VSTATS

May 3, 2006

1 PURPOSE:

VSTATS computes some specialized statistics appropriate for a velocity vector time series expressed in the following complex form: \( \mathbf{W}_j = u_j + iv_j \). Here \( j = 1, N \) the number of terms and \( u_j \) and \( v_j \) are the orthogonal eastward and northward velocity component series, respectively.

The statistical quantities computed are based on a Reynolds partition as outlined in Kundu and Allen (JPO, 6, 181-199, 1976). Each velocity component series, \( u_j \) \((v_j)\), is separated into its mean and varying components according to the following definitions

\[
u_j = \overline{u} + u'_j ,
\]

where the series mean value is

\[
\overline{u} = \frac{1}{N} \sum_{j=1}^{N} u_j .
\]

and the fluctuation is \( u'_j = u_j - \overline{u} \), such that \( \overline{u'_j} = 0 \). Thus the variance of \( u_j \) is

\[
\sigma^2_u = \frac{1}{N-1} \sum_{j=1}^{N} u'_j^2 ,
\]

and the series mean value of the product of vector component fluctuations, (i.e. Reynolds stress) is

\[
\overline{u'v'} = \frac{1}{N} \sum_{j=1}^{N} (u'_j v'_j) .
\]

The standard deviations of the minimum \( \hat{u}_p' \) and maximum \( \hat{v}_p' \) fluctuation velocities in the respective principal directions are
\[ \hat{u}'_p, \hat{v}'_p = \left| \frac{u'^2 + v'^2}{2} \pm \gamma \frac{1}{2} \right|, \quad (5a) \]

where

\[ \gamma = \left( \frac{u'^2 - v'^2}{2} \right)^2 + u'v' \quad (5b) \]

The corresponding principal directions \( \phi_p \) are the two roots of

\[ \phi_p = \frac{1}{2} \tan^{-1} \left( \frac{-2u'v'}{u'^2 - v'^2} \right), \quad (6) \]

where the direction of the major axis \( \phi_p^{\text{max}} \) is clockwise relative to the direction of the input velocity component \( v \) (usually north); the direction of the minor axis \( \phi_p^{\text{min}} = \phi_p^{\text{max}} + 90^\circ \).

2 EXECUTION:

OK, VSTATS
DO YOU WANT LIST OPTION Y/N?
SERIES u INPUT NAME: - enter u filename
SERIES v INPUT NAME: - enter v filename

. .

until $\$$ entered
TTY TABULAR OUTPUT

INPUT
SERIES NAMES MEAN VAR \( \bar{u}'v' \) \( \phi_{\hat{u}} \) \( \phi_{\hat{v}} \) \( \phi_p \) \( \delta_p \) \( \hat{u}_p \)
U
V

DO YOU WANT TO CREATE OUTPUT FILES Y/N?
IF Y,
VSTATS

ENTER COLUMN (0 TO END):
ENTER FILE NAME:

3 OUTPUT: