FEWS – URBS Adapters
V 1.0

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Acknowledgements.

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28th March 2001

1 Introduction.

The Mekong River Commission through its Regional Flood Management and Mitigation Centre office commissioned the development of URBS' adapters so that the Mekong River URBS' model could be interfaced with the FEWS flood forecasting system.

This manual outlines the adapters developed for this interface. Three adapters are described viz. pre, model and post adapters.

In general terms the pre adapter reads data files created by the FEWS Flood forecasting system and converts these data to URBS input data files. It also reads the URBS initialization file put the URBS data files into the correct directories and to facilitate creation of a Model Adapter and which is simply a batch file that runs the model. All errors, warnings, debug and general information produced by the pre adapter are filed to a FEWS diagnostic or log file.

The post adapter reads the URBS output files and converts these files to FEWS xml format. It also collates all model messages together with messages created by the adapter itself and files these to the prescribed FEWS log file.

The three adapters are executed using FEWS' general adapter.

The next sections described details of the three adapters in turn.

2 URBS Pre Adapter.

The URBS pre adapter executable is named preadapter.exe.

The executable takes 5 parameters. These are as follows:

Parameter 1: FEWS XML data file
Parameter 2: URBS 'ini' file
Parameter 3: FEWS Diagnostic or log file
Parameter 4: URBS catchment definition file or vector file
Parameter 5: URBS Rainfall definition file

These parameters should be entered into the general adapter file. Details of each parameter are discussed in turn:

2.1 Parameter 1: FEWS XML Data Series File

This file is created by FEWS and should contain all the data necessary for the run. These data should include – rainfall series – one for each sub-catchment, recorded gauging station data and thirdly inflow data.   Which type of data is specified using the ParameterId keyword in the XML file as follows:

Rainfall   to specify rainfall data
Gauge   to specify recorded river level data
Inflow   to specify inflow data (discharge data from external catchment)

As an example, an excerpt from a typical FEWS xml data (the header section) is shown below. In this instance the ParameterId is set to *Rainfall* indicating that the following data is a rainfall series.

```
<header>
        <type>accumulative</type>
        <locationId>basin64p001</locationId>
        <parameterId>Rainfall</parameterId>
        <timeStep unit="second" multiplier="3600"/>
        <startDate date="2008-01-01" time="07:00:00"/>
        <endDate date="2008-01-28" time="00:00:00"/>
        <missVal>-99.0</missVal>
        <stationName>64_1</stationName>
        <units>mm</units>
</header>
```

The pre adapter extracts the start date, end date and time increment for the data series from the startDate, endDate and timeStep keywords in the header file. When several series are included in the FEWS xml data file, the earliest start date and latest end date is assumed to the start date and end date for the URBS model run.

The pre adapter creates an individual file for each data series contained in the FEWS xml data file. The name of this file is taken from the locationId keyword in the series header – see example above. This locationId tag is appended with either a ".r", ".g" or '.i" suffix depending on whether the type of data is rainfall, gauging station or inflow data respectively.

The pre adapter obtains the time zone from the timezone keyword listed in the XML file e.g.
 `<timeZone>7.0</timeZone>`

If this time zone is not specified then the operating system time zone will be used. The time zone value is written to the model adapter batch file through setting the operating system environment variable "TZ".

If the pre adapter cannot read the prescribed fields in the FEWS xml file, an error message will be generated and the error location specified with a line number. The adapter subsequently terminated and the message written to the FEWS Diagnostic log file. The name of this file is specified as the parameter 3 of the pre adapter.

2.2 Parameter 2: URBS' 'Ini' File

The URBS 'ini' file is a file that contains the bin and run directories for the model run, model parameters and general model settings.   To specify a directory the user should not end the directory name with a backslash. This will be added to by the pre adapter.

A sample URBS 'ini' file is shown below as an example.

[URBS Directories]
URBS_BIN=..\..\..\bin
URBS_RAIN=..\input
URBS_GAUG=..\input
URBS_INFS=..\input
URBS_RETS=..\output
URBS_HSTD=..\states
URBS_LOGD=..\logs

[Model Parameters]
URBS_IL=0
URBS_PR=0.25
URBS_IF=2500
URBS_ALPHA=0.15
URBS_BETA=10
URBS_M=0.8

[Data Parameters]
URBS_BASF=FALSE
URBS_HOTS=FALSE

[Matching Parameters]
URBS_SCAL=TRUE

[Real Time Parameters]
URBS_REAL=FALSE

The pre adapter reads the locations of the URBS directories specified in the ini file to determine the location of the URBS kernel urbs32.exe , where the newly created data files extracted from the FEWS xml file will be written to, and where the pre adapter diagnostic messages will be sent to.

An explanation for each of the URBS' model variables used to specify directory locations follows:

URBS_BIN specifies the location of the URBS model kernel urbs32.exe
URBS_RAIN specifies where the rainfall files (.r) will be written to.
URBS_GAUG specifies where the gauging station files (.g) will be written to.
URBS_INFS specifies where the inflow files (.i) will be written to.
URBS_RETS specifies where the results of the model will be stored.
URBS_HSTD specifies where the hot start file should be stored.
URBS_LOGD specifies where the pre adapter messages should be written to.

Setting of these directories has to be done as per the directory model set up as prescribed in the FEWS general adapter.

The pre adapter reads the URBS_HOTS model variable. Its value (TRUE or FALSE) as indicated in the 'ini' file is included in the model adapter. The URBS_HOTS variable determines whether the model run will be hot started or not.

The remaining parameters in the 'ini' file are not read by the adapter but used directly by the URBS' model kernel urbs32.

It should be noted that the model parameters are traditionally listed on the URBS' kernel urbs32.exe command line. For the FEWS implementation these are now listed in the URBS 'ini' file. It is envisaged that in the future a FEWS utility will be available to allow changes to these parameters values. This can currently only be done by directly editing the URBS' 'ini' file.

2.3 Parameter 3: FEWS Diagnostic File.

This is an xml file that contains diagnostic messages from the URBS' pre adapter. The parameter should also include the directory where this file should be stored. It is recommended that the XML diagnostic filename be named as urbsdiag.xml.

2.4 Parameter 4:   URBS Catchment Definition or Vector File.

This parameter specifies the URBS catchment definition or vector file. This parameter should not include a directory as it is assumed it will be available from the current run directory. For the FEWS setup this is set to the 'model' directory. This vector file usually has a suffix of '.vec'.

2.5   Parameter 5:   URBS Rainfall Definition File.

This is parameter specifies the URBS catchment definition or vector file. This parameter should not include a directory as it is assumed it will be available from the current run directory. This file contains the model time step (not to be confused with the data series time step) and the forecast duration ie the number of hours after the current time for which forecasts are required.   The file usually has a suffix as '.rdf'. The name of the file (without the suffix) will be used as the base name for all URBS' output files.

2.6 General Considerations

It should be noted that dates specified in the FEWS flood forecasting system are specified using the usual nomenclature as yyyy-mm-dd. In URBS the specification is dd-mm-yyyy. This is automatically catered for in the pre-processing.

The FEWS Diagnostic file name (Parameter 3) can be omitted from the list of arguments. If this is the case then it is assumed that the file will be located where the URBS ini file is located and its name will be urbsdiag.xml. Omitting this parameter will prevent specification of the URBS' catchment and rainfall definition files. These in turn can be specified in the URBS' ini file using the URBS' model variables URBS_CDF and URBS_RDF respectively.

The pre adapter xml parser assumes that all data are contained on the one line – i.e. line breaks are not inserted within parameter or data value assignments in the xml file. Any inserted line breaks of this type will cause the pre adapter to fail.

The pre adapter log file should always be checked for any errors warnings etc..

3   URBS Model Adapter

The URBS' Model adapter is written by the URBS' pre adapter and together with the URBS' ini file contains all the information for the URBS model to run. The URBS Model adapter is named ModelAdapter.bat and is located in the URBS model directory in the FEWS forecasting system.

The model adapter sets the start date for the run, the end date for data extraction, the relevant time zone, the directory that the model run diagnostic files will be written to, and the date at which a hot start file will be written.

A sample Model Adapter file is shown on the next page.

REM FEWS URBS MODEL ADAPTER DATED Tue Mar 25 11:50:20 2008

```
SET URBS_DATE=01/01/2008
SET URBS_TIME=06:00:00
SET URBS_HOTS=FALSE
SET END_DATE=28/01/2008
SET END_TIME=00:00:00
SET UHST_DATE=28/01/2008
SET UHST_TIME=00:00:00
SET URBS_LOGF=TRUE
SET URBS_LOGD=..\logs
SET TZ=CST-7
..\..\..\BIN\URBS32.EXE basin64.vec basin64.rdf
```

The model start time is specified using the URBS_DATE and URBS_TIME variables. If a hot start file is to be used then this file will contain the starting date and time – however the URBS_HOTS will have to be set to TRUE in the URBS' ini file.

The hot start date and time are specified using the UHST_DATE and UHST_TIME respectively. These values are specified in the URBS' 'ini' file. If they are not specified then are set to the end date and time. If the end date and time is in the future then the hot start and time are set to 7:00 am run date. The hot start file is written to the output directory and named as basename.hst – where the 'basename' is obtained from the rainfall definition file name as described in the pre adapter section of this manual.

The last line executes the URBS' kernel urbs32. Note the location of this executable is determined from the URBS_BIN setting in the URBS' 'ini' file. If this is not set the default is ..\..\..\bin – which is the current implementation (March 2008) in FEWS.

3.1 General Considerations

URBS has hot starting capabilities – however integrating these with FEWS model has as yet to be implemented. This is not a serious limitation as the execution time to run the model from the beginning of each year to the wet season's end is very fast. Notwithstanding this the hot start parameters are included to facilitate future implementations of the URBS FEWS interface.

4 URBS Post Adapter

The URBS post adapter is named postAdapter.exe. This adapter converts the URBS output files to a single xml results file and appends log messages from both the model run and the post adapter itself to the log file created by the pre adapter.

The URBS Post adapter requires 5 parameters. These are as follows:

Parameter 1: URBS CSV output file
Parameter 2: URBS run log file
Parameter 3: URBS error log file
Parameter 4: FEWS xml results file
Parameter 5: FEWS xml diagnostic file.

These parameters should be entered into the general adapter file. Details of each parameter are discussed in turn:

4.1 Parameter 1: URBS CSV File

The URBS' 'csv' file contains all the results from the URBS' model run. The 'csv' file contains 4 sets of data for each 'Point of Interest' (POI). POI's are specified using the Print command in the URBS' catchment definition file.   The four sets are:

*Gross Rainfal*l – the averaged total rainfall to each point of interest for each time step
Effective Rainfall – the average excess rainfall to each point of interest.
River Levels - both calculated and recorded if available
Flow Rates - both calculated and estimated from rating curves using recorded levels.

The post adapter extracts all information from this file and converts it to an FEWS xml file. The header (see pre adapter section) required for each FEWS xml series is populated as follows:

The header *<type>* is accumulative for gross and effective rainfall and instantaneous for river levels and flow rates.

The header *<parameterId>* is as follows:

Gross Rainfall   : Gross_Rainfall
Effective Rainfall   :   Net_Rainfall
River Levels – calculated : Calculated_Level
River Levels – recorded   :   Recorded_Level
Flow Rates – calculated   :   Calculated_Discharge
Flow Rates – recorded [*]   :   Recorded_Discharge
* estimated from rating curves using recorded levels

The *<ParameterId>* is used by FEWS to determine how the data should be presented.

The FEWS xml data series *<startDate>*, *<endDate>* and *<timeStep>* parameter values are determined from the start date, end date and calculated time increment in the URBS' 'csv' file.

The *<locationId>* and *<stationName>* parameters values are set to the Point of Interest location name as written to the URBS' 'csv' file.
An xml data flag of 2 (good data) is assigned to each data value written.

4.2 Parameter 2: URBS Run Log File.

With every model run URBS produces a run log file that details all the information that the model produces associated with model run. The default name for this file is urbsout.log. This parameter should be specified in the general adapter including its full path name to the location of this log file. The location of this file is specified in the URBS' 'ini' file – see URBS pre adapter section.

4.3 Parameter 3: URBS Error Log File.

With every model run URBS produces an error log file that details all the warning and errors that the model produces associated with model run. The default name for this file is urbserr.log. This parameter should be specified in the general adapter to include its full path name to the location of this log file. The location of this file is specified in the URBS' 'ini' file – see URBS pre adapter section.

4.4 Parameter 4: FEWS xml Results File.

This parameter specifies the location and name of the FEWS xml results file.

4.5 Parameter 5: FEWS xml Diagnostics File.

This parameter specifies the location and name of the FEWS xml diagnostic file. This file should be same name as prescribed on the third parameter required for the URBS pre adapter.

4.6 General Considerations

The time stamp for each value in the URBS' 'csv' file is in EXCEL format i.e. number of days since 1900. Part of a day is represented as a fraction. This value is in local time. Two issues may emerge here – rounding errors due to the conversion process and secondly the time zone. The time zone is accessed from the operating system for the conversion process.

5 Version Control and Support

Only versions of the URBS' kernel 4.32 or later should be used with the FEWS system.

The user should contact Don Carroll at doncarroll@optusnet.com.au for support in regards to the use of the URBS' adapters. However, at all times the user should check the FEWS' URBS diagnostic file to determine whether the problem is a configuration issue or a problem with the adapter themselves.

Good Luck!.