Dataset description

Turbulent Ekman flow with cubic small-scale surface roughness under stable stratification ($Re_D = 1000$, $Ri_\Lambda = [0, \dots, 256]$)

 $(100D 1000, 100K [0, \dots, 200])$

Direct numerical simulation - Set-up and vertical profiles

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1 Metadata

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Collection This dataset is part of the collection *Turbulent wall-bounded flow*³.

The collection is freely available and hosted by Refubium, the institutional repository of Freie Universität Berlin.

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HPC systems The data was generated under the project TrainABL on the supercomputer HAWK at Höchstleistungsrechenzentrum Stuttgart (HLRS, in Germany).

Code The data was generated by the tool-suite for turbulence simulation $tLab^4$.

Related Publication

10.1017/jfm.2024.542

2 The dataset

2.1 Physical setting

The physical case corresponds to stratified Ekman flow over a rough surface. The canonical flow configuration is characterized by four parameters: the geostrophic wind vector $\mathbf{G} = (G_1, G_2, 0)^T$ (with the magnitude $G = \sqrt{G_1^2 + G_2^2}$, rotated here by $\approx 18.1^\circ$ w.r.t. the coordinate direction O_x), the constant kinematic fluid viscosity ν , the Coriolis parameter f, and the buoyancy difference B_0 between the wall and free stream. The Rossby radius $\Lambda = G/f$ is the length scale implied for this choice of parameters. The flow is then governed by two

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⁴github.com/turbulencia/tlab

Case (ID)	Ri_{Λ}	Ri_B	Grid	$t_{\rm start}^-[1/f]$	$t_{\rm end}^-[1/f]$	$\Delta t_{\rm sim}^-[1/f]$	#iterations
N	0	0.000	А	64.96	66.02	1.06	29500
S001	1	0.073	А	66.02	66.61	0.58	16000
S002	2	0.147	А	66.61	67.06	0.44	11800
S004	4	0.293	А	67.06	67.78	0.71	17800
S005	5	0.367	А	67.78	68.26	0.48	11800
S008	8	0.587	А	68.26	69.02	0.74	17800
S012	12	0.880	А	69.02	69.53	0.51	11800
S016	16	1.174	А	69.53	69.98	0.44	10300
S020	20	1.467	А	69.98	70.38	0.39	8800
S032	32	2.348	А	70.38	70.84	0.45	9800
S042	42	3.081	А	70.84	71.40	0.55	11800
S064	64	4.695	А	71.40	71.84	0.43	8800
S128	128	9.390	А	71.84	72.32	0.48	8800
S128P	128	9.390	В	72.32	74.27	1.95	40600
S192P	192	14.086	В	73.49	74.46	0.97	19000
S256P	256	18.781	В	73.49	75.68	2.19	41400

Table 1: Simulations cases of this dataset. Time in eddy-turnover times f^{-1} ; t_{start}^- start, t_{end}^- end and Δt_{sim}^- total simulation time of the cases. #iterations is the total number of Runge–Kutta time-integration steps used for integration of the problem over the respective time span.

dimensionless numbers, since the molecular Prandtl number Pr = 1, i.e. the kinematic diffusivity equals the viscosity, and the Rossby number Ro = 1. The Reynolds number Re and the Froude number Fr are given as (for comparison, the scaled bulk Richardson number Ri_B)

$$Re_{\Lambda} = \frac{G\Lambda}{\nu}, \quad Fr_{\Lambda} = \frac{G^2}{B_0\Lambda} = Ri_{\Lambda}^{-1} \quad \text{and} \quad Ri_B = \frac{B_0\delta_{\text{neutral}}}{G^2}.$$
 (1)

The small-scale surface roughness at the lower domain boundary is given in the file geometry2d.nc and is identical for all cases: 56×56 square blocks with a uniform height and width distribution. It also features identical statistical properties as case r3 in the study 10.1017/jfm.2024.542, but corresponds to a realization on a grid with slightly higher resolution / smaller grid spacing.

2.2 Simulation cases

This dataset contains 16 simulation cases which are driven by the same large-scale forcing and exposed to a rough surface. Members of the parametric set of simulations differ by stable density stratification, which is imposed via a Dirichlet boundary condition (viz. constant temperature difference between upper and lower domain boundary). The cases are listed in Tab. 1 and labelled by their ID (N, S001,..., S128, ..., S256P) according to the stratification measured by the Richardson number Ri_{Λ} ; N stands for neutral stratification, S for stable. The simulations were carried out sequentially in time starting from the neutral case N, a suffix P indicates three concurrent runs for very stable stratification (S128P, S192P, S256P).

Here the bulk Richardson number Ri_B is evaluated based on the boundary layer thickness

of the neutrally stratified case N such that it does not evolve over the course of simulation. The choice of $Re_{\Lambda} = 5 \cdot 10^5$ corresponds to $Re_D = 1000$ ($Re_D = DG/\nu$, with the laminar Ekman-layer depth $D = \sqrt{2\nu/f}$) and a friction Reynolds number $Re_{\tau} \approx 2700$ for the neutrally stratified case. Two computational grids are used: (A) $N_{xz} \times N_y = 3840^2 \times 704$, (B) $3840^2 \times 576$ with similar spatial resolution of approximately $\Delta(xz)_N^+ \times \Delta y_{N,\text{wall}}^+ = 2.6^2 \times 1.0$ wall units and a domain size in terms of the Rossby radius of $(L_{xz} \times L_y)/\Lambda^3 = 0.27^2 \times 0.26$ for grid (A), and $0.27^2 \times 0.11$ for grid (B).

2.3 Contents of the dataset

This dataset holds the two metadata files

- Data_Description_Re1000_rough_stable.pdf (this file) containing the data set description in portable document format (PDF),
- geometry2d.nc, which holds the geometry of all cases in the form of a two-dimensional horizontal plane where the height of obstacles in grid cells from the ground level is given.

For the set of 16 simulations, the primary data are given in namelist files in ASCII format (denoted by suffix .ini) as required by the tool suite tLab (for details, the reader is referred to the documentation of the open-source code available under github.com/turbulencia/tlab). The actual statistical data are provided in the network common data format self-documenting file type (netCDF) and denoted by the suffix .nc. The naming convention for the set of 16 simulations is as follows:

 $ri\langle ri\rangle_re\langle re\rangle_\langle nx\rangle x\langle ny\rangle x\langle nz\rangle_\langle date\rangle_\langle case\rangle_\langle type\rangle.$ (suffix)

For example ri00.00_re1000_3840x0704x3840_20231206_n_avg.nc, where

- $\langle \mathrm{ri} \rangle$ is the Richardson number $Ri_{\Lambda} = G\Lambda/B_0$,
- $\langle \text{re} \rangle$ the Reynolds number $Re_D = GD/\nu$ with $D = \sqrt{2\nu/f}$, the Ekman layer depth scale
- $\langle nx \rangle$ the number of grid points in direction of Ox (similar for $\langle ny \rangle$, $\langle nz \rangle$)
- (date) the start date of the simulation on the HPC cluster in the format YYYYMMDD.
- (case) the case identifier used in the corresponding paper, indicating the bulk stability.
- (type) the type of data, either avg1s for scalar statistics, avg for flow statistics, and
- (suffix) is the file suffix indicating the file type (.ini for primary data / .nc for statistics)

2.4 Variable information

The statistical data is available in self-documented netCDF format, and it contains a wide array of parameters, encompassing vertical profiles of velocity and scalar variables (temperature/buoyancy as active and for some cases also passive scalars), scalar and momentum budget terms, as well as statistical moments up to the fourth order of velocities, scalars, and derivatives. These parameters provide a comprehensive perspective on Ekman flow dynamics. They are organized into distinct groups. Within the subsequent table, you will find numerous variables grouped together, accompanied by their descriptions and associated equations. In order to fully describe the geometry of the surface roughness, there is a horizontal domain slice in netCDF format, that describe the positions and heights of the roughness elements in grid points.

Vertical profiles flow

rR rU	Mean density (RA) u, x-component of the velocity (RA)	$\frac{\overline{ ho}}{\overline{u}}$
rV rW rP	v, y-component of the velocity (RA) w, z-component of the velocity (RA) π dynamic, reduced pressure (RA)	$rac{\overline{v}}{\overline{w}}$ $\overline{\pi}$
rT re rh	T, caloric temperature (RA) e, internal energy (RA) h, enthalpy (RA)	$\frac{\overline{T}}{\overline{e}} = \frac{1}{e + (\Gamma_0 - 1)Ma^{2\overline{P}}}$
rs rB	s, entropy (RA) B, buoyancy (RA)	$\frac{\overline{s}}{\overline{B}}$
fV fW	v, y-component of the velocity (FA) w, z-component of the velocity (FA) w, z-component of the velocity (FA)	$\begin{array}{c} \langle u \rangle \\ \langle v \rangle \\ \langle w \rangle \end{array}$
fT fe fh	 T, caloric Temperature (FA) e, internal energy (FA) h, enthalpy (FA) 	$ \begin{array}{l} \langle T \rangle \\ \langle e \rangle \\ \left\langle e + (\Gamma_0 - 1) M a^2 \frac{p}{a} \right\rangle \end{array} $
fs	s, entropy (FA) Fluctuations	$\langle s \rangle$
Tke Rxx	turbulence kinetic energy Reynolds stress R_{11}	$\frac{\overline{\frac{1}{2}u_i'u_i'}}{\underline{u'u'}}$
Ryy Rzz Rxy	Reynolds stress R_{22} Reynolds stress R_{33} Reynolds stress R_{12}	$\frac{v'v'}{w'w'} \frac{w'w'}{u'v'}$
Rxz Ryz rP2	Reynolds stress R_{13} Reynolds stress R_{23} pressure fluctuation (BA)	$\frac{\overline{u'w'}}{\overline{v'w'}}$
rR2 rT2	density fluctuation (RA) temperature fluctuation (RA)	$\frac{\pi \pi}{\rho' \rho'} \frac{1}{T'T'}$
fT2 re2 fe2	temperature fluctuation (FA) internal energy fluctuation (RA) internal energy fluctuation (FA)	$\frac{\langle T'T' \rangle}{e'e'} \\ \langle e'e' \rangle$
rh2 fh2 rs2	enthalpy fluctuation (RA) enthalpy fluctuation (FA) entropy fluctuation (RA)	$\overline{h'h'} \ \langle h'h' angle \ \overline{s's'}$
fs2	entropy fluctuation (FA) DerivativeFluctuations	$\langle s's' \rangle$
U_y1 V_y1 W_y1		$\frac{\overline{\partial_y u}}{\overline{\partial_y v}}$
U_ii2 U_x2		$\overline{(\partial_x u')^2}$
U_y2 U_z2 V_x2		$\frac{\overline{(\partial_y u')^2}}{\overline{(\partial_z u')^2}}$
V_y2 V_z2		$\frac{\frac{(\partial_x v')}{(\partial_y v')^2}}{(\partial_z v')^2}$
W_x2 W_y2 W_z2		$\frac{(\partial_x w')^2}{(\partial_y w')^2} \\ \frac{(\partial_x w')^2}{(\partial_x w')^2}$
U_x3 U_y3		$\frac{\frac{(\partial_z u')}{(\partial_x u')^3}}{\frac{(\partial_y u')^3}{(\partial_y u')^3}}$
U_z3 V_x3 V_v3		$\frac{(\partial_z u')^3}{(\partial_x v')^3} \\ \overline{(\partial_v v')^3}$
V_z3 W_x3		$\frac{\frac{(\partial_y v')}{(\partial_z v')^3}}{(\partial_x w')^3}$
W_y3 W_z3 U_x4		$rac{(\partial_y w')^3}{(\partial_z w')^3} \ rac{(\partial_v w')^3}{(\partial_v w')^4}$
U_y4 U_z4		$\frac{\overline{(\partial_x u')^4}}{\overline{(\partial_z u')^4}}$
V_x4 V_y4 V_z4		$\frac{(\partial_x v')^4}{(\partial_y v')^4} \\ \overline{(\partial_z v')^4}$
W_x4 W_y4 W_z4		$\frac{\overline{(\partial_x w')^4}}{\overline{(\partial_y w')^4}}$
W-Z4	Vorticity	$(O_z W')^{\mathbf{x}}$
w x Wy Wz	vorticity (x-component) vorticity (y-component) vorticity (z-component)	$\frac{\partial_z v - \partial_y w}{\partial_x w - \partial_z u} \\ \frac{\partial_y u - \partial_x v}{\partial_y u - \partial_x v}$
Wx2 Wy2 Wz2	fluctuation of x-Vorticity fluctuation of y-Vorticity fluctuation of z-Vorticity	$\frac{\partial_z v' - \partial_y w'}{\partial_x w' - \partial_z u'} \\ \frac{\partial_y w' - \partial_y w'}{\partial_y u' - \partial_y v'}$
Rxx_t	time-rate of change of R	$\overline{\partial_t R_{11}}$
Bxx Cxx Pro-	buoyancy production advection in y-direction	$\frac{2b_x \overline{u'B'}}{-\overline{v}} \frac{\partial_y \overline{u'u'}}{\partial_y \overline{u'u'}} = -\frac{\partial_y \overline{u'u'}}{\partial_y \overline{u'u'}}$
Pxx Exx PIxx	shear-production viscous dissipation pressure-velocity correlation Π_{11}	$-2 \ u'v' \ \partial_y \overline{u}$ $2 \ \overline{u'p'}$
Fxx Txxy_y T	Coriolis production divergence of T_{112} turbulent transport vertical transport T	$\frac{2f_y \overline{u'w'}}{\partial_y R_{112}}$
Gxx Dxx	vertical transport I_{112} pressure variable-density term viscous variable-density term	$\frac{u'u'v'-2\nu\partial_y(u-\langle u\rangle)}{0}$
Ryy_t	RyyBudget time-rate of change of R_{22}	$\overline{\partial_t R_{22}}$
Вуу Суу Руу	buoyancy production of Ryy advection in y-direction shear production	$\frac{2b_y v' B'}{\overline{v} \ \partial_y \overline{v' v'}} \\ -2\overline{v' v'} \partial_y \overline{v}$
Eyy PIyy Fyy	viscous dissipation pressure–velocity correlation Π_{22} Coriolis production	$2\overline{v'p'}$
Tyyy_y Tyyy	divergence of T_{222} turbulent transport vertical transport T_{222}	$\frac{\partial_y R_{222}}{v'v'v'} + 2\overline{v'p'} - 2\nu \overline{(\partial_y v)(v - \langle v \rangle)}$
Dyy	viscous variable-density term RzzBudget	2(<i>t</i> -(<i>t</i>)) <i>byp</i>
Deg t		
Rzz_t Bzz	time-rate of change of R_{33} buoyancy production	$\frac{\partial_t R_{33}}{\partial z w' B'}$
Rzz_t Bzz Czz Pzz Ezz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation	$ \begin{array}{c} \overline{\partial_t R_{33}} \\ 2b_z \overline{w' B'} \\ -\overline{v} \ \overline{\partial_y} \ \overline{w' w'} \\ -2\overline{v' w'} \overline{\partial_y} \ \overline{w} \end{array} $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy_y	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport	$ \begin{array}{c} \overline{\partial_t R_{33}} \\ 2b_z \overline{w'B'} \\ -\overline{v} \ \overline{\partial_y} \ \overline{w'w'} \\ -2\overline{v'w'} \overline{\partial_y} \ \overline{w} \end{array} \\ 2\overline{w'p'} \\ -2f_y \overline{u'w'} \\ \overline{\partial_y R_{332}} \end{array} $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy_y Tzzy Gzz Dzz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term	$ \begin{array}{l} \overline{\partial_t R_{33}} \\ 2b_z \overline{w'B'} \\ -\overline{v} \ \overline{\partial_y} \ \overline{w'w'} \\ -2\overline{v'w'} \overline{\partial_y} \ \overline{w} \\ \end{array} \\ 2\overline{w'p'} \\ -2f_y \overline{u'w'} \\ \overline{\partial_y R_{332}} \\ \overline{w'w'v'} - 2\nu \overline{(\partial_y w)(w - \langle w \rangle)} \\ 0 \end{array} $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy_y Gzz Dzz Rxy_t	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term time-rate of change of R_{12}	$ \frac{\partial_t R_{33}}{2b_z w' B'} \\ -\overline{v} \ \partial_y \ \overline{w'w'} \\ -2\overline{v'w'} \partial_y \ \overline{w} \\ 2\overline{w'p'} \\ -2f_y \overline{u'w'} \\ \partial_y R_{332} \\ \overline{w'w'v'} - 2\nu \overline{(\partial_y w)(w - \langle w \rangle)} \\ 0 $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy_t Bxy Cxy Pxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term RxyBudget time-rate of change of R_{12} buoyancy production advection in y-direction shear production	$ \frac{\partial_t R_{33}}{2b_z \overline{w'B'}} \\ -\overline{v} \ \partial_y \ \overline{w'w'} \\ -2\overline{v'w'} \partial_y \ \overline{w} \\ 2\overline{w'p'} \\ -2f_y \overline{u'w'} \\ \frac{\partial_y R_{332}}{\overline{w'w'v'} - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} \\ 0 \\ \overline{\partial_t R_{12}} \\ b_x \overline{u'B'} + b_y \overline{v'B'} \\ -\overline{v} \partial_y \overline{u'v'} \\ -\overline{u'v'} \partial_y \overline{v} - \overline{v'v'} \ \partial_y \overline{u} \\ $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy PIxy Exy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Ryy	$ \frac{\partial_{t}R_{33}}{2b_{z}\overline{w'B'}} \\ -\overline{v} \ \partial_{y} \ \overline{w'w'} \\ -2\overline{v'w'}\partial_{y} \ \overline{w} \\ 2\overline{w'p'} \\ -2f_{y}\overline{u'w'} \\ \frac{\partial_{y}R_{332}}{w'w'v' - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle)} \\ 0 \\ \overline{\partial_{t}R_{12}} \\ b_{x}\overline{u'B'} + b_{y}\overline{v'B'} \\ -\overline{v}\partial_{y}\overline{u'v'} \\ -\overline{w'v'}\partial_{y}\overline{v} - \overline{v'v'} \ \partial_{y}\overline{u} \\ \overline{p'} (\frac{\partial_{y}u}{\partial_{y}u} - \partial_{x}v) \\ f \ \frac{d}{d_{x}w'} \\ \frac{\partial_{y}}{\partial_{y}w'} \\ \frac{\partial_{y}}{\partial$
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Pxy Exy PIxy Fxy Txyy-y Txyy-y Txyy Cxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term RxyBudget time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122}	$ \frac{\partial_t R_{33}}{2b_z \overline{w'B'}} \\ -\overline{v} \ \partial_y \ \overline{w'w'} \\ -2v'w' \partial_y \ \overline{w} \\ 2\overline{w'v'} \\ 2\overline{w'w'} \\ \frac{\partial_y R_{332}}{w'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} \\ 0 \\ \frac{\overline{\partial_t R_{12}}}{v'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} \\ 0 \\ \frac{\overline{\partial_t R_{12}}}{v'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} \\ \frac{\overline{\partial_t R_{12}}}{p'(\overline{\partial_y u} - \partial_x v)} \\ f_y \overline{v'w'} \\ \frac{\partial_y R_{122}}{w'v'v' + w'p'} \\ (\overline{w} - \langle w \rangle) \partial_z \ \overline{w} \\ $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Pixy Fxy Fxy Txyy-y Txyy-y Txyy Gxy Dxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term $\mathbf{RxyBudget}$ time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of \mathbf{Rxy} divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term	$ \frac{\partial_t R_{33}}{2b_z \overline{w'B'}} \\ -\overline{v} \ \partial_y \ \overline{w'w'} \\ -2\overline{v'w'}\partial_y \ \overline{w} \\ \frac{2\overline{w'p'}}{-2f_y \overline{u'w'}} \\ \frac{\partial_y R_{332}}{\overline{w'w'v'} - 2\nu \overline{(\partial_y w)(w - \langle w \rangle)}} \\ 0 \\ \frac{\overline{\partial_t R_{12}}}{0} \\ \frac{\overline{\partial_t R_{12}}}{-\overline{v}\partial_y \overline{u'v'}} \\ -\overline{u'v'}\partial_y \overline{v} - \overline{v'v'} \ \partial_y \overline{u} \\ \frac{\overline{p'}(\partial_y u - \partial_x v)}{f_y \overline{v'w'}} \\ \frac{\partial_y R_{122}}{\overline{u'v'v'} + \overline{u'p'}} \\ (\overline{u} - \langle u \rangle) \partial_y \overline{p} \\ \end{array} $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Pixy Fxy Txyy-y Txyy-y Txyy-y Txyy Gxy Dxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term	$ \frac{\partial_t R_{33}}{2b_z \overline{w'B'}} \\ -\overline{v} \ \partial_y \ \overline{w'w'} \\ -2\overline{v'w'}\partial_y \ \overline{w} \\ 2\overline{w'p'} \\ -2f_y \overline{u'w'} \\ \frac{\partial_y R_{332}}{w'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} \\ 0 \\ \frac{\partial_t \overline{R_{12}}}{b_x \overline{u'B'} + b_y \overline{v'B'}} \\ -\overline{v}\partial_y \overline{u'v'} \\ -\overline{u'v'}\partial_y \overline{v} - \overline{v'v'} \ \partial_y \overline{u} \\ \frac{\partial_f R_{122}}{u'v'v' + u'p'} \\ (\overline{u} - \langle u \rangle)\partial_y \overline{p} \\ \frac{\partial_t \overline{R_{13}}}{b_x \overline{u'B'} + b_z \overline{u'B'}} \\ -\overline{v} \ \partial \overline{u'w'} \\ \frac{\partial_t \overline{R_{13}}}{v'w'} \\ -\overline{v} \ \partial \overline{u'w'} \\ \frac{\partial_t \overline{w'w'}}{w'} \\ \frac{\partial_t \overline{w'w'}}{w$
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Pixy Fxy Txyy-y Txyy-y Txyy-y Txyy-y Txyy-y Txyy-y Txyy-y Txyy-y Txyy-y Txyz Exz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term RxyBudget time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term	$\frac{\partial_t R_{33}}{2b_z \overline{w'B'}} - \overline{v} \frac{\partial_y \overline{w'w'}}{2v'w'\partial_y \overline{w}} = 2\overline{w'p'} - 2f_y \overline{w'w'} \frac{\partial_y R_{332}}{2w'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} = 0$ $\frac{\partial_t R_{12}}{w'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} = 0$ $\frac{\partial_t R_{12}}{2v'v'\partial_y \overline{w} - \overline{v'v'} \partial_y \overline{w}} = \frac{\partial_y R_{122}}{2v'v' + \overline{w'p'}} \frac{\partial_y R_{122}}{2w'v'v' + \overline{w'p'}} \frac{\partial_y R_{122}}{(\overline{u} - \langle u \rangle)\partial_y \overline{p}} = \frac{\partial_t R_{13}}{2w'w'\partial_y \overline{w} - \overline{v'w'} \partial_y \overline{w} - \overline{v'w'} \partial_y \overline{w}} = \frac{\partial_y \overline{w'w'}}{-\overline{w'w'} \partial_y \overline{w} - \overline{v'w'} \partial_y \overline{w}} = \frac{\partial_y \overline{w'w'}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + \frac{\partial_y \overline{w'w'}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + \frac{\partial_y \overline{w'w'}}{2w'w'} + \frac{\partial_y \overline{w'w'}}{2w'w'} + \frac{\partial_y \overline{w}}{2w'w'} + $
