

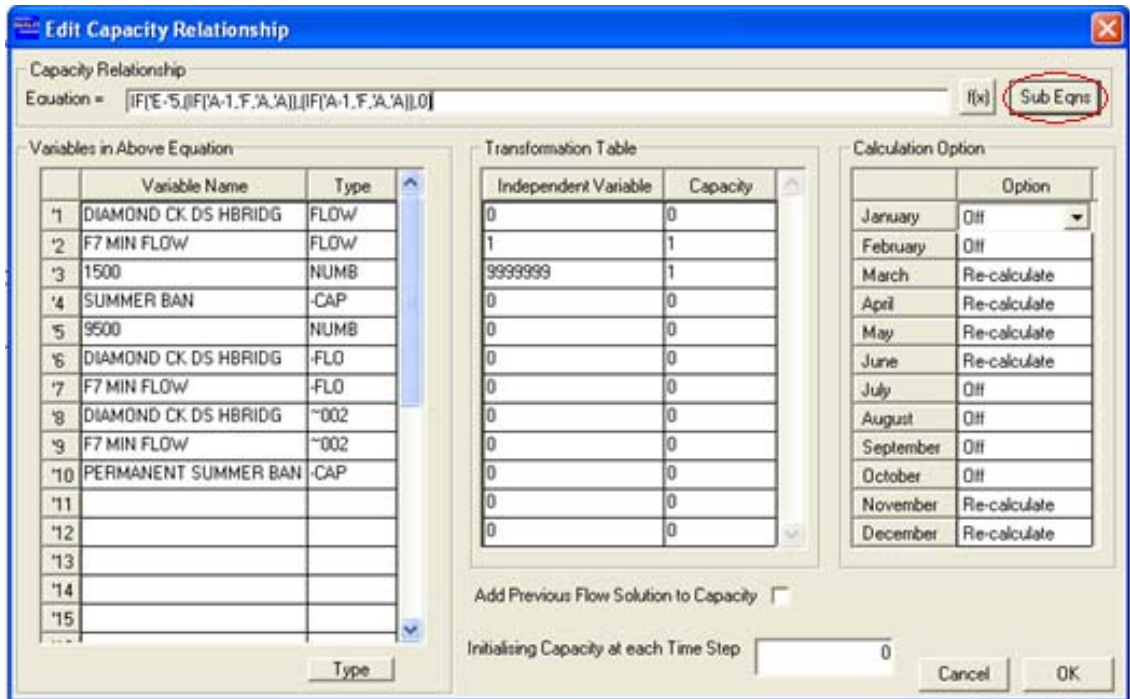
# General changes to REALM version 6.00

## 1. Introduction

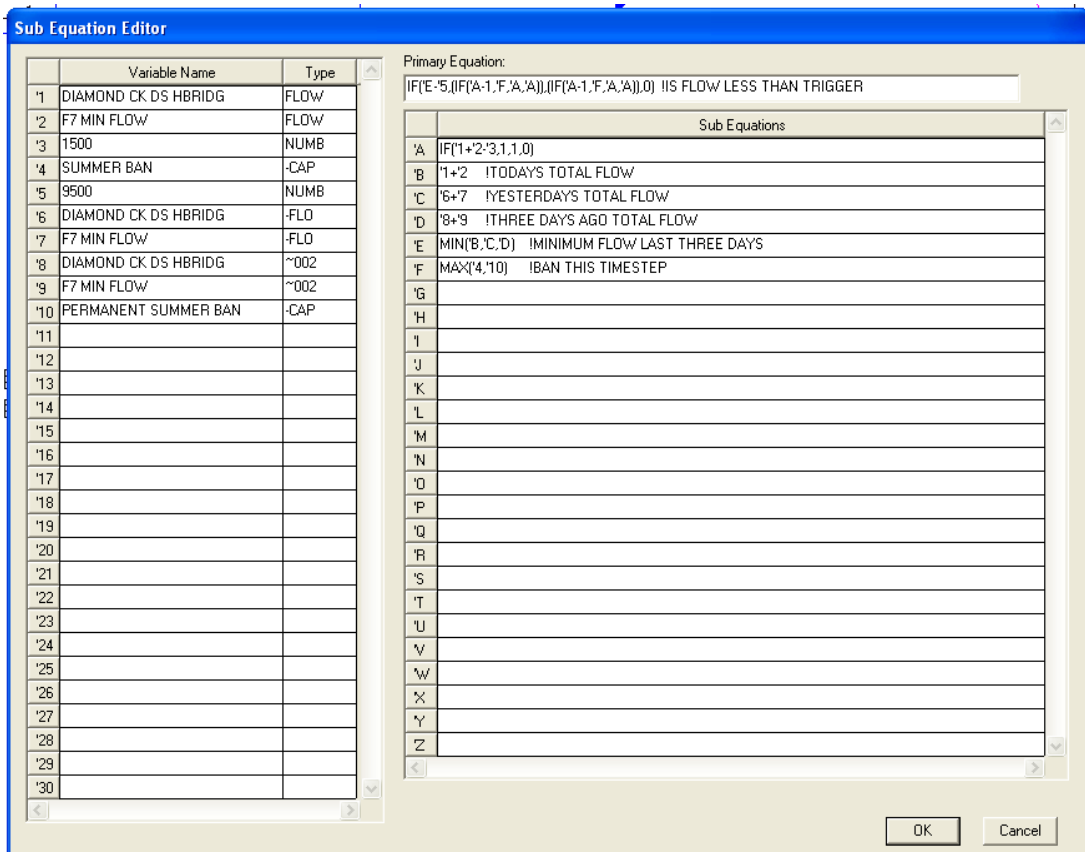
This file note is a documentation of some of the major modifications to REALM version 6.00 and discussion of why model results may change.

## 2. Sub-equations

REALM version 6.00 includes functionality to specify up to 26 sub-equations within variable capacity carriers. Sub-equations act as intermediate steps in the calculation of the carrier capacity, and can be accessed via the “Edit Capacity Relationship” windows (shown in Figure 2-1) by clicking the *Sub Eqns* button.



■ Figure 2-1: Edit Capacity Relationