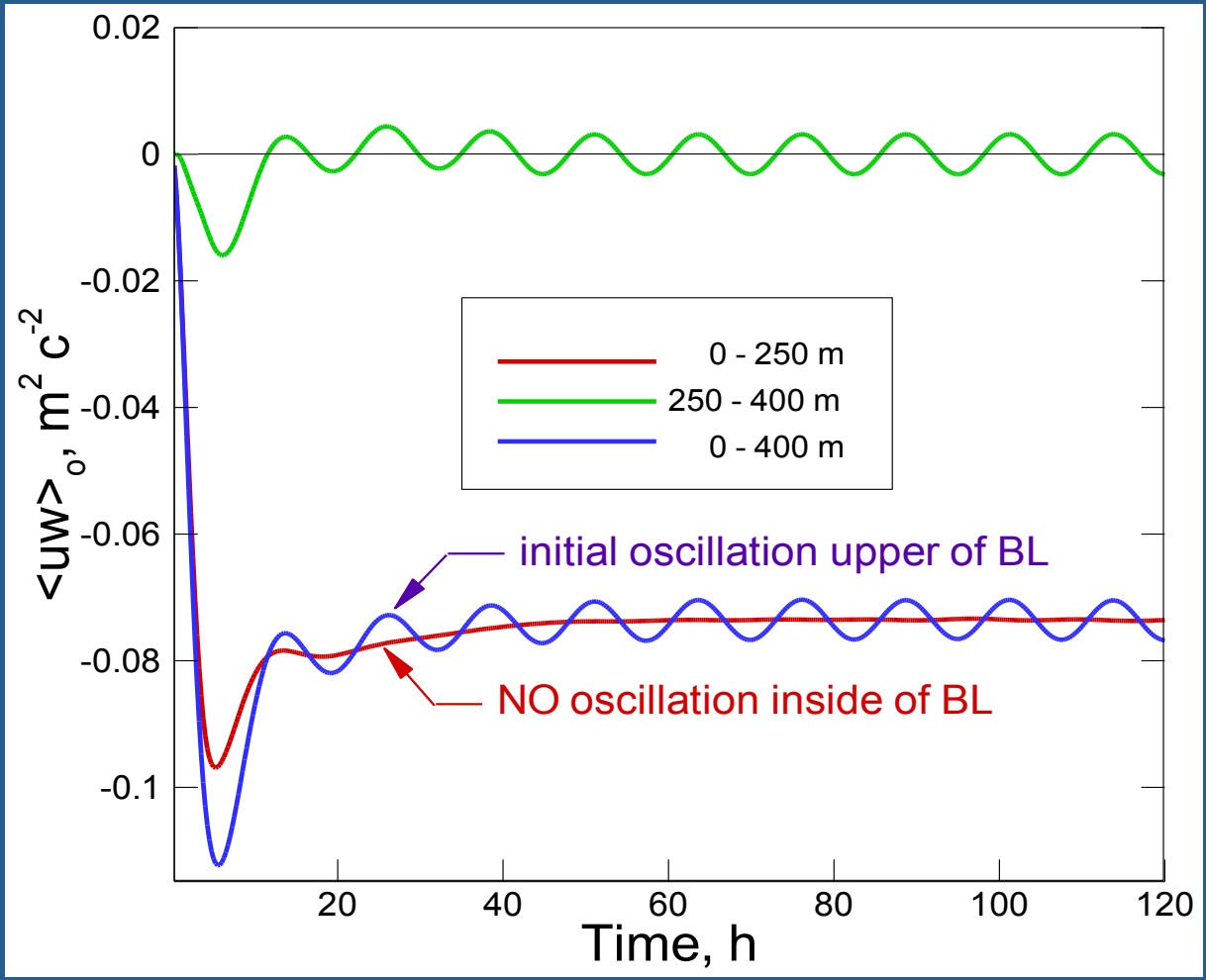



$$fV = \frac{\partial \overline{uw}}{\partial z}$$

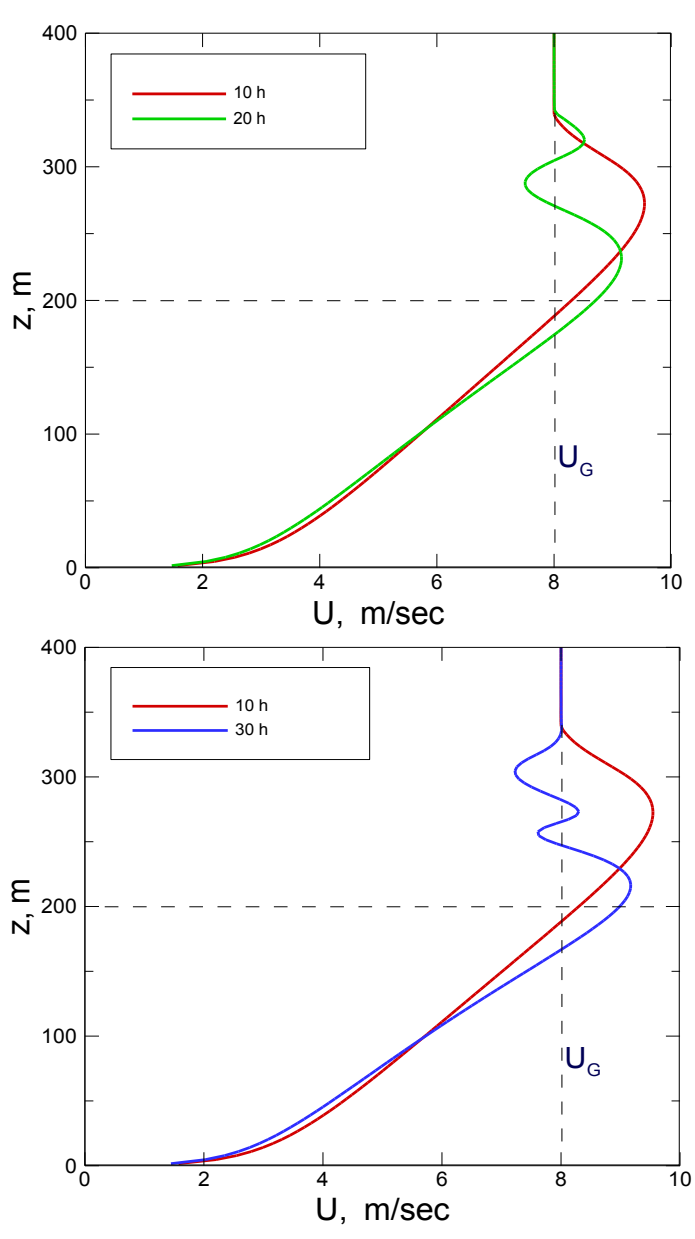
$$\Downarrow$$