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy PIxy Fxy Txyy-y Txyy Gxy Dxy Sxy Dxy Sxy PIxy Fxy Txyy-y Txyy Gxy Dxy Sxy Txyy-y Txyy Sxy Fxy Txyy-y Txyy Sxy Sxy Sxy Sxy Sxy Sxy Sxy Sxy Sxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term	$\frac{\partial_t R_{33}}{2b_z \overline{w'B'}} - \overline{v} \frac{\partial_y \overline{w'w'}}{2v'\overline{w'}} - 2\overline{v'\overline{w'}\partial_y \overline{w}}$ $\frac{2\overline{w'p'}}{-2f_y \overline{w'w'}} - 2\overline{p_y \overline{w'w'}} - \overline{w'\overline{w'}} \partial_y \overline{w} - \overline{v'\overline{v'}} \partial_y \overline{w}$ $\frac{\overline{\partial_t R_{12}}}{\overline{p'} (\overline{\partial_y u} - \partial_x v)} - \overline{f_y \overline{v'w'}} - \overline{w_y \overline{w'}} - \overline{w'\overline{w'}} \partial_y \overline{p}$ $\frac{\overline{\partial_t R_{13}}}{\overline{p'} (\overline{u} - \langle u \rangle) \partial_y \overline{p}}$ $\frac{\overline{\partial_t R_{13}}}{\overline{p'} (\overline{\partial_z u} - \overline{\partial_x w})} - \overline{v'\overline{w'}} \partial_y \overline{w} - \overline{v'\overline{w'}} \partial_y \overline{w}$ $\overline{p'} (\overline{\partial_z u} - \overline{\partial_x w}) - \overline{f_y \overline{w'w'}} - \overline{u'\overline{w'}} \partial_y \overline{w} - \overline{v'\overline{w'}} \partial_y \overline{w}$
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Pixy Fxy Txyy-y Txyy-y Txyy Gxy Dxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term viscous variable-density term vertical transport T_{132} pressure variable-density term viscous variable-density term	$\frac{\partial_t R_{33}}{2b_z \overline{w'B'}} - \overline{v} \frac{\partial_y \overline{w'w'}}{-2\overline{v'w'}\partial_y \overline{w}} = \frac{2\overline{w'p'}}{-2f_y \overline{u'w'}} \frac{\partial_y R_{332}}{\partial_y R_{332}} \frac{\partial_y R_{332}}{\overline{w'w'v'} - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)} = 0$ $\frac{\partial_t R_{12}}{b_x \overline{u'B'} + b_y \overline{v'B'}} - \overline{\overline{v}\partial_y \overline{u'v'}} - \overline{\overline{v'v'}} \frac{\partial_y \overline{u}}{\partial_y \overline{v} - \overline{v'v'}} \frac{\partial_y \overline{u}}{\partial_y \overline{w}} = \frac{\overline{p'}(\overline{\partial_y u} - \partial_x v)}{f_y \overline{v'w'}} \frac{\partial_y R_{122}}{\overline{u'v'v'} + u'p'} (\overline{u} - \langle u \rangle) \partial_y \overline{p}}$ $\frac{\partial_t R_{13}}{b_x \overline{u'B'} + b_z \overline{u'B'}} - \overline{\overline{v}\partial_y \overline{u'w'}} - \overline{\overline{v'w'}} \partial_y \overline{u}$ $\frac{\partial_t R_{13}}{p'(\overline{\partial_z u} - \partial_x v)} \frac{\partial_y \overline{u'w'}}{f_y(\overline{w'w'} - u'u')} \frac{\partial_y R_{132}}{u'w'v'} \frac{\partial_y R_{132}}{\partial_y R_{132}} \partial_y R_{13$
Rzz_t Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy PIxy Fxy Txyy-y Txyy Gxy Dxy	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{322} turbulent transport vertical transport T_{332} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term	$\frac{\partial_t R_{33}}{2b_z w'B'} = \frac{\nabla}{2v'w'\partial_y w'w'} = \frac{\nabla}{2v'w'\partial_y w}$ $\frac{2\overline{w'p'}}{-2f_y w'w'} = \frac{\nabla}{2v(\partial_y w)(w - \langle w \rangle)}$ $\frac{\partial_t R_{12}}{\partial_y R_{332}} = \frac{\nabla}{w'w'v' - 2v(\partial_y w)(w - \langle w \rangle)}$ 0 $\frac{\partial_t R_{12}}{\partial_t w'w'} = \frac{\nabla}{2v(v'\partial_y \overline{v} - v'v')} = \frac{\nabla}{2v(v'\partial_y \overline{v} - v'v')} = \frac{\nabla}{2v(v'\partial_y \overline{v} - v'v')} = \frac{\nabla}{2v(v'v' + u'p')}$ $\frac{\partial_y R_{122}}{(\overline{u} - \langle u \rangle) \partial_y \overline{p}}$ $\frac{\partial_t R_{13}}{\partial_y w'w'} = \frac{\nabla}{2v(w' - u'w')} = \frac{\nabla}{2v(w'v' - u'w')} = \frac{\nabla}{2v(w'v'$
Rzz_t Bzz Czz Pzz Ezz Plzz Fzz Tzzy-y Gzz Dzz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term $\mathbf{RxyBudget}$ time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term	$\frac{\partial_t R_{33}}{2b_z w'B'} = \frac{\nabla}{2v'w'\partial_y w'} = \frac{\nabla}{2v'w'\partial_y w}$ $\frac{2\overline{w'p'}}{-2f_y w'w'} = \frac{2\overline{w'p'}}{-2f_y w'w'} = \frac{\partial_y R_{332}}{\sqrt{w'w'} - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)}$ $\frac{\partial_t R_{12}}{w'w'v' - 2\nu(\overline{\partial_y w})(w - \langle w \rangle)}$ 0 $\frac{\partial_t R_{12}}{-\overline{w'v'}\partial_y \overline{v} - \overline{v'v'} \partial_y \overline{u}}$ $\frac{\overline{p'}(\partial_y u - \partial_x v)}{f_y \overline{v'w'}} = \frac{\partial_y R_{122}}{w'v'v' + w'p'}$ $(\overline{u} - \langle u \rangle)\partial_y \overline{p}$ $\frac{\overline{\partial_t R_{13}}}{f_y (w'w' - u'w')} = \frac{\partial_y \overline{u'w'}}{\partial_y \overline{w} - \overline{v'w'} \partial_y \overline{u}}$ $\frac{\overline{\partial_t R_{132}}}{\frac{\partial_y R_{132}}{w'w'v'}} = \frac{\partial_y R_{132}}{w'w'v'}$ 0
NZZ_L Bzz Czz Pzz Ezz Pizz Fzz Tzzy_y Gzz Dzz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term $\mathbf{RxyBudget}$ time-rate of change of R_{12} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term	$\begin{array}{l} \frac{\partial_{t}R_{33}}{2b_{z}\overline{w'B'}} \\ -\overline{v} \ \overline{\partial_{y}} \ \overline{w'w'} \\ -2\overline{v'w'\partial_{y}} \ \overline{w} \\ \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{u'w'}} \\ \frac{\partial_{y}R_{332}}{w'w'v'-2\nu(\overline{\partial_{y}w})(w-\langle w \rangle)} \\ \\ \frac{\partial_{t}R_{12}}{b_{x}\overline{u'B'}+b_{y}\overline{v'B'}} \\ -\overline{v}\overline{\partial_{y}\overline{u'v'}} \\ -\overline{v}\overline{v'}\overline{\partial_{y}\overline{v}}-\overline{v'v'} \ \partial_{y}\overline{u} \\ \\ \hline p'(\overline{\partial_{y}u}-\partial_{x}v) \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{u'v'v'+u'p'} \\ (\overline{u}-\langle u \rangle)\partial_{y}\overline{p} \\ \\ \hline \\ \hline \\ \frac{\partial_{t}R_{13}}{b_{x}\overline{u'B'}+b_{z}\overline{u'B'}} \\ -\overline{v} \ \partial_{y}\overline{u'w'} \\ -\overline{u'w'} \ \partial_{y} \ \overline{w}-\overline{v'w'} \ \partial_{y}\overline{u} \\ \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{t}R_{13}}{p'(\overline{\partial_{z}u}-\partial_{x}w)} \\ f_{y}(\overline{w'w'-u'u'}) \\ \frac{\partial_{y}R_{132}}{u'w'v'} \\ 0 \\ \hline \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{t}R_{23}}{v'w'v'} \\ 0 \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{t}R_{23}}}{p'(\overline{\partial_{z}v}-\overline{\partial_{y}w)}} \\ -\overline{t}, \overline{v'v'} \\ \partial_{y} \ \overline{w}-\overline{v'w'} \ \partial_{y}\overline{w} \\ \end{array}$
NZZ_LBzzCzzPzzEzzPIzzFzzTzzy-yGzzDzzRxy-tBxyCxyPxyExyPIxyFxyTxyy-yTxyyGxyDxyRxz.tBxzCxzPxzExzPlxzFxzTxzy-yTxzyGxzDxz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production pressure-velocity correlation Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term	$\frac{\partial_{t}R_{33}}{2b_{z}\overline{w'B'}} - \overline{v} \frac{\partial_{y} \overline{w'w'}}{\partial_{y} \overline{w}} - 2\overline{v'w'} \frac{\partial_{y} \overline{w'w'}}{\partial_{y} \overline{w}} - 2\overline{v'w'} \frac{\partial_{y}R_{32}}{\partial_{y}R_{322}} \frac{2\overline{w'p'}}{-2f_{y}\overline{u'w'}} - 2\overline{v}(\overline{\partial_{y}w})(w - \langle w \rangle) $ 0 $\frac{\partial_{t}R_{12}}{b_{x}\overline{u'B'} + b_{y}\overline{v'B'}} - \overline{v} \frac{\partial_{y}\overline{u'v'}}{\partial_{y}\overline{w} - \overline{v'v'}} \frac{\partial_{y}\overline{u}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{w}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{w}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{u}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{w}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{w}}{\partial_{y}\overline{w}} - \overline{v'v'} \frac{\partial_{y}\overline{w}}{\partial_{y}\overline{w}} - \overline{v'w'} \frac{\partial_{y}\overline{w}$
Rzz.tBzzCzzPzzEzzPIzzFzzTzzy.yGzzDzzRxy.tBxyCxyPxyExyPlxyFxyTxyy.yGxyDxyRxz.tBxzCxzPxzExzPlxzFxzTxzy.yGxzDxzRyz.tByzCyzPyzFyzFyzTyzy.yGyzDyz	time-rate of change of R_{33} buoyancy production advection in y-direction shear production of Rz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term RxyBudget time-rate of change of R_{12} buoyancy production advection in y-direction shear production Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density term	$\begin{array}{l} \frac{\partial_{t}R_{33}}{2b_{z}\overline{w'B'}} \\ -\overline{v} \frac{\partial_{y} \overline{w'w'}}{-2v'\overline{w'}\partial_{y} \overline{w}} \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{w'w'}} \\ \frac{\partial_{y}R_{32}}{\partial_{y}R_{32}} \\ \overline{w'w'v'} - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle) \\ 0 \end{array}$ $\begin{array}{l} \frac{\partial_{t}R_{12}}{-\overline{v}\partial_{y}\overline{w'v'}} \\ -\overline{v}\partial_{y}\overline{w}\overline{v}\overline{v'} \\ -\overline{w'v'}\partial_{y}\overline{v} - \overline{v'v'} \partial_{y}\overline{u} \\ \hline p'(\overline{\partial_{y}u} - \partial_{x}v) \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{u'v'v' + w'p'} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \end{array}$ $\begin{array}{l} \frac{\partial_{t}R_{13}}{\overline{v}} \\ \frac{\partial_{t}R_{13}}{\overline{v'}} \\ \frac{\partial_{y}R_{122}}{u'v'v' + w'p'} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \end{array}$
Rzz.t Bzz Czz Pzz Ezz Plzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy-y Txyy Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy-y Txzy Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Pyz Pyz </td <td>time-rate of change of R_{33} buoyancy production advection in y-direction shear production R_{33} Coriolis production of R_{22} divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of R_{21} buoyancy production shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of R_{21} divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production shear production viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of L_{23} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{23} Coriolis production turbulent transport T_{232} pressure variable-density term viscous variable-density term</td> <td>$\begin{array}{c} \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \\ -\overline{v} \ \partial_{y} \ \overline{w'w'} \\ -2 \overline{v'w'}\partial_{y} \ \overline{w} \\ \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{w'w'}} \\ \frac{\partial_{y}R_{332}}{w'w'v'-2\nu(\partial_{y}w)(w-\langle w\rangle)} \\ 0 \\ \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{12}}{-\overline{v}\partial_{y}\overline{w'v'}} \\ -\overline{v}\partial_{y}\overline{w'v'} \\ -\overline{w'v'}\partial_{y}\overline{v}-\overline{v'v'}\partial_{y}\overline{u} \\ \\ \overline{p'(\partial_{y}u-\partial_{x}v)} \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{u'w'+u'p'} \\ (\overline{u}-\langle u\rangle)\partial_{y}\overline{p} \\ \\ \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{13}}{b_{x}\overline{u'B'}+b_{z}\overline{u'B'}} \\ -\overline{v} \ \partial_{y}\overline{u'w'} \\ -\overline{w'w'} \ \partial_{y}\overline{w}-\overline{v'w'} \ \partial_{y}\overline{u} \\ \\ \\ \frac{\partial_{y}R_{122}}{u'w'v-u'} \\ -\overline{w'w'} \ \partial_{y}\overline{w}-\overline{v'w'} \ \partial_{y}\overline{u} \\ \\ \\ \frac{\partial_{y}R_{122}}{u'w'v'} \\ \frac{\partial_{y}W'B'}{(\overline{u}-\langle u\rangle)\partial_{y}\overline{p}} \\ \\ \\ \\ \frac{\partial_{t}R_{23}}}{b_{y}\overline{v'B'}+b_{z}\overline{w'B'}} \\ \\ \frac{\partial_{t}R_{23}}}{v'w'v'} \\ 0 \\ \\ \\ \\ \frac{\partial_{t}I_{232}}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v' + w'p'} \\ (\overline{w}-\langle w\rangle)\partial_{y}\overline{p} \\ \end{array}$</td>	time-rate of change of R_{33} buoyancy production advection in y-direction shear production R_{33} Coriolis production of R_{22} divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of R_{21} buoyancy production shear production viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of R_{21} divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production shear production viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of L_{23} buoyancy production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{23} Coriolis production turbulent transport T_{232} pressure variable-density term viscous variable-density term	$\begin{array}{c} \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \\ -\overline{v} \ \partial_{y} \ \overline{w'w'} \\ -2 \overline{v'w'}\partial_{y} \ \overline{w} \\ \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{w'w'}} \\ \frac{\partial_{y}R_{332}}{w'w'v'-2\nu(\partial_{y}w)(w-\langle w\rangle)} \\ 0 \\ \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{12}}{-\overline{v}\partial_{y}\overline{w'v'}} \\ -\overline{v}\partial_{y}\overline{w'v'} \\ -\overline{w'v'}\partial_{y}\overline{v}-\overline{v'v'}\partial_{y}\overline{u} \\ \\ \overline{p'(\partial_{y}u-\partial_{x}v)} \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{u'w'+u'p'} \\ (\overline{u}-\langle u\rangle)\partial_{y}\overline{p} \\ \\ \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{13}}{b_{x}\overline{u'B'}+b_{z}\overline{u'B'}} \\ -\overline{v} \ \partial_{y}\overline{u'w'} \\ -\overline{w'w'} \ \partial_{y}\overline{w}-\overline{v'w'} \ \partial_{y}\overline{u} \\ \\ \\ \frac{\partial_{y}R_{122}}{u'w'v-u'} \\ -\overline{w'w'} \ \partial_{y}\overline{w}-\overline{v'w'} \ \partial_{y}\overline{u} \\ \\ \\ \frac{\partial_{y}R_{122}}{u'w'v'} \\ \frac{\partial_{y}W'B'}{(\overline{u}-\langle u\rangle)\partial_{y}\overline{p}} \\ \\ \\ \\ \frac{\partial_{t}R_{23}}}{b_{y}\overline{v'B'}+b_{z}\overline{w'B'}} \\ \\ \frac{\partial_{t}R_{23}}}{v'w'v'} \\ 0 \\ \\ \\ \\ \frac{\partial_{t}I_{232}}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{322}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v'} \\ \frac{\partial_{y}R_{132}}{v'w'v' + w'p'} \\ (\overline{w}-\langle w\rangle)\partial_{y}\overline{p} \\ \end{array}$
Rzz.t Bzz Czz Pzz Ezz Plzz Fzz Tzzy-y Tzzy-y Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy-y Txyy Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy-y Txzy Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Fyz Tyzy-y Tyzy-y </td <td>time-rate of change of R_{33} buoyancy production advection in y-direction shear production Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term $\mathbf{RxyBudget}$ time-rate of change of R_{12} buoyancy production advection in y-direction shear production Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{23} Coriolis production turbulent transport divergence vertical transport T_{232} pressure-velocity correlation Π_{23} Coriolis production turbulent transport T_{232} pressure variable-density term viscous variable-density term</td> <td>$\begin{array}{c} \frac{\partial_{l}R_{33}}{2b_{z}\overline{w'B'}} \\ -\overline{v} \ \partial_{y} \ \overline{w'w'} \\ -2\overline{v'w'}\partial_{y} \ \overline{w} \\ \end{array} \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{w'w'}} \\ \frac{\partial_{y}R_{332}}{\overline{w'w'v'} - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle)} \\ 0 \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{12}}{b_{x}\overline{w'B'} + b_{y}\overline{v'B'}} \\ -\overline{v}\partial_{y}\overline{w'v'} \\ -\overline{w'v'}\partial_{y}\overline{v} - \overline{v'v'} \ \partial_{y}\overline{u} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{12}}{p'(\partial_{y}u - \partial_{x}v)} \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{\overline{w'v'v'} + \overline{w'p'}} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{13}}{b_{x}\overline{w'B'} + b_{z}\overline{w'B'}} \\ -\overline{v} \ \partial_{y}\overline{w'w'} \\ -\overline{w'w'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{u} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{13}}{p'(\partial_{z}u - \partial_{x}w)} \\ f_{y}(\overline{w'w' - u'u'}) \\ \frac{\partial_{y}R_{132}}{\overline{w'w'v'}} \\ 0 \\ \hline \\ \hline \\ \frac{\partial_{l}R_{23}}{\overline{w'w'v'}} \\ -\overline{v'v'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{v} \\ -\overline{v'v'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{v} \\ -\overline{v'w'} \ \partial_{y}\overline{w} - \overline{v'w'} \\ \frac{\partial_{y}R_{32}}{\overline{v'w'v'} + w'p'} \\ (\overline{w} - \langle w \rangle)\partial_{y}\overline{p} \\ \hline \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{l}\frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \hline \\ \end{array}$</td>	time-rate of change of R_{33} buoyancy production advection in y-direction shear production Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term $\mathbf{RxyBudget}$ time-rate of change of R_{12} buoyancy production advection in y-direction shear production Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{23} Coriolis production turbulent transport divergence vertical transport T_{232} pressure-velocity correlation Π_{23} Coriolis production turbulent transport T_{232} pressure variable-density term viscous variable-density term	$\begin{array}{c} \frac{\partial_{l}R_{33}}{2b_{z}\overline{w'B'}} \\ -\overline{v} \ \partial_{y} \ \overline{w'w'} \\ -2\overline{v'w'}\partial_{y} \ \overline{w} \\ \end{array} \\ \frac{2\overline{w'p'}}{-2f_{y}\overline{w'w'}} \\ \frac{\partial_{y}R_{332}}{\overline{w'w'v'} - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle)} \\ 0 \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{12}}{b_{x}\overline{w'B'} + b_{y}\overline{v'B'}} \\ -\overline{v}\partial_{y}\overline{w'v'} \\ -\overline{w'v'}\partial_{y}\overline{v} - \overline{v'v'} \ \partial_{y}\overline{u} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{12}}{p'(\partial_{y}u - \partial_{x}v)} \\ f_{y}\overline{v'w'} \\ \frac{\partial_{y}R_{122}}{\overline{w'v'v'} + \overline{w'p'}} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{13}}{b_{x}\overline{w'B'} + b_{z}\overline{w'B'}} \\ -\overline{v} \ \partial_{y}\overline{w'w'} \\ -\overline{w'w'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{u} \\ \end{array} \\ \hline \\ \frac{\partial_{l}R_{13}}{p'(\partial_{z}u - \partial_{x}w)} \\ f_{y}(\overline{w'w' - u'u'}) \\ \frac{\partial_{y}R_{132}}{\overline{w'w'v'}} \\ 0 \\ \hline \\ \hline \\ \frac{\partial_{l}R_{23}}{\overline{w'w'v'}} \\ -\overline{v'v'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{v} \\ -\overline{v'v'} \ \partial_{y}\overline{w} - \overline{v'w'} \ \partial_{y}\overline{v} \\ -\overline{v'w'} \ \partial_{y}\overline{w} - \overline{v'w'} \\ \frac{\partial_{y}R_{32}}{\overline{v'w'v'} + w'p'} \\ (\overline{w} - \langle w \rangle)\partial_{y}\overline{p} \\ \hline \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{l}\frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \hline \\ \end{array}$
Rzz.t Bzz Czz Pzz Ezz PIzz Fzz Tzzy.g Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Gxy Dxy Kx_1t Bxz Cxx Pxy Exz Plxz Fxz Txzy.y Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Fyz Tyzy.y Tyzy.y Gyz Dyz Pizz Fyz Tyzy.y Gyz Pyz Eyz Pyz Eyz Pyz Eyz Pyz Eyz	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₃₂ turbulent transport vertical transport T ₃₃₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₂ Coriolis production of Rxy divergence of change of R ₁₃ buoyancy production advection in y-direction shear production viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure variable-density term viscous variable-density t	$\begin{array}{c} \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \\ -\overline{v} \frac{\partial_{y}}{w'w'} \\ -2\overline{v'w'}\partial_{y}\overline{w} \\ \hline\\ \frac{2\overline{w'p'}}{-2f_{y}w'w'} \\ \frac{\partial_{y}R_{332}}{w'w'v' - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle)} \\ 0 \\ \hline\\ \frac{\partial_{t}\overline{R_{12}}}{b_{x}w'B' + b_{y}\overline{v'B'}} \\ -\frac{\overline{v}\partial_{y}\overline{w'v'}}{-u'v'\partial_{y}\overline{w} - \overline{v'v'}} \\ \partial_{y}\overline{u} \\ \hline\\ \frac{\partial_{y}R_{122}}{u'v'v' + u'p'} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \\ \hline\\ \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}w'B'} \\ -\overline{v}\partial_{y}\overline{u'w'} \\ \partial_{y}\overline{w} \\ -\overline{v'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{u} \\ \hline\\ \\ \frac{\partial_{t}R_{122}}{u'w'v' - u'w'} \partial_{y}\overline{w} \\ -\overline{v}\partial_{y}\overline{u'w'} \\ -\overline{v'w'} \partial_{y}\overline{w} \\ -\overline{v'w'} \partial_{y}\overline{w} \\ \hline\\ \\ \frac{\partial_{t}R_{23}}{v'w'v' - u'w'} \partial_{y}\overline{w} \\ \hline\\ \\ \frac{\partial_{t}R_{23}}{v'w'v' - w'w'} \partial_{y}\overline{v} \\ -\overline{v'w'} \partial_{y}\overline{w} \\ -\overline{v'w'} \partial_{y}\overline{w} \\ \hline\\ \\ \frac{\partial_{t}\frac{1}{2}R_{1i}}{(\overline{w} - \langle w \rangle)\partial_{y}\overline{p}} \\ \hline\\ \\ \hline\\ \\ \frac{\partial_{t}\frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}T_{ii22}} \\ \hline\\ \end{array}$
Rzz Bzz Czz Pzz Ezz Plzz Fzz Tzzy,-y Tzzy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy.y Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Pyz Eyz	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₃₂ turbulent transport vertical transport T ₃₃₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport viscous dissipation pressure-velocity correlation Π ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production davection in y-direction shear production viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure-velocity correlation Π ₁₃ Coriolis production divergence of change of R ₂₃ buoyancy production divergence of change of R ₂₃ buoyancy production divergence of change of R ₂₃ buoyancy production divergence of change of T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation Π ₂₃ Coriolis production turbulent transport divergence vertical transport T ₂₃₂ pressure-velocity correlation Π ₂₃ Coriolis production divergence of change of Tke turbulent transport divergence vertical transport terms viscous variable-density term viscous vari	$\begin{array}{c} \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \\ -\overline{v} \partial_{y} \overline{w'w'} \\ -2v'w'\partial_{y} \overline{w} \\ \hline \\ \frac{2\overline{w'v'}}{-2f_{y}w'w'} \\ \frac{\partial_{y}R_{332}}{\partial_{y}R_{332}} \\ \overline{w'w'v' - 2\nu(\partial_{y}w)(w - \langle w \rangle)} \\ 0 \\ \hline \\ \frac{\partial_{t}R_{12}}{b_{x}\overline{w'B'} + b_{y}\overline{v'B'}} \\ -\overline{v}\partial_{y}\overline{w'v'} \\ -\overline{u'v'}\partial_{y}\overline{v} - \overline{v'v'}\partial_{y}\overline{u} \\ \hline \\ \frac{\partial_{t}R_{13}}{b_{x}\overline{w'B'} + b_{z}\overline{w'B'}} \\ \frac{\partial_{y}R_{122}}{u'v'v' + u'p'} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \\ \hline \\ \hline \\ \frac{\partial_{t}R_{23}}{b_{y}\overline{w'B'} + b_{z}\overline{w'B'}} \\ -\overline{v}\partial_{y}\overline{w'w'} \\ 0 \\ \hline \\ \hline \\ \frac{\partial_{t}R_{23}}{b_{y}\overline{w'B'} + b_{z}\overline{w'B'}} \\ -\overline{v}\partial_{y}\overline{w'w'} \\ -\overline{v'v'}\partial_{y}\overline{w} - \overline{v'w'}\partial_{y}\overline{v} \\ \hline \\ \hline \\ \frac{\partial_{t}R_{23}}{b_{y}\overline{w'v'} + w'p'} \\ (\overline{w} - \langle w \rangle)\partial_{y}\overline{p} \\ \hline \\ \hline \\ \hline \\ \hline \\ \frac{\partial_{t}\frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}F_{ii}} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii} \\ \frac{1}{2}R_{ii}}{\frac{1}{2}R_{ii}} \\ \frac{1}{2}R_{ii} \\ $
