**1. Run control keywords**

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| **NAME** | **DEFAULT VALUE** | **TYPE** | **DESCRIPTION** | **MODEL** | **VALID ENTRIES** | **UNITS** |
| MODEL |  | CHARACTER | Model | TWOLAYERS  TWOCOMPONENTS | TWOLAYERS  TWOCOMPONENTS | - |
| DISTR1 | .FALSE. | LOGICAL | Flag to enable grainsize analysis for component 1. If .TRUE. the user must indicate the weights of the different grainsize classes | TWOLAYERS  TWOCOMPONENTS | .TRUE.  .FALSE. | - |
| DISTR2 | .FALSE. | LOGICAL | Flag to enable grainsize analysis for component 2. If .TRUE. the user must indicate the weights of the different grainsize classes | TWOCOMPONENTS | .TRUE.  .FALSE. | - |
| DEPRATES | .FALSE. | LOGICAL | Flag to enable deposition rates calculation. If .TRUE. the user must supply the grainsize of each nth component via the data file “componentn.dat” | DEPRATES | .TRUE.  .FALSE. | - |
| ONLY\_DEPRATES | .FALSE. | LOGICAL | If .TRUE. it is possible to run only the depositional model | DEPRATES | .TRUE.  .FALSE. | - |
| USR\_Z\_DYNPR | .FALSE. | LOGICAL | Flag to enable the calculation of depth averaged dynamic pressure at user requested heights | PROFILES | .TRUE.  .FALSE. | - |
| USR\_Z\_C | .FALSE. | LOGICAL | Flag to enable the calculation of the particle volumetric concentration at user requested heights | PROFILES | .TRUE.  .FALSE. | - |
| USR\_Z\_T | .FALSE. | LOGICAL | Flag to enable the calculation of the flow temperature | PROFILES | .TRUE.  .FALSE. | - |
| USR\_PCX\_SOL | .FALSE. | LOGICAL | Flag to enable the calculation of flow field variables at user requested percentiles | PROFILES DEPRATES | .TRUE.  .FALSE. | - |
| PROBT |  | DOUBLE PRECISION | Significance level for the two-tailed T-Student test | TWOLAYERS  TWOCOMPONENTS | - | - |
| ZDYNPR(i) |  | DOUBLE PRECISION ARRAY | User requested height(s) for the calculation of depth averaged dynamic pressure | PROFILES | - | m |
| ZC(i) |  | DOUBLE PRECISION ARRAY | User requested height(s) for the calculation of particle volumetric concentration | PROFILES | - | m |
| ZT(i) |  | DOUBLE PRECISION ARRAY | User requested height(s) for the calculation of depth averaged flow temperature | PROFILES | - | m |
| PCX(i) |  | DOUBLE PRECISION ARRAY | User requested percentile(s) for the calculation of flow field variables | PROFILES DEPRATES | - | - |
| PNSAVGGUESS | 1.d0 | DOUBLE PRECISION | Guessed initial value of average Rouse number | TWOLAYERS  TWOCOMPONENTS | - | - |
| PNSMAXGUESS | 1.d0 | DOUBLE PRECISION | Guessed initial value of maximum Rouse number | TWOLAYERS  TWOCOMPONENTS | - | - |
| PNSMINGUESS | 1.d0 | DOUBLE PRECISION | Guessed initial value of minimum Rouse number | TWOLAYERS  TWOCOMPONENTS | - | - |
| ZSFAVGGUESS | 1.d0 | DOUBLE PRECISION | Guessed initial value of average shear flow thickness | TWOLAYERS  TWOCOMPONENTS | - | m |
| Z0AVGGUESS | 1.d-4 | DOUBLE PRECISION | Guessed initial value of average reference level in the Rouse equation | TWOLAYERS  TWOCOMPONENTS | - | m |
| Z0MINGUESS | 1.d-4 | DOUBLE PRECISION | Guessed initial value of minimum reference level in the Rouse equation | TWOLAYERS  TWOCOMPONENTS | - | m |
| Z0MAXGUESS | 1.d-4 | DOUBLE PRECISION | Guessed initial value of maximum reference level in the Rouse equation | TWOLAYERS  TWOCOMPONENTS | - | m |
| ZLAM |  | DOUBLE PRECISION | Layer thickness | TWOLAYERS  TWOCOMPONENTS | - | m |
| ZLAMS |  | DOUBLE PRECISION | Sublayer thickness | TWOLAYERS  TWOCOMPONENTS | - | m |
| ZLAM\_MASSIVE |  | DOUBLE PRECISION | Thickness of the fine massive layer on top of the laminated layer | DEPRATES | - | m |