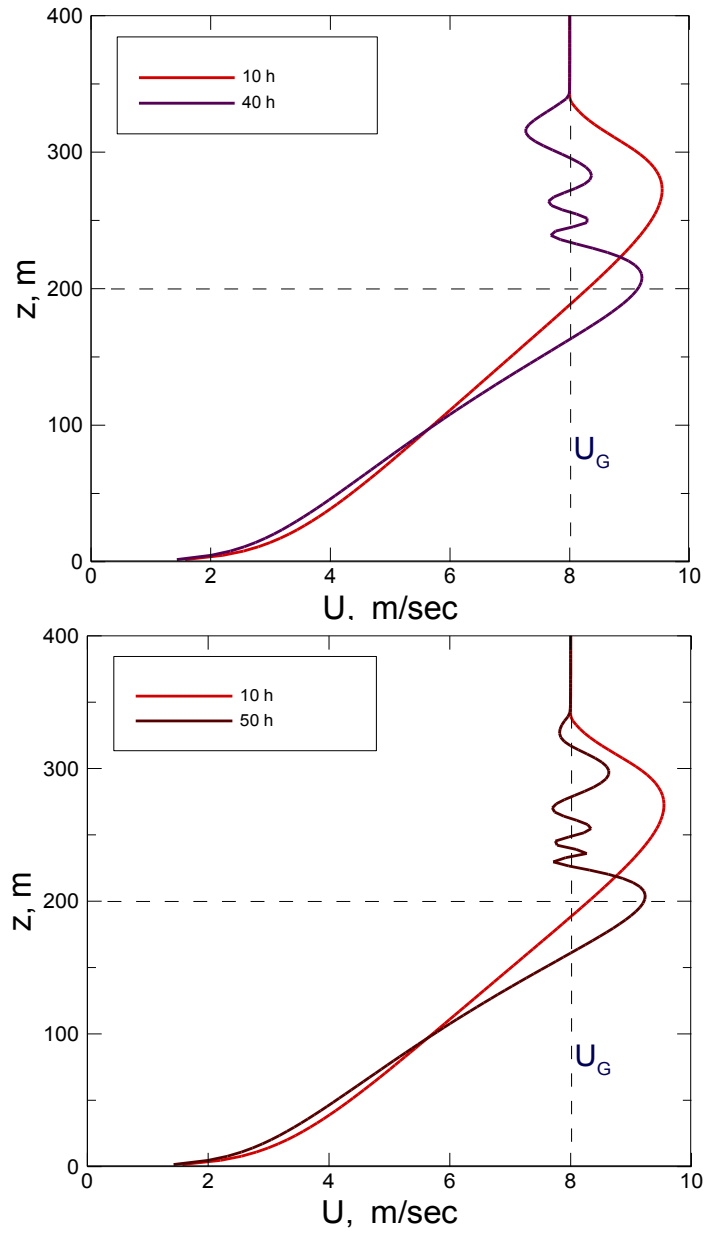
$$f\int_0^{\infty} V dz = -(\overline{uw})_0$$

# INITIAL OSCILLATION
# AS APPEARANCE CROSS-ISOBARIC FLOW



# LOW LEVEL JET AS AND INITIAL OSCILLATION



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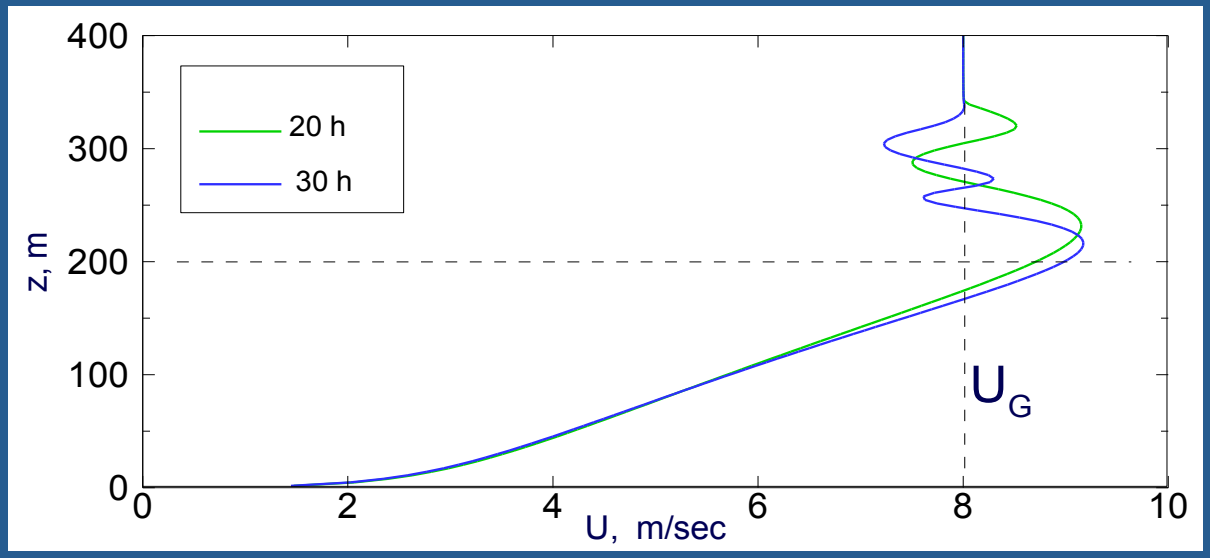


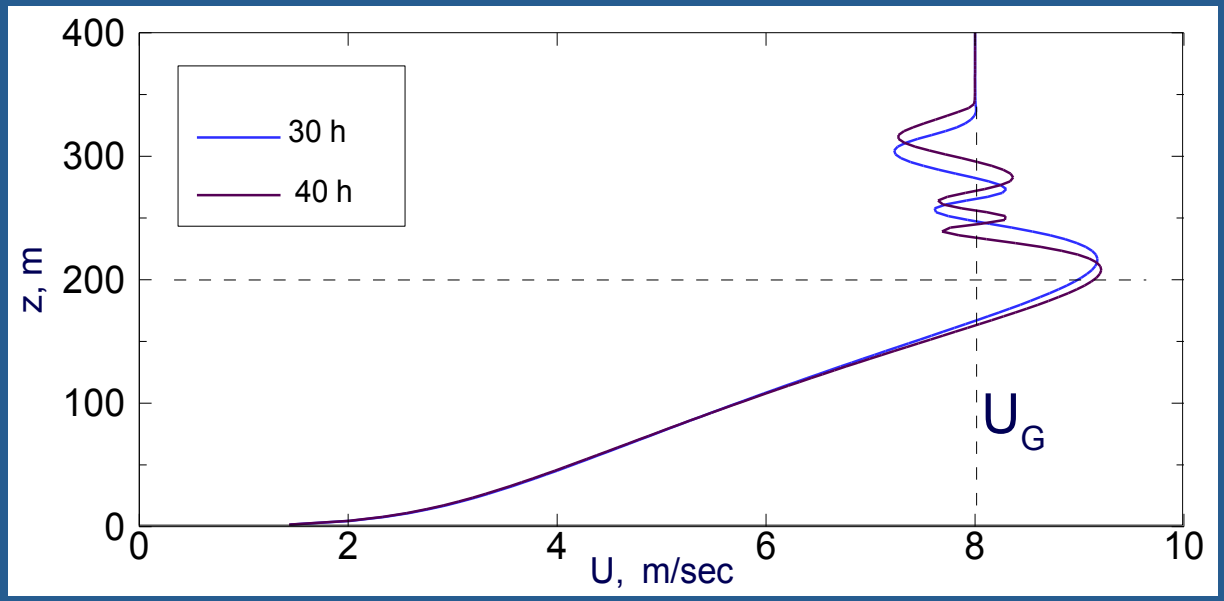

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