Rzz Bzz Czz Pzz Ezz Plzz Fzz Tzzy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy.y Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Fyz Tyzy.y Gyz Dyz Piyz Eyz Plyz Fyz Tyzy.y Gyz Dyz Piyz Fyz Tyzy.y Gyz Dyz Piyz <td>time-rate of change of R_{33} buoyancy production advection in y-direction shear production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density te</td> <td>$\frac{\partial_{t}R_{33}}{2b_{z}w'B'} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{-2v'w'\partial_{y}\overline{w}} \overline{w}$ $\frac{2\overline{w'p'}}{-2v'w'\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}R_{32}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{-2v'w'\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{-2v'\overline{v'}\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{w'} - \overline{u'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}} \frac{-\overline{v'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\partial_{y}\overline{w'v'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}$</td>	time-rate of change of R_{33} buoyancy production advection in y-direction shear production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous variable-density te	$ \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{-2v'w'\partial_{y}\overline{w}} \overline{w} $ $ \frac{2\overline{w'p'}}{-2v'w'\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}R_{32}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{-2v'w'\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{-2v'\overline{v'}\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'v'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w}} \frac{-\overline{v'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{w'} - \overline{u'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}} \frac{-\overline{v'w'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\partial_{y}\overline{w'v'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v} \partial_{y}\overline{w'w'}}{\partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'} - \overline{v'w'} \partial_{y}\overline{w}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}}{\overline{v'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}} \frac{-\overline{v'v'} \partial_{y}\overline{w'}$
Rzz Bzz Czz Pzz Ezz PIzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Ply Fxy Txyy-y Txyy Gxy Dxy Rxz-t Bxz Cxz Pxz Exz Plxz Fxz Txzy-y Txzy Gxz Dxz Ryz-t Byz Cyz Pyz Eyz Plyz Pyz Eyz Plyz Syz Dyz Exp Piyz Fyz Tyzy-y Tyzy Gyz Dyz Exp Pi	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₃₂ turbulent transport vertical transport T ₃₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation Π ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport viscous variable-density term viscous dissipation pressure-velocity correlation Π ₂₃ Coriolis production divergence of change of R ₂₃ buoyancy production divergence of change of R ₂₃ buoyancy production viscous dissipation pressure-velocity correlation Π ₂₃ Coriolis production divergence of change of Tke advection in y-direction shear production viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-den	$\begin{array}{c} \frac{\partial_{t}R_{33}}{2b_{z}w'B'} \\ -\overline{v} \partial_{y} \overline{w'w'} \\ -2v'w'\partial_{y} \overline{w} \\ \end{array} \\ \hline \\ \frac{2w'p'}{-2v'w'\partial_{y} \overline{w}} \\ \frac{2w'p'}{-2v(\partial_{y}w)(w - \langle w \rangle)} \\ 0 \\ \end{array} \\ \hline \\ \frac{\partial_{t}R_{12}}{b_{x}w'B' + b_{y}\overline{v'}B'} \\ -\frac{v}{-2\partial_{y}w'v'} \\ -\overline{v}\partial_{y}\overline{w}-v'v' \partial_{y}\overline{w} \\ -\overline{v}\partial_{y}\overline{w}'v' \\ \frac{\partial_{y}R_{122}}{w'v'\partial_{y}\overline{w} - v'v' \partial_{y}\overline{w}} \\ \hline \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}\overline{w'B'}} \\ -\overline{v}\partial_{y}\overline{w'w'} \\ -\overline{w'w'}\partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w} \\ \hline \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}\overline{w'B'}} \\ -\overline{v}\partial_{y}\overline{w'w'} \\ -\overline{w'w'}\partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w} \\ \hline \\ \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}\overline{w'B'}} \\ -\overline{v'w'}\partial_{y}\overline{w} - \overline{v'w'} \partial_{y}\overline{w} \\ \hline \\ \frac{\partial_{t}R_{23}}{v'w'v'} \\ 0 \\ \hline \\ \\ \frac{\partial_{t}R_{23}}{v'w'v' + w'p'} \\ (\overline{w} - \langle w \rangle)\partial_{y}\overline{p} \\ \hline \\ \\ \hline \\ \\ \frac{\partial_{t}\frac{1}{2}R_{1i}}{\frac{1}{2}F_{1i}} \\ \frac{1}{2}F_{1i} \\ \frac{1}$
Rzz.t Bzz Czz Pzz Ezz PIzz Fzz Tzzy.y Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Txyy Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy.y Gxz Dxz Ryz.t Byz Gyz Pyz Eyz Plyz Fyz Tyzy.y Tyzy.g Gyz Dyz Syz Plyz Fyz Tyzy.y Tyzy.y Tyzy.y Tyzy.y Tyzy.y Tyzy.y Tyzy.y	time-rate of change of R_{33} buoyancy production advection in y-direction shear production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term advection in y-direction shear production advection in y-direction shear production of Rxy divergence of T_{12} turbulent transport vertical transport T_{12} pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{12} turbulent transport vertical transport T_{122} pressure-velocity correlation Π_{13} coriolis production advection in y-direction shear production shear production advection in y-direction shear production divergence of T_{132} turbulent transport vertical transport Π_{13} coriolis production advection in y-direction Π_{13} coriolis production divergence of T_{132} turbulent transport viscous dissipation pressure-velocity correlation Π_{13} coriolis production divergence of T_{132} turbulent transport vertical transport Π_{13} coriolis production divergence of T_{132} turbulent transport viscous variable-density term viscous variable-density term	$\begin{array}{c} \frac{\partial_{t} R_{33}}{2b_{z}w'B'} \\ -\overline{v} \partial_{y} \overline{w'w'} \\ -2w'w'\partial_{y} \overline{w} \\ \end{array} \\ \frac{2w'p'}{-2y'w'\partial_{y} \overline{w}} \\ \frac{2w'p'}{-2y'(\partial_{y}w)(w - \langle w \rangle)} \\ 0 \\ \end{array} \\ \hline \\ \frac{\partial_{t} R_{12}}{b_{x}w'B' + b_{y}v'B'} \\ -\frac{-\overline{v} \partial_{y}u'v'}{-2v'\partial_{y}\overline{w} - v'v'} \partial_{y}\overline{u} \\ \hline \\ \frac{\partial_{t} R_{13}}{b_{x}w'B' + b_{z}\overline{w'B'}} \\ -\frac{\overline{v} \partial_{y}w'w'}{-u'w'\partial_{y}\overline{w} - v'w'} \partial_{y}\overline{u} \\ \hline \\ \frac{\partial_{t} R_{13}}{b_{x}w'B' + b_{z}\overline{w'B'}} \\ -\frac{\overline{v} \partial_{y}w'w'}{-u'w'\partial_{y}\overline{w} - v'w'} \partial_{y}\overline{u} \\ \hline \\ \frac{\partial_{t} R_{23}}{v'w'v'} \\ -\frac{\overline{v'v'} \partial_{y} \overline{w} - v'w'}{\partial_{y}\overline{w} - v'w'} \partial_{y}\overline{v} \\ \hline \\ \frac{\partial_{t} R_{23}}{v'w'v'} \\ \frac{\partial_{y} R_{122}}{u'w'v'} \\ \frac{\partial_{y} R_{122}}{v'w'v' + w'p'} \\ (\overline{w} - \langle w \rangle) \partial_{y}\overline{p} \\ \hline \\ \hline \\ \\ \frac{\partial_{t} \frac{1}{2}R_{i}}{\frac{1}{2}P_{i}} \\ \frac{1}{2}P_{i} \\ \frac{1}{2}P_{i}$
Rzz.t Bzz Czz Pzz Ezz Plzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Txz Pxz Exz Plxz Fxz Txzy.y Gxz Dxz Image: Ima	time-rate of change of R_{33} buoyancy production advection in y-direction shear production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production advection in y-direction shear production shear production divergence of T_{132} turbulent transport vertical transport T_{132} pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure-velocity correlation Π_{23} Coriolis production viscous dissipation pressure-velocity correlation Π_{23} Coriolis production turbulent transport divergence vertical transport T_{232} pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous transport to triple correlation terms transport due to triple correlation terms transport due to triple correlation terms transport to transport terms transport to transport terms transport to transport terms transport due to triple correlation terms transport due to triple correlation terms transport due to triple correlations divergence of viscous transport viscous variable-density term viscous variable-density term viscous variable-density term	$\begin{array}{c} \frac{\partial_{t}R_{33}}{\partial z_{s}} \frac{2b_{s}w^{\prime}B^{\prime}}{B^{\prime}} \\ -\overline{v} \frac{\partial_{y}}{w^{\prime}}W^{\prime}}{\partial_{y}}\overline{w} \\ \frac{2w^{\prime}p^{\prime}}{\partial_{y}} \\ -\overline{z}f_{y}w^{\prime}w^{\prime}v^{\prime} - 2\nu(\overline{\partial_{y}w})(w - \langle w \rangle) \\ 0 \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{12}}{b_{s}w^{\prime}B^{\prime}B + b_{y}\overline{v^{\prime}}B^{\prime}} \\ -\overline{v}\partial_{y}w^{\prime}v^{\prime} \\ -\overline{v^{\prime}v^{\prime}}\partial_{y}\overline{v} - \overline{v^{\prime}v^{\prime}} \partial_{y}\overline{u} \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{13}}{p^{\prime}(\partial_{y}u - \partial_{x}v)} \\ f_{y}\overline{v^{\prime}w^{\prime}} \\ \frac{\partial_{y}R_{122}}{u^{\prime}v^{\prime}v^{\prime} + u^{\prime}p^{\prime}} \\ (\overline{u} - \langle u \rangle)\partial_{y}\overline{p} \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{13}}{p^{\prime}(\partial_{z}u - \partial_{x}v)} \\ f_{y}\overline{w^{\prime}w^{\prime}} \\ -\overline{v}\partial_{y}\overline{w^{\prime}w^{\prime}} \\ -\overline{v}\partial_{y}\overline{w^{\prime}w^{\prime}} \\ -\overline{v}\partial_{y}\overline{w^{\prime}w^{\prime}} \\ \frac{\partial_{y}R_{132}}{u^{\prime}w^{\prime}v^{\prime}} \partial_{y}\overline{w} - \overline{v^{\prime}w^{\prime}} \partial_{y}\overline{u} \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{23}}{p^{\prime}(w^{\prime}v - u^{\prime}u^{\prime})} \\ \frac{\partial_{y}R_{132}}{p^{\prime}(w^{\prime}v - u^{\prime}u^{\prime})} \\ \frac{\partial_{y}R_{232}}{v^{\prime}w^{\prime}v^{\prime}} \\ 0 \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}R_{23}}{p^{\prime}(w^{\prime}v^{\prime} + w^{\prime}p^{\prime}} \\ (\overline{w} - \langle w \rangle)\partial_{y}\overline{p} \\ \end{array}$ $\begin{array}{c} \frac{\partial_{t}\frac{1}{2}R_{1i}}{\frac{1}{2}P_{1i}} \\ \frac{1}{2}R_{1i} \\ \frac{1}{2}R_{1i} \\ \frac{1}{2}R_{1i} \\ \frac{1}{2}P_{1i} \\ \frac{1}{2}R_{1i} \\ \frac{1}{2}T_{1i} \\ \frac{1}{2}T_{1i} \\ \frac{1}{2}D_{1i} \\ \frac{1}{2}D_{1i} \\ \end{array}$
Rzz Bzz Czz Pzz Ezz Plzz Fzz Tzzy-y Tzzy Gzz Dzz Rxy-t Bxy Cxy Pxy Exy Plxy Fxy Txyy-y Txyy-y Txyy-y Txyy Gxy Dxy Rxz-t Bxz Cxz Pxz Exz Plxz Fxz Tzzy-y Txzy Gxz Dxz Ryz-t Byz Cyz Pyz Eyz Tyzy-y Tyzy-y <	time-rate of change of R_{33} buoyancy production advection in y-direction Π_{33} Coriolis production of Rzz divergence of T_{332} turbulent transport vertical transport T_{332} pressure variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{12} Coriolis production of Rxy divergence of T_{122} turbulent transport vertical transport T_{122} pressure variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{13} Coriolis production divergence of T_{132} turbulent transport vertical transport T_{132} pressure variable-density term viscous dissipation pressure-velocity correlation Π_{23} Coriolis production advection in y-direction shear production viscous dissipation pressure-velocity correlation Π_{23} Coriolis production divergence of change of R_{23} buoyancy production duvergence of change of R_{23} buoyancy production furbulent transport T_{232} pressure variable-density term viscous transport terms transport due to triple correlation terms t	$\begin{array}{c} \frac{\partial_{t}R_{33}}{\partial b_{z}w'B'} \\ -\overline{v} \ \partial_{y} w'w'' \\ -2v'w' \ \partial_{y} w \\ \end{array} \\ \\ \frac{2w'p'}{\partial y} \\ -2v'w' \ \partial_{y} w \\ \frac{\partial_{y}R_{32}}{w'w'v' - 2v(\partial_{y}w)(w - \langle w \rangle)} \\ 0 \\ \end{array} \\ \\ \hline \\ \frac{\partial_{t}R_{12}}{b_{x}w'B' + b_{y}v'B'} \\ -\overline{v} \ \partial_{y}u'v' \\ -\overline{w'v'} \ \partial_{y}\overline{v} - v'v' \ \partial_{y}\overline{u} \\ \hline \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}w'B'} \\ \frac{\partial_{y}R_{122}}{u'v'' + u'p'} \\ (\overline{u} - \langle u \rangle) \partial_{y}\overline{p} \\ \hline \\ \hline \\ \\ \frac{\partial_{t}R_{13}}{b_{x}w'B' + b_{z}w'B'} \\ -\overline{v} \ \partial_{y}\overline{u'w'} \\ -\overline{w'w'} \ \partial_{y} \overline{w} - v'w' \ \partial_{y}\overline{u} \\ \hline \\ \hline \\ \\ \frac{\partial_{t}R_{23}}{b_{y}v'B' + b_{z}w'B'} \\ \frac{\partial_{t}R_{23}}{v'w'v'} \\ 0 \\ \hline \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \frac{\partial_{t}\frac{1}{2}R_{i}}{u'w'v'} \\ 0 \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \frac{\partial_{t}\frac{1}{2}R_{i}}{\frac{1}{2}R_{i}}{\frac{1}{2}R_{i}} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}C_{i} \\ \frac{1}{2}R_{i}}{\frac{1}{2}C_{i}} \\ \frac{1}{2}R_{i} \\ \frac{1}{2}C_{i} \\ \frac{1}{2}D_{i} \\ \frac{1}{2}D_{i} \\ \hline \\ \\ \\ \hline \\ \\ \\ \\ \\ \frac{1}{2}D_{i} \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $
Rzz Bzz Czz Pzz Ezz Plzz Fzz/y Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy, Gaz Oxz Ryz.t Byz Cyz Pyz Gyz Dxz Ryz.t Byz Cyz Pyz Eyz Plyz Fyz Tyzy.y Tyzy Gyz Dyz Plyz Fyz Tyzy.y Tyzy.y Gyz Dyz Plyz Trp1	<pre>time-rate of change of R₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T₃₃₂ turbulent transport vertical transport T₃₃₂ pressure-velocity correlation II₃₃ Coriolis production of Rzz divergence of change of R₁₂ buoyancy production advection in y-direction shear production of Rxy divergence of T₁₂₂ turbulent transport viscous dissipation pressure-velocity correlation II₁₂ Coriolis production of Rxy divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production advection in y-direction shear production advection in y-direction shear production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure-variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₂₃ Coriolis production divergence of T₁₃₂ turbulent transport vertical transport T₂₃₂ pressure variable-density term viscous transport terms transport due to triple correlation terms transport d</pre>	$ \frac{\partial_{r}R_{33}}{2b_{z}w^{T}B^{T}} = \frac{-\overline{v}}{-2y'w^{T}\partial_{y}} \frac{w'w'}{-2z'(w^{T}\partial_{y})} \frac{w}{w} $ $ \frac{2w^{T}p'}{-2z'(w^{T}\partial_{y})} \frac{w}{w} $ $ \frac{2w^{T}p'}{-2z'(\partial_{y}w)(w - \langle w \rangle)} $ $ 0 $ $ \frac{\partial_{t}R_{12}}{b_{x}u^{T}B^{T} + b_{y}v^{T}B^{T}} - \frac{\partial_{y}u'w'}{-2z'(\partial_{y}w)(w - \langle w \rangle)} $ $ 0 $ $ \frac{\partial_{t}R_{12}}{v^{T}w' \partial_{y}\overline{v} - v'v'} \partial_{y}\overline{u} $ $ \frac{\partial_{t}R_{13}}{p'(\partial_{y}u - \partial_{x}v)} + \frac{\partial_{y}u'w'}{\partial_{y}\overline{v} - v'w'} \partial_{y}\overline{u} $ $ \frac{\partial_{t}R_{13}}{p'(\partial_{y}u - \partial_{x}v)} + \frac{\partial_{y}u'w'}{\partial_{y}\overline{v} - v'w'} \partial_{y}\overline{u} $ $ \frac{\partial_{t}R_{13}}{p'(\partial_{y}u - \partial_{x}w)} + \frac{\partial_{y}R_{12}}{(\overline{u} - \langle u \rangle)\partial_{y}\overline{p} $ $ \frac{\partial_{t}R_{23}}{p'(\partial_{y}u - \partial_{x}w)} + \frac{\partial_{y}R_{13}}{p'(\partial_{y}u'w' - u'u')} + \frac{\partial_{y}R_{13}}{\partial_{y}R_{13}} $ $ \frac{\partial_{t}R_{23}}{v'(w'v' - u'u')} + \frac{\partial_{y}w}{\partial_{y}\overline{v}} + \frac{\partial_{y}w'w'}{\partial_{y}\overline{v}} $ $ \frac{\partial_{t}\frac{1}{2}R_{13}}{\frac{1}{2}F_{14}} + \frac{1}{2}\frac{R_{14}}{\frac{1}{2}}\frac{1}{2}R_{14}} + \frac{1}{2}\frac{R_{14}}{\frac{1}{2}}\frac{1}{2}R_{14}} + \frac{1}{2}\frac{1}{2}R_{14}} + \frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}$
Rzz Bzz Czz Pzz Ezz Plzz Fzz Tzzyy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Txyy Gxz Dxy Txyy.y Txyy.y Txyy.y Txyy.y Txyy.y Gxz Dxz Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy.y Gxz Dxz Ryz.t Byz Cyz Pyz Eyz Pyz Eyz Pyz.t Byz Cyz Pyz Eyz Tyz Tyz Tyzy	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₂₂ turbulent transport vertical transport T ₃₃₂ pressure-velocity correlation II ₃₃ Coriolis production of Rzz divergence of R ₁₂₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous dissipation advection in y-direction shear production divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₂₃ Coriolis production divergence of Taga turbulent transport divergence vertical transport Z ₂₃₂ pressure variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II ₂₃ Coriolis production divergence of transport Z ₂₃₂ pressure variable-density term viscous variable-density term v	$\frac{\partial_{r}R_{33}}{2b_{w}WB} = \frac{\partial_{r}R_{33}}{-2v'w'\partial_{y}} \frac{\partial_{r}W'w'}{w}$ $\frac{2w'p'}{-2v'w'\partial_{y}w} = \frac{\partial_{r}R_{33}}{w'w'v'-2v(\partial_{y}w)(w-\langle w \rangle)}$ $\frac{\partial_{r}R_{12}}{\partial_{r}R_{12}} = \frac{\partial_{r}R_{13}}{w'w'} + \frac{\partial_{r}R_{13}}{\partial_{r}w'v'} + \frac{\partial_{r}W'}{w'}$ $\frac{\partial_{r}R_{13}}{-u'w'\partial_{y}w - v'v'} + \frac{\partial_{r}W}{\partial_{y}w}$ $\frac{\partial_{r}R_{13}}{v'v''} + \frac{\partial_{r}W'}{w'}$ $\frac{\partial_{r}R_{13}}{\partial_{r}w'B'} + \frac{\partial_{r}W'B'}{w'} + \frac{\partial_{r}W'B'}{w'}$ $\frac{\partial_{r}R_{13}}{w'w'B'} + \frac{\partial_{r}W'B'}{w'} + \frac{\partial_{r}W'B'}{w'}$ $\frac{\partial_{r}R_{13}}{w'w'B'} + \frac{\partial_{r}W'B'}{w'v'} + \frac{\partial_{r}W'B'}{w'v'}$ $\frac{\partial_{r}R_{23}}{w'w'V'} + \frac{\partial_{r}W'B'}{w'y'}$ $\frac{\partial_{r}R_{23}}{v'w'v'} + \frac{\partial_{r}R_{23}}{w'y'}$ $\frac{\partial_{r}R_{23}}{v'w'v'} + \frac{\partial_{r}R_{23}}{w'y'}$ $\frac{\partial_{r}R_{23}}{v'w'v'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{\partial_{r}R_{23}} + \frac{\partial_{r}R_{23}}{w'w'y'}$ $\frac{\partial_{r}R_{23}}{v'w'v'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{v'w'v'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{\partial_{r}R_{23}} + \frac{\partial_{r}R_{23}}{w'w'y'}$ $\frac{\partial_{r}R_{23}}{\partial_{r}R_{23}} + \frac{\partial_{r}R_{23}}{w'w'y'}$ $\frac{\partial_{r}R_{23}}{w'w'y'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{w'w'y'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{w'w'y'} + \frac{\partial_{r}R_{23}}{w'y'y'}$ $\frac{\partial_{r}R_{23}}{w'w'y'} + \frac{\partial_{r}R_{23}}{w'w'y'} + \frac{\partial_{r}R_{23}}{w'w'y'}$ $\frac{\partial_{r}R_{23}}{w'w'y'} + \partial$
Rzz Bzz Czz Pzz Ezz PIz Fzz Tzzy-y Tzzy Gzz Dzz Rxy.t Bxy Cxy Pxy Exy Plxy Fxy Txyy.y Txyy.y Txyy.y Txyy.y Gxy Dxy Rxz.t Bxz Cxz Pxz Exz Plxz Fxz Txzy.y Txzy Gxz Dxz Sx Cyz Pyz Eyz Plxz Fyz Tyzy.y Tyzy.y Gyz Dyz Con Prid Eps Pi Trp Trp3 Trp1.y Trp	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₃₂ turbulent transport viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous variable-density term advection in y-direction shear production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure-velocity correlation Π ₁₂ Coriolis production divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production viscous dissipation pressure-velocity correlation Π ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₃₂ pressure variable-density term viscous variable-density term mean viscous dissipation rate	$\frac{\partial_{F}R_{33}}{2b_{z}w'B'} = \frac{-\overline{v}\partial_{y}w'w'}{-2\overline{v}'w'\partial_{y}w}$ $\frac{2w'w''}{-2f_{y}w'w'} = \frac{2}{\sqrt{y}} = 2$
NZZ.tBzzCzzPzzEzzPizzFzzTzzy-yTzzyGzzDzzDzzRxy.tBxyCxyPxyExyPixyFxySzCxzPxzSzCxzPxzSzCxzPxzSzCxzPxzSzCxzPxzSzCyzPyzSyzCyzPyzSyzSyzSyzPixzFxzTxzy-yTxzyGyzDyzSyzSyzPiyzFyzSyzSyzPiyzFyzTyzyGyzDyzSy	time-rate of change of R ₃₃ buoyancy production advection in y-direction shear production of Rzz divergence of T ₃₃₂ turbulent transport vertical transport T ₃₃₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₂ Coriolis production of Rxy divergence of T ₁₂₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II ₁₃ Coriolis production divergence of T ₁₃₂ turbulent transport vertical transport T ₁₂₂ pressure variable-density term viscous variable-density correlation shear production dissipation pressure-velocity correlation terms transport due to triple correlation s divergence of triscous transport viscous variable-density term viscous variable-density term	$\frac{\partial_{I}R_{33}}{2b_{z}w'B'} = \frac{-\overline{v}\partial_{y}w'w'}{-2v'w'\partial_{y}w}$ $\frac{2w'p'}{-2f_{y}w'w'} = \frac{2}{\sqrt{y}v'(v'-2v(\partial_{y}w)(w-\langle w \rangle)}$ $\frac{\partial_{I}R_{12}}{\partial_{Y}R_{332}} = \frac{\partial_{I}R_{12}}{\sqrt{y}w'w'} = \frac{\partial_{I}R_{12}}{\sqrt{y}w'w'}$ $\frac{\partial_{Y}R_{12}}{-w'v'\partial_{y}\overline{v}-v'v'} = \frac{\partial_{Y}w'}{\partial_{y}\overline{u}}$ $\frac{\partial_{I}R_{13}}{\frac{\partial_{I}R_{13}}{\frac{\partial_{I}}{v'v'} + u'p'}} = \frac{\partial_{I}R_{12}}{\sqrt{v'v'} + u'p'}$ $(\overline{u} - \langle u \rangle) \partial_{y}\overline{p}$ $\frac{\partial_{I}R_{23}}{\sqrt{w'w'}} = \frac{\partial_{Y}W'w'}{\partial_{Y}\overline{u}} = \frac{\partial_{Y}R_{12}}{\sqrt{v'v'} + u'p'}$ $(\overline{u} - \langle u \rangle) \partial_{y}\overline{p}$ $\frac{\partial_{I}R_{23}}{\sqrt{w'w'} - u'w'} = \frac{\partial_{Y}W'w'}{\partial_{Y}\overline{u}} = \frac{\partial_{I}R_{23}}{\sqrt{w'w'} - u'w'} = \frac{\partial_{Y}W'w'}{\partial_{Y}\overline{u}} = \frac{\partial_{Y}R_{13}}{\sqrt{w'w'} + u'p'}$ $\frac{\partial_{Y}R_{132}}{\sqrt{w'w'} - u'w'} = \frac{\partial_{Y}W'w'}{\partial_{Y}\overline{u}} = \frac{\partial_{Y}R_{13}}{\sqrt{w'w'}} = \frac{\partial_{Y}W'w'}{\partial_{Y}\overline{u}} = \frac{\partial_{Y}R_{13}}{\sqrt{w'w'}} = \frac{\partial_{Y}$
NZZ.tBzzCZzPIzEzzTzzy.yTzzyGZDzRxy.tBxyCXYPxyExyPlizFxyTxyy.yTxyy.yGZDzRxz.tBzzCx2PizFxzTxzy.yGXPixFxzTxzy.yGXGXPizFzTxzy.yGXGXDyYYyYyGCyPyz.tByzCyzPyzFyzTyzy.yTyzyGyzDyPixTrp1Trp1Trp2Trp3Trp1.yTrp2.yTrp3.yGDPhiUgradPImmaRho.ac <td><pre>time-rate of change of R₃₃ buoyancy production shear production of R₂₂ divergence of T₃₃₂ turbulent transport vertical transport T₃₃₂ pressure variable-density term viscous variable-density term ime-rate of change of R₁₂ buoyancy production advection in y-direction shear production of R₃₂ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ coriolis production of R₃₃ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous of sispation advection in y-direction advection in y-direction advection in y-direction advection in y-direction shear production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II₂₃ Coriolis production advection in y-direction shear production in y-direction shear production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous variabl</pre></td> <td>$\frac{\partial_{r}R_{33}}{\partial z} \frac{2b_{z}w'B'}{w'd'} \frac{-2\overline{v'w'}\partial_{y}w'w'}{-2\overline{v'w'}\partial_{y}w}$ $\frac{2\overline{w'p'}}{-2f_{y}w'w'} \frac{2w'p'}{-2f_{y}w'w'} \frac{2w'p'}{-2f_{y}w'w'} \frac{2w'p'}{-2v(\partial_{y}w)(w - \langle w \rangle)}$ 0 $\frac{\overline{\partial_{t}R_{12}}}{\frac{b_{x}w'B'}{b_{y}v'D'} \frac{2w'p'}{-v'v'}\partial_{y}\overline{u}}$ $\frac{\overline{\partial_{t}R_{13}}}{p'(\partial_{y}u - \partial_{x}v)} \frac{2w'p'}{dy''} \frac{2w'p'}{-w'v'} \frac{2w'p'}{dy}$ $\frac{\overline{\partial_{t}R_{13}}}{\overline{v'v''} \frac{2w'P'}{-w'v'}} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'}\partial_{y}\overline{u}}$ $\frac{\overline{\partial_{t}R_{13}}}{p'(\partial_{z}u - \partial_{x}w)} \frac{2w'p'}{dy'''} \frac{2w'p'}{dy'''} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'p'} \frac{2w'p'}{-2w'p'} \frac{2w'p'}{-2w'$</td>	<pre>time-rate of change of R₃₃ buoyancy production shear production of R₂₂ divergence of T₃₃₂ turbulent transport vertical transport T₃₃₂ pressure variable-density term viscous variable-density term ime-rate of change of R₁₂ buoyancy production advection in y-direction shear production of R₃₂ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ coriolis production of R₃₃ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous of sispation advection in y-direction advection in y-direction advection in y-direction advection in y-direction shear production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous dissipation pressure-velocity correlation II₂₃ Coriolis production advection in y-direction shear production in y-direction shear production divergence of T₁₃₂ turbulent transport vertical transport T₁₃₂ pressure variable-density term viscous variabl</pre>	$\frac{\partial_{r}R_{33}}{\partial z} \frac{2b_{z}w'B'}{w'd'} \frac{-2\overline{v'w'}\partial_{y}w'w'}{-2\overline{v'w'}\partial_{y}w}$ $\frac{2\overline{w'p'}}{-2f_{y}w'w'} \frac{2w'p'}{-2f_{y}w'w'} \frac{2w'p'}{-2f_{y}w'w'} \frac{2w'p'}{-2v(\partial_{y}w)(w - \langle w \rangle)}$ 0 $\frac{\overline{\partial_{t}R_{12}}}{\frac{b_{x}w'B'}{b_{y}v'D'} \frac{2w'p'}{-v'v'}\partial_{y}\overline{u}}$ $\frac{\overline{\partial_{t}R_{13}}}{p'(\partial_{y}u - \partial_{x}v)} \frac{2w'p'}{dy''} \frac{2w'p'}{-w'v'} \frac{2w'p'}{dy}$ $\frac{\overline{\partial_{t}R_{13}}}{\overline{v'v''} \frac{2w'P'}{-w'v'}} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'}\partial_{y}\overline{u}}$ $\frac{\overline{\partial_{t}R_{13}}}{p'(\partial_{z}u - \partial_{x}w)} \frac{2w'p'}{dy'''} \frac{2w'p'}{dy'''} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w} - v'w'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'v'} \frac{2w'p'}{\partial_{y}\overline{w}} \frac{2w'p'}{-w'p'} \frac{2w'p'}{-2w'p'} \frac{2w'p'}{-2w'$
NZZ.tBzzCZzPzzEzzTzzy-yTzzy-yTzzyGzzDzzRxy.tBxyCxyPxyExyCxyPxyExyFxyTxyy.yTxyy.yGasyDxzPxExzPlxzFxzTxzy.yGasyDxzPxExzPlxzFxzTxzy-yTxzyGasyDyzEyzPlxzFyzTxzy-yTxzyGasyDyzEyzPlyzFyzTyzy-yTyzy-yTyzy-yTyzyGyzDPhiUgradPImpoRhoFluxY <trr>RhoFlu</trr>	<pre>time-rate of change of R₃₃ buoyancy production shear production of R₂₂ diveregence of T₃₃₂ trubulent transport vertical transport T₃₃₂ pressure variable-density term viscous variable-density term interate of change of R₁₂ buoyancy production advection in y-direction shear production of Rxy divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ coriolis production of Rxy divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production viscous dissipation pressure-velocity correlation II₂₃ Coriolis production viscous dissipation pressure-velocity correlation II₂₃ Coriolis production turbulent transport T₂₃₂ pressure variable-density term viscous variable-density term</pre>	$\frac{\partial_{1}R_{33}}{2b_{2}w'B'} = \frac{-v}{2v'w'} \frac{w'w'}{2v'w'} = \frac{-2f_{2}w'w'}{2} \frac{w'w'}{2} \frac{w'w'}{2} \frac{w'w''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w'''}{2} \frac{w'w''''}{2} \frac{w'w''''''''}{2} w'w''''''''''''''''''''''''''''''''''$
NZZ.t.BzzCzPzzEzzPlzzFzTzzy.gGzDzzRxy.t.BxyCxyPlxyFxyTxyy.yTxyy.gGxyDxyExyPlxy.FxyTxyy.yTxyy.aGxyDxyExzPlxzFxzTxzy.yGxzDxzExzPlxzFxzTxzy.yGxzDxzCyzPlyzFyzTyzy.yTyzy.yTyzy.yTyzy.yTyzy.yTyzy.yTyzy.gGyzDPhiUgradPrulrulrulRhoFluxXRhoFluxXRhoFluxXRhoFluxXRhoFlux<	<pre>time-rate of change of R₃₃ shows any of the terms of the terms</pre>	$\frac{\partial_{1}R_{33}}{\partial z_{z}w'B'} = \frac{\nabla_{2}}{\nabla v'w'} = $
N2z.t.BzCziPzzEzzTzzy-yTzzy-yTzzy-yCzzDzzRxy.t.BxyCxyPxyExyPlixyFxySxyCxyPxySxyCxyPxySxyCxPxySyCxPxzSzCx2PxzExzCx2PixFxzTxzy-yTxzyGyzDyzSyzCyzPyzCyzPyzGyzDyzSyFyzTransTreTrp1Trp1Trp2Trp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp3.pGDPhiURhoAliRhoAliRhoJDi2RhoAliRhoPiliRhoPiliRhoPiliRhoPiliRhoPiliRhoPiliRhoPiliRhoPili <trr>RhoPili<td>time-rate of change of R_{33} bouyoancy production advection in y-direction shear production R_{23} Coriolis production of R_{22} pressure-velocity correlation Π_{33} Coriolis production of R_{22} pressure variable-density term viscous variable-density term viscous</td><td>$\frac{\partial_{1}R_{33}}{\partial z} \frac{\partial_{2}w'w'}{w''} \frac{\partial_{2}w'w'}{\partial_{2}w''} \frac{\partial_{2}w'w'}{\partial_{2}w''} \frac{\partial_{2}w'''}{\partial_{2}w'''} \frac{\partial_{2}w'''}{\partial_{2}w'''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w'''''} \frac{\partial_{2}w'''''}{\partial_{2}w'''''''''} \frac{\partial_{2}w''''''}{\partial_{2}w''''''''''''''''''''''''''''''''''''$</td></trr>	time-rate of change of R_{33} bouyoancy production advection in y-direction shear production R_{23} Coriolis production of R_{22} pressure-velocity correlation Π_{33} Coriolis production of R_{22} pressure variable-density term viscous	$\frac{\partial_{1}R_{33}}{\partial z} \frac{\partial_{2}w'w'}{w''} \frac{\partial_{2}w'w'}{\partial_{2}w''} \frac{\partial_{2}w'w'}{\partial_{2}w''} \frac{\partial_{2}w'''}{\partial_{2}w'''} \frac{\partial_{2}w'''}{\partial_{2}w'''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w''''} \frac{\partial_{2}w''''}{\partial_{2}w'''''} \frac{\partial_{2}w'''''}{\partial_{2}w'''''''''} \frac{\partial_{2}w''''''}{\partial_{2}w''''''''''''''''''''''''''''''''''''$
N2z.t.BzzCzzPizzEzzFizTzzy-yTzzy-yCzzDzzRxy.t.BxyCxyPxyExyPlizyFxyTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxyy-yTxzy-yTxzy-yTxzy-yTxzy-yTxzy-yTxzy-yTxzy-yTxzy-yTyzGyzDyzCyzPyzEyzCyzPyzGyzDyzTyz-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyzy-yTyz-y <td><pre>time-rate of change of R₃₃ shours any production advection in y-direction shear production II₃₃. Coriolis production of Rzz Coriolis production of Rzz Vertical transport 7₃₂₂ pressure valable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₂. Coriolis production of Ry divergence of T₁₂₂ turbulent transport vertical transport 7₁₂₂ pressure valable-density term viscous variable-density term</pre></td> <td>$\frac{\partial_{1}R_{33}}{\partial z} = \frac{2v_{z}w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2v_{z}w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}w_{z}}$</td>	<pre>time-rate of change of R₃₃ shours any production advection in y-direction shear production II₃₃. Coriolis production of Rzz Coriolis production of Rzz Vertical transport 7₃₂₂ pressure valable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₂. Coriolis production of Ry divergence of T₁₂₂ turbulent transport vertical transport 7₁₂₂ pressure valable-density term viscous variable-density term</pre>	$\frac{\partial_{1}R_{33}}{\partial z} = \frac{2v_{z}w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2v_{z}w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2v_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}} = \frac{2w_{z}w_{z}w_{z}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}}{2w_{z}w_{z}}} = \frac{2w_{z}w_{z}w_{z}}w_{z}}$
N22.1BzCziPizzFzzTzyyyYzyYCzyDzzRxy.tBxyCxyPxyExyPlxyFxyTxyy,yCxyPxyExyPlxyFxyTxyy,yCxzPxzExPizFxzTxy,yGxzDxzCxzPxzExPizFrzTxy,yTxy,yTxyGxzDxzCyzPyzEyzPizFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzFyzTrp1Trp2Trp3.yGCPhoUgradPUImmaC2Rho.enT.acT.acT.acT.acT.acRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPituxZRhoPitusZRhoPitusZRhoPitusZRhoPitusZ <td><pre>time-rate of change of R₃₃ buyoganey production advection in y-direction shear production Ir₃₃. Coriolis production of R₂₃ divergence of T₃₃₂ turbulent transport y- vertical transport T₃₃₂ pressure valable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₂ Coriolis production of R₁₂ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure valable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production of R₁₃ buyoganey production divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure valable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production divergence of T₁₂₂ turbulent transport vertical transport transport vertical transport divergence vertical transport divergence vertical transport divergence vertical transport divergence vertical transport transport viscous variable-density term viscous viscous dissipation pressure-velocity correlation terms transport by pressure-velocity correlation terms transport by pressure-velocity correlation terms transport by pressure-velocity correlation terms transport due to triple correlation terms transp</pre></td> <td>$\frac{\partial_{1}R_{33}}{\partial v} = \frac{2v_{v}'w'}{v_{v}'} = \frac{\partial_{y}w'w'}{\partial_{y}w} = \frac{2\overline{w}'y'}{\partial_{y}w'} = \frac{\partial_{y}w'w'}{\partial_{y}R_{33}} = \frac{2\overline{w}'y'}{\partial_{y}R_{33}} = \frac{2\overline{w}'y'}{\partial_{y}W'v'} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}w} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}w'} = \frac{2\overline{w}\partial_{y$</td>	<pre>time-rate of change of R₃₃ buyoganey production advection in y-direction shear production Ir₃₃. Coriolis production of R₂₃ divergence of T₃₃₂ turbulent transport y- vertical transport T₃₃₂ pressure valable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₂ Coriolis production of R₁₂ divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure valable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production of R₁₃ buyoganey production divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure valable-density term viscous dissipation pressure-velocity correlation II₁₃ Coriolis production divergence of T₁₂₂ turbulent transport vertical transport transport vertical transport divergence vertical transport divergence vertical transport divergence vertical transport divergence vertical transport transport viscous variable-density term viscous viscous dissipation pressure-velocity correlation terms transport by pressure-velocity correlation terms transport by pressure-velocity correlation terms transport by pressure-velocity correlation terms transport due to triple correlation terms transp</pre>	$\frac{\partial_{1}R_{33}}{\partial v} = \frac{2v_{v}'w'}{v_{v}'} = \frac{\partial_{y}w'w'}{\partial_{y}w} = \frac{2\overline{w}'y'}{\partial_{y}w'} = \frac{\partial_{y}w'w'}{\partial_{y}R_{33}} = \frac{2\overline{w}'y'}{\partial_{y}R_{33}} = \frac{2\overline{w}'y'}{\partial_{y}W'v'} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}v} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}w} = \frac{2\overline{w}\partial_{y}w'w'}{\partial_{y}w'} = \frac{2\overline{w}\partial_{y$
N22.1BzCziPizzEzzPizzFzzTzzyyGziDzzRxyCxyPxyExyPisyFxyTxyy,yTxyyGxyPxyExyPisyFxzTxyy,yTxyyGxzPizzExzPizzFxzTxyy,YTxyyGzzDyzExzPizzFxzTxyy,YTxyyGyzDyzEyzPizzTyzyGyzDyzEyzPiyzTyzTyzy-yTyzyGyzDyzEyzPiTrp1Trp2Trp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.yTrp2.yTrp3Trp1.pTrp3Trp1.pTrenHobTrpRhoPinitRhoPinitRhoPinitRhoPinit<	<pre>time-rate of change of R₃₃ buoyancy production shear production pressure-velocity correlation II₃₃. Coroiolis production of Rzz divergence of T₃₃₂ turbulent transport vertical transport T₃₃₂ pressure variable-density term viscous sivariable-density term viscous variable-density term oressure variable-density term vertical transport T₁₂ coroiolis production GRy divergence of T₁₂₂ turbulent transport vertical transport T₁₂₂ pressure variable-density term viscous variable-density term viscous variable-density term viscous variable-density term viscous dissipation pressure-velocity correlation II₁₂ coriolis production divergence of T₁₂₂ turbulent transport viscous dissipation pressure-velocity correlation II₁₃ coriolis production shear production viscous dissipation pressure-velocity correlation II₁₃ coriolis production divergence of T₁₂₂ turbulent transport viscous dissipation pressure-velocity correlation II₁₃ coriolis production divergence of T₁₃₂ turbulent transport viscous variable-density term viscous variable-density term pressure-velocity correlation terms transport by pressure-velocity correlation shear production viscous variable-density term viscous variable-density term viscou</pre>	$\frac{\partial_{1}R_{32}}{\partial_{2}v^{W}W'} = \frac{\partial_{2}v^{W}w'}{\partial_{2}v^{W}} = \frac{\partial_{2}v^{W}w'}{\partial_{2}v^{W}w'} = \frac{\partial_{2}v^{W}w'}{\partial_{2}v^{W}w'}}{\partial_{2}v^{W}w'$