| C0 | 0.75 | DOUBLE PRECISION | Particle volumetric concentration at the reference height z0 | TWOLAYERS  TWOCOMPONENTS | - | - |
| KS |  | DOUBLE PRECISION | Substrate roughness | TWOLAYERS  TWOCOMPONENTS | - | m |
| SLOPE\_GROUND |  | DOUBLE PRECISION | Substrate slope | TWOLAYERS  TWOCOMPONENTS | - | ° |
| MU |  | DOUBLE PRECISION | Gas viscosity | TWOLAYERS  TWOCOMPONENTS | - | Pa s |
| DENGAS |  | DOUBLE PRECISION | Gas density | TWOLAYERS  TWOCOMPONENTS | - | kg m-3 |
| T\_GAS |  | DOUBLE PRECISION | Magmatic gas temperature | PROFILES | - | K |
| T\_AIR |  | DOUBLE PRECISION | Air temperature | PROFILES | 293 | K |
| T\_PARTICLES |  | DOUBLE PRECISION | Particles temperature | PROFILES | - | K |
| RHO\_PARTICLES |  | DOUBLE PRECISION | Particles density | PROFILES | - | kg m-3 |
| CP\_AIR |  | DOUBLE PRECISION | Specific heat at constant pressure of air | PROFILES | 1005 | J kg-1 K-1 |
| CP\_PARTICLES |  | DOUBLE PRECISION | Specific heat at constant pressure of the particles | PROFILES | - | J kg-1 K-1 |
| CP\_GAS |  | DOUBLE PRECISION | Specific heat at constant pressure of the gas | PROFILES | - | J kg-1 K-1 |
| R\_GAS |  | DOUBLE PRECISION | Gas constant of the magmatic gases | PROFILES | - | J kg-1 K-1 |
| P\_AIR |  | DOUBLE PRECISION | Atmospheric pressure | PROFILES | 101325 | Pa |
| DENS\_ENT |  | DOUBLE PRECISION | Density of the entrained particle | TWOLAYERS | - | kg m-3 |
| DM\_ENT |  | DOUBLE PRECISION | Diameter of the entrained particle | TWOLAYERS | - | m |
| DEP\_MEDIAN |  | DOUBLE PRECISION | Median of the total deposit | DEPRATES | - | m |
| RHOS\_MEDIAN |  | DOUBLE PRECISION | Density of the median of the total deposit | DEPRATES | - | kg m-3 |
| DAVGEQSPH(i) |  | DOUBLE PRECISION ARRAY | Average diameter of the equivalent sphere of particles in the median grainsize class of component 1 or 2 | TWOLAYERS  TWOCOMPONENTS | - | phi |
| PHI50(i) |  | DOUBLE PRECISION ARRAY | Particle equivalent diameter of the median size of component 1 or 2. Ignored if DISTR1=.TRUE. | TWOLAYERS  TWOCOMPONENTS | - | phi |
| D50MM(i) |  | DOUBLE PRECISION ARRAY | Particle equivalent diameter of the median size of component 1 or 2. Ignored if DISTR1=.TRUE. | TWOLAYERS  TWOCOMPONENTS | - | mm |
| SORTING(i) |  | DOUBLE PRECISION ARRAY | Sorting of grainsize distribution of component 1 or 2.  Ignored if DISTR1=.TRUE | TWOLAYERS  TWOCOMPONENTS | - | phi |
| NCLASS(i) |  | INTEGER ARRAY | Number of classes in the grainsize distribution of components.  Ignored if DISTR2=.TRUE. | TWOLAYERS  TWOCOMPONENTS | - | - |
| RHOS(i,j) |  | DOUBLE PRECISION ARRAY | Particle density of component i and class j (j=0 for median grainsize) | TWOLAYERS  TWOCOMPONENTS  DEPRATES | - | kg m-3 |
| RHOLAW(i) |  | CHARACTER ARRAY | Use correlation laws for calculating size-dependent particle density | TWOLAYERS  TWOCOMPONENTS  DEPRATES | POLLENA  AVERNO2  AMS  POMPEI  SIAL\_XX  FEM\_XX  LITHIC  MERCATO  ASTRONI  CUSTOM | - |
| RHO\_CUSTOM(i) |  | CHARACTER ARRAY | Type of user defined density | DEPRATES | CONSTANT  VARIABLE | - |
| CDLAW(i) |  | CHARACTER ARRAY | Drag law for component i | TWOLAYERS  TWOCOMPONENTS  DEPRATES | SPHERE  HAIDLEV  SWAMOJ  GANSER  CHIEN  TRANCONG  DELLINO  HOLZSOMM  DIOGMELE  DIOG2017  DIOG2018 | - |
| CIRCEQARD(i,j) |  | DOUBLE PRECISION ARRAY | Equal projected area circle diameter of component i | GANSER |  | m |
| CIRCULARITY(i,j) |  | DOUBLE PRECISION ARRAY | Circularity of component i | TRANCONG |  | - |
| COREY(i,j) |  | DOUBLE PRECISION ARRAY | Corey shape factor of component i (if undefined, then DLONG(i), DMED(i), DSHORT(i) are needed) | SWAMOJ |  | - |