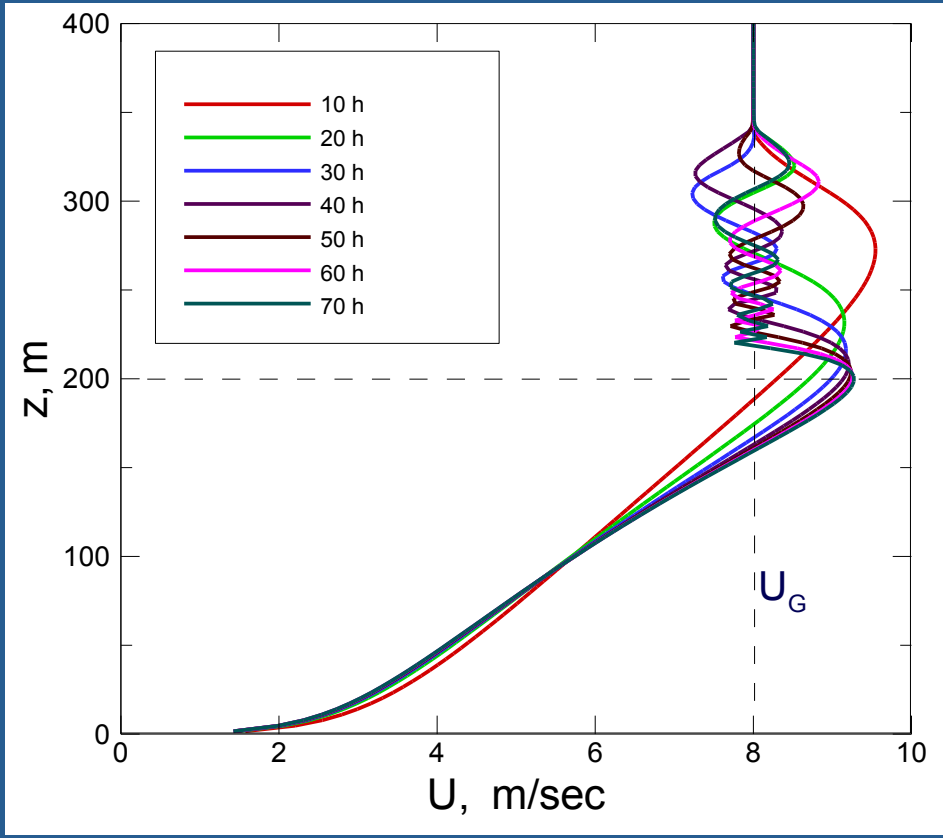


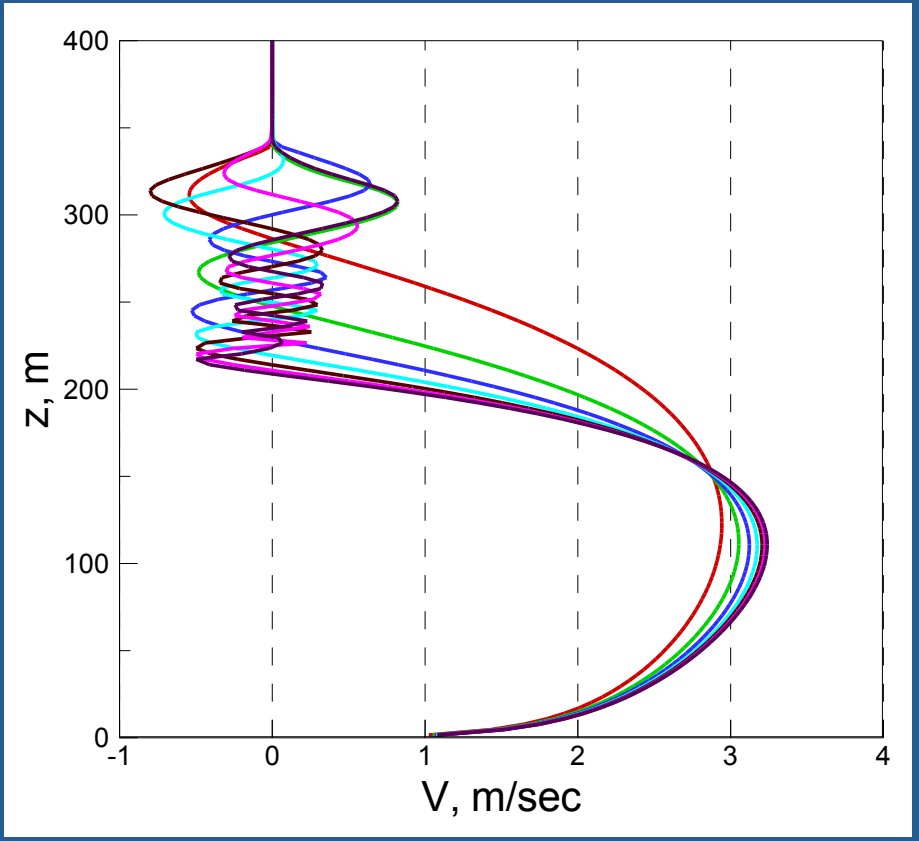

# Thank you
# for your attention