

Direct Numerical Simulation of turbulent canopy flow



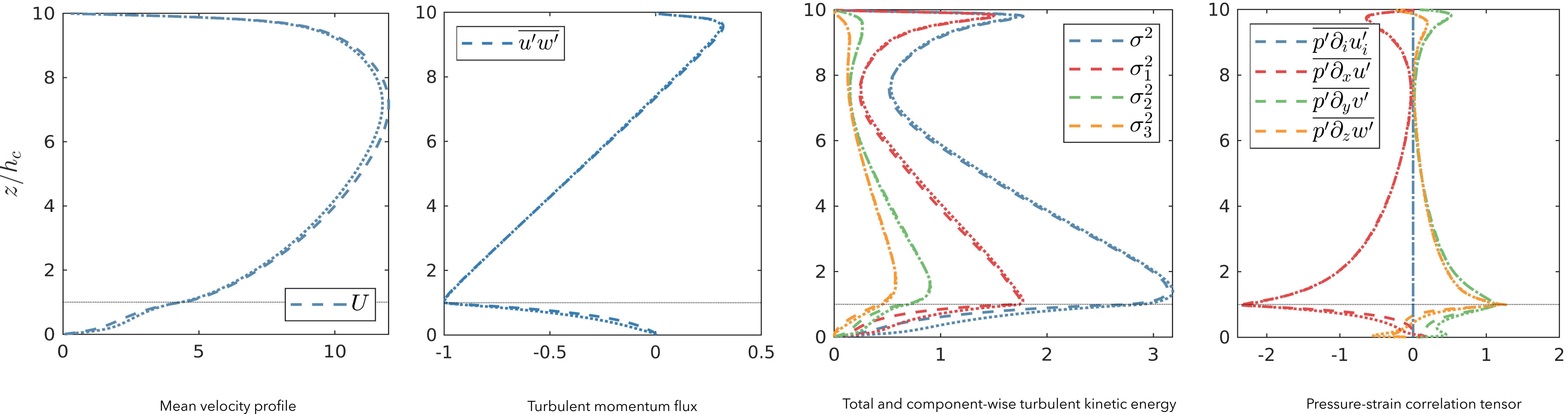
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Computational Domain: Closed channel of size $L_x \times L_y \times L_z$, periodic in x, y directions. Canopy of uniform areal-density profile $a(z)$, with leaf-area index LAI and height h_c , implemented using the Forchheimer drag, on the bottom wall.

L_x	L_y	L_z	h_c	LAI	F (flow rate)	Re
6	4	1	0.1	0.8	1	5,600 – 40, 000

Forchheimer Drag (a) based on total velocity $\mathbf{F}_d^{\text{nl}}(\mathbf{r}) = C_d a(z) |\mathbf{u}(\mathbf{r})| \mathbf{u}(\mathbf{r})$ (dashed -- lines),
(b) based on filtered velocity $\mathbf{F}_d^{\text{l}}(\mathbf{r}) = C_d a(z) |\mathbf{U}(z)| \mathbf{u}(\mathbf{r})$ (dotted : lines),
where $\mathbf{u}(\mathbf{r})$ is the velocity field at position $\mathbf{r}$, and $\mathbf{U}(z)$ is the z -dependent mean velocity field.



Mean velocity profile

Turbulent momentum flux

Total and component-wise turbulent kinetic energy

Pressure-strain correlation tensor