| CROSSSPHER(i,j) |  | DOUBLE PRECISION ARRAY | Crosswise sphericity of component i | HOLZSOMM |  | m |
| FLATRATIO(i,j) |  | DOUBLE PRECISION ARRAY | Flatness ratio of component i (if undefined, then SUREQSPHD(i) and VOLEQSPHD(i) are needed | TRANCONG |  | m |
| ISOMETRIC(i) | .TRUE. | DOUBLE PRECISION LOGICAL | Flag to define that component i is isometric | GANSER |  | - |
| LONGSPHER(i,j) |  | DOUBLE PRECISION ARRAY | Lengthwise sphericity of component i | HOLZSOMM |  | m |
| SHAPEFACT(i,j) |  | DOUBLE PRECISION ARRAY | Shape factor of component i | DELLINO  DIOGMELE |  | - |
| SPHERICITY(i,j) |  | DOUBLE PRECISION ARRAY | Sphericity of component i | HAIDLEV  GANSER  CHIEN  HOLZSOMM  DIOG2016 |  | - |
| FRACTDIM(i,j) |  | DOUBLE PRECISION ARRAY | Fractal dimension of component i | DIOG2016 |  | m |
| FRACTAL(i) | .FALSE. | DOUBLE PRECISION LOGICAL | If .TRUE. the drag law uses fractal dimension as shape descriptor, otherwise sphericity | DIOG2016 | .TRUE.  .FALSE. | - |
| VOLEQSPHD(i,j) |  | DOUBLE PRECISION ARRAY | Volume equivalent sphere diameter of component i | GANSER |  | m |
| DOTESTCHI(i) | .TRUE. | LOGICAL ARRAY | Flag to enable Chi Squared test of the grainsize distribution of the two components | TWOLAYERS  TWOCOMPONENTS | .TRUE.  .FALSE. | - |
| SIGLEVCHI(i) |  | DOUBLE PRECISION ARRAY | Significance level of the Chi Squared test of the two components | TWOLAYERS  TWOCOMPONENTS |  | - |
| SENSCHI(i) | 0.05 | DOUBLE PRECISION ARRAY | Sensitivity of the Chi Squared test in rearranging weight fractions of the two components | TWOLAYERS  TWOCOMPONENTS |  | - |
| DPHI(i) |  | DOUBLE PRECISION ARRAY | Grainsize step in the distribution of the two components | TWOLAYERS  TWOCOMPONENTS  DEPRATES |  | phi |
| PHIMIN(i) |  | DOUBLE PRECISION ARRAY | Minimum phi of the distribution (maximum dimension) of the two components | TWOLAYERS  TWOCOMPONENTS  DEPRATES |  | phi |
| PHIMAX(i) |  | DOUBLE PRECISION ARRAY | Maximum phi of the distribution (minimum dimension) of the two components | TWOLAYERS  TWOCOMPONENTS  DEPRATES |  | phi |
| INPUT\_WEIGHT | - | CHARACTER | Type of input for the weight of the classes. If WT, the code read the weights as weight fractions, if MASS as mass in gr | TWOLAYERS  TWOCOMPONENTS  DEPRATES | WT  MASS |  |
| WTOT\_SAMPLE | - | DOUBLE PRECISION | Total mass of the sample. If not provided and if INPUT\_WEIGHT=MASS, the code recalculate this | TWOLAYERS  TWOCOMPONENTS  DEPRATES |  | gr |
| WEIGHT(i,j) |  | DOUBLE PRECISION ARRAY | Weights of the grainsize class of component i | TWOLAYERS  TWOCOMPONENTS  DEPRATES |  | gr or (%) |
| NCOMP |  | INTEGER | Number of components considered in the deposit | DEPRATES |  | - |
| MERGE\_CLASSES(i) | .F. | LOGICAL ARRAY | Flag to enable merging of grainsize classes | DEPRATES | .TRUE.  .FALSE. | - |
| PN\_CUT | .T. | LOGICAL ARRAY | Flag to avoid considering classes with Pn>5 in the deposition rates calculations | DEPRATES | .TRUE.  .FALSE. | - |
| SENSMERGE(i) | - | DOUBLE PRECISION ARRAY | Sensitivity of grainsize classes merging | DEPRATES |  | - |
| RHO\_FLOW(k) | - | DOUBLE PRECISION ARRAY | Flow density | DEPRATES | - | kg m-3 |
| ZTOT\_FLOW(k) | - | DOUBLE PRECISION ARRAY | Flow thickness | DEPRATES | - | m |
| USH\_FLOW(k) | - | DOUBLE PRECISION ARRAY | Flow shear velocity | DEPRATES | - | m s-1 |
| PNS\_FLOW(k) | - | DOUBLE PRECISION ARRAY | Flow average Rouse number | DEPRATES | - | m s-1 |
| N\_SOLUTIONS | - | INTEGER | Number of solutions for DEPRATES (valid if only DEPRATES is used) | DEPRATES | - | - |

**i**

**i = component**

**j = grainsize class**

**k = number of solutions for DEPRATES (if only this model is run).**