RelativeHumidity







eps_0	fluid fraction (grid-based approach)
eps_1	solid fraction (grid-based approach)
eps_f	fluid fraction (volume-based approach)
eps_s	solid fraction (volume-based approach)

Vertical profiles scalar

	Mean						
rS rO	scalar (RA) scalar source (RA)	\overline{s}					
rS_y	y-derivative of scalar (RA)	$\overline{\partial_y s}$					
fS	scalar (FA)	$\langle s \rangle$					
fQ	scalar source (FA)	$\langle O_y s \rangle$					
	Fluctuations						
Rsu	covariance R_{su} (of scalar s and velocity u)	$\overline{s'u'}$					
Rsv	covariance R_{sv} (of scalar s and velocity v)	$\frac{s'v'}{s'sv'}$					
rS2	scalar variance R_{ss} (RA)	$\frac{s}{s's'}$					
rS3							
rS4 fS2	scalar variance (FA)	s's's' $\langle s's' \rangle$					
fS3		$\langle s's's'\rangle$					
fS4 $\langle s's's's' \rangle$							
S x2		$\overline{(\partial_{-}s')^2}$					
S_y2		$\frac{(\sigma_x s)}{(\partial_y s')^2}$					
S_z2		$\frac{(\partial_z s')^2}{(\partial_z s')^2}$					
S_x3 S2		$\frac{(\partial_x s')^3}{(\partial_x s')^3}$					
S_y3 S_z3		$\frac{(\partial_y s)^2}{(\partial_z s')^3}$					
S_x4		$\frac{\partial (z^{(2,1)})}{\partial x^{(2,1)}}$					
S_y4		$\frac{\overline{(\partial_y s')^4}}{\overline{(\partial_y s')^4}}$					
S_Z4	PssBudget	$(O_z S')^4$					
Reg t	time-rate of change of <i>B</i>	$\overline{\partial_{\cdot} R}$					
Css	advection in y-direction	$-\langle v \rangle \ \partial_u \overline{s's'}$					
Pss	gradient production	$-2\overline{s'v'}{\partial}_y\langle s\rangle$					
Ess Tssv1	molecular dissipation turbulent transport due to triple correlation	$\frac{1}{c'c'_{0}}$					
Tssy2	transport	$-2\kappa_d \overline{s'\partial_y s'}$					
Tssy_y	turbulent transport	$\partial_y(\mathrm{Tssy1} + \mathrm{Tssy2})$					
Qss	source						
	RsuBudget						
Rsu_t	time-rate of change of R_{su}	$\overline{\partial_t R_{su}}$					
Csu Psu	advection in y-direction shear and gradient production	$-\frac{\langle v \rangle}{-\overline{s'v'}\partial}\frac{\partial_y s'u'}{\langle u \rangle} - \overline{u'v'}\partial \langle s \rangle$					
Esu	molecular dissipation	$b \in Oy(u)$ $u \in Oy(b)$					
PIsu T 1	pressure redistribution	$\frac{\overline{p'\partial_x s'}}{\overline{d_x s'}}$					
Tsuv2	turbulent transport due to triple correlation transport	s' u' v'					
Tsuy_y	turbulent transport	$\partial_y(\mathrm{Tsuy1} + \mathrm{Tsuy2})$					
Dsu Gsu	diffusion variable-density term pressure-flux	0					
Bsu	buoyant production	0					
Fsu	Coriolis production	$f_y \overline{s'w'}$					
çsu	RsvBudget						
Rsv_t	time-rate of change of R_{sv}	$\overline{\partial_t R_{sv}}$					
Csv	advection in y-direction	$-\underline{\langle v \rangle} \partial_y \overline{s' v'}$					
Psv Fsv	shear and gradient production molecular dissipation	$-s'v'\partial_y\langle v angle -v'v'\partial_y\langle s angle$					
PIsv	pressure redistribution	$\overline{p'\partial_y s'}$					
Tsvy1	turbulent transport due to triple correlation	$\overline{s'v'v'}$					
1 svy2 Tsvv3	transport transport	$\overline{p's'}$					
Tsvy_y	turbulent transport	$\partial_y(\mathrm{Tsvy1} + \mathrm{Tsvy2} + \mathrm{Tsvy3})$					
Dsv Csv	diffusion variable-density term						
Bsv	buoyant production	$\frac{s \ o_y p}{\rho b' s'}$					
Fsv	Coriolis production	0					
QSV	RswBudget						
Rsw_t	time-rate of change of R_{sm}	$\overline{\partial_t R_{em}}$					
Csw	advection in y-direction	$-\langle v \rangle \partial_y \overline{s'w'}$					
Psw	shear and gradient production	$-s'v'\partial_y\langle w angle -v'w'\partial_y\langle s angle$					
PIsw	pressure redistribution	$\overline{p'\partial_z s'}$					
Tswy1	turbulent transport due to triple correlation	$\overline{s'v'w'}$					
Tswy2 Tswy_v	transport turbulent transport	$\partial_{u}(Tswy1 + Tswy2)$					
Dsw	diffusion variable-density term						
Gsw Bsw	pressure-flux buovant production	U 0					
Fsw	Coriolis production	$-f_y \overline{s'u'}$					
Qsw	source						
Cs1							
Čss1							
	Roughness						
Sbcs	scalar boundary values applied on solids						
eps_1	solid fraction (grid-based approach)						
eps_f	fluid fraction (volume-based approach)						
eps_s	soud traction (volume-based approach)						

Horizontal distribution of roughness elements





horizontal (x,z) distribution of roughness heights of the elements in grid points