

where  $n$  is the size of the HDS and  $F(\alpha;p,n-p)$  is the  $\alpha$  quantile of  $F(\alpha;p,n-p)$ .

### III. CONCLUSION

Signal interpretation requires a procedure for isolating the contribution of each variable and/or a particular group of variables. As with univariate control, out of control situations can be attributed to individual variables being outside their allowable operational range

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## A SOFTWARE FOR TIME SERIES ANALYSIS OF NORTEK INSTRUMENTS: TSA\_NORTEK\_V1

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*Abstract - The software TSA\_NORTEK\_V1 has been created to carry out the processing of current meter data from NORTEK INSTRUMENTS: AWAC, AQUAPRO and AQUADOPP. The software offers a default data processing (spectral analysis, harmonic analysis, calculation of residual series) and an optional processing (axes rotation, choice of depth for the analysis, processing of vertical velocity component and filtering of time series). In addition, TSA\_NORTEK\_V1 produces harmonic constituent files to be used with the tidal prediction software TIDEX.*

*Keywords - software, processing data, time series analysis, AWAC, AQUAPRO, AQUADOPP.*

### I. INTRODUCTION

TSA\_NORTEK\_V1 software has been created by the Physical Oceanography Group of University of Cádiz in collaboration with the Instituto Hidrográfico de la Marina and INNOVA S.A. to carry out the processing of current meter data from NORTEK INSTRUMENTS: AWAC, AQUAPRO and AQUADOPP. TSA\_NORTEK\_V1 is written in Matlab language but it has been compiled to works independently of that.

The program begins asking some questions. First one, you should indicate which instrument data to process are from. Data can be derived from three different instruments: AQUADOPP (current meter), AQUAPRO or AWAC (current profilers). Later, you should indicate the mooring position and the header file name, to open and extract the more relevant information about the mooring and instrument configuration. This part of the program is common to any analysis you want to do, nevertheless, from here, the processing of AQUADOPP data varies slightly from the AQUAPRO and AWAC ones.

### II. RUNNING TSA\_NORTEK\_V1 TO AQUAPRO AND AWAC DATA

The processing of AQUAPRO and AWAC data has the same features (both are current profilers) and, therefore, the software runs similarly in both cases. Once the header file is opened, the program shows the more important information related to the mooring and instrument configuration: mooring position, sample period, sample interval, cell size, blanking distance, mean mooring depth and cell depths. AQUAPRO and AWAC data are available along the whole water column at different depths and you can choose the desired depths for the data analysis. As an aid, the program displays two graphics. First one, illustrating the pressure (sea level) and velocity time series of the five surface cells.

The second one shows the time averaged current velocity profiles for the chosen period. Once the depths for the analysis are selected, the software carries out an optional and a default data processing

#### Optional data processing:

- Axes rotation to project the velocity data on the predominant direction.
- If several depths were chosen, you can decide between the data analysis for each depth or for the averaged depths.
- In many cases the value of the vertical velocity is not necessary for the study and then the analysis of this velocity component is optional.
- If you want, it is possible to obtain a filtered series of velocity and sea level data.

#### Default data processing:

- Spectral analysis of original and/or residual series.
- Harmonic analysis of time series.
- Velocity and sea level tidal prediction for the mooring dates and computation of residual series.
- Creation of harmonic constituent files for tidal prediction software TIDEX.

The results from data analysis are saved in a set of files:

- A data processing information file.
- Harmonic analysis results for each depth (or averaged depths), each velocity component and sea level.
- Harmonic analysis results for each depth (or averaged depths), each velocity component and sea level compatible with TIDEX software.
- Residual series for each velocity component and sea level.
- Filtered data for each velocity component and sea level (only if filtered data option is chosen).
- Spectral analysis graphics for original and/or residual velocity and sea level data.

### III. RUNNING TSA\_NORTEK\_V1 TO AQUADOPP DATA.

The recorded data by AQUADOPP, on the contrary that these obtained by current profilers (AQUAPRO or AWAC) are taken in only one depth, were instrument is placed. Therefore, the software varies slightly. The principal differences are three:

- Mooring information and depth choice. As there are not time series in different depths, it is not necessary to choose the desired depth to analyse.
- Sea level series analysis. Due to the fact that the instrument is moored at a certain depth suffering the displacement of the mooring line these measurements are frequently noisy and its analysis is not worthwhile.
- Output files. The number of result files is lesser by the cited reasons: Sea level analysis is not carried out and only one depth is processed.