**Data file 1**

Detection data for each site: AQ2\_S, AQ2\_W, CS2\_S. CS2\_W. GZ2\_S, GZ2\_W, NC2\_S, NC2\_W, WH2\_S, WH2\_W, YC2\_S, YC2\_W. W and S represent autumn and summer respectively.

sites: Yichang (YC), Wuhan (WH), Anqing (AQ), Changsha (CS), Nanchang (NC) and Ganzhou (GZ) in China.

elements: altitude (z), latitude (lat), longitude (lon), seconds after release (time). 1, 2, and 3 represent rising, flat-floating, and falling, respectively.

**Data file 2**

Calculated parameter files from the rising and flat-floating stages including six sites:

GWFL1\_W, GWFL1\_S.

elements:

IGW parameters: horizontal wavelength (lh1), kinetic energy (Ek), potential energy (Ep), zonal momentum flux (mfx1), meridional momentum flux (mfy1).

Turbulence parameters: turbulent kinetic energy dissipation rate (ԑ), and KHI (ratio of 0<Ri<0.25 from 18-25 km)

SGW parameters: Hurst index (H1) and intermittent parameter (C1)

**Data file 3**

Parameter files calculated from flat-floating data:

Parameter\_AQS, Parameter\_CSS, Parameter\_GZS, Parameter\_NCS, Parameter\_WHS, Parameter\_YCS, Parameter\_AQW, Parameter\_CSW, Parameter\_GZW, Parameter\_NCW, Parameter\_WHW, Parameter\_YCW.

elements: Hurst index (H1), intermittent parameter (C1), days from the first release (date, .5 represents the afternoon, starting on June 1 and October 13 respectively), mean flat-floating height (h)

**Data file 4**

Parameter files for the calculation premise of C1:

var\_AQS, var\_YCS, var\_CSS, var\_GZS, var\_NCS, var\_WHS, var\_YCW, var\_AQW, var\_WHW, var\_CSW, var\_GZW, var\_NCW.

elements: zonal (value is 1 means separation distance along the zonal direction, value is 2 means separation distance along the meridional direction), dgw (the scale of SGW corresponding to the parameter space), C3q (The distance between K(q) and 0 when q=1, and taking the case of less than 0.02 as approximately satisfying K(1)=0).

**Data file 5**

Parameter files for mean flat-floating height of all data:

Height\_S, Height\_S.

**Data file 6**

Parameter files from flat-floating stage for all data:

TOTAL\_float\_parameter\_S, TOTAL\_float\_parameter\_W

elements: C3q ((The distance between K(q) and 0 when q=1, and taking the case of less than 0.02 as approximately satisfying K(1)=0), intermittent parameter (C3), dgw (the scale of SGW corresponding to the parameter space), Hurst index (H1), mean flat-floating height (h), and GW state (state, 0 means stable GW, 1 means unstable GW, and 2 means GW + turbulence)

**Data file 7**

Gravity wave parameters and turbulence parameters in the ascending stage

TOTAL\_gravitywave\_parameter\_1S, TOTAL\_gravitywave\_parameter\_1W

elements:

IGW parameters: horizontal wavelength (lh1), kinetic energy (Ek1), potential energy (Ep1), zonal momentum flux (mfx1), meridional momentum flux (mfy1), horizontal propagation direction (theta1), ratio of intrinsic frequency to Coriolis force parameters (ratio1)

TOTAL\_turbulence\_parameter\_1S, TOTAL\_turbulence\_parameter\_1W

elements:

Turbulence parameters: Thorpe length (Lt), turbulent layer thickness (thikness1), turbulent kinetic energy dissipation rate (epsilon1), and turbulent diffusion coefficient (K1).

**Data file 8**

TOTAL\_C1

C1 parameter used to draw the corresponding graph

W3\_O3\_PV\_float, W3\_O3\_float.mat, PV\_float.mat

The ERA5 matched to the corresponding observation position then analyzes the vertical velocity, ozone, and potential vorticity in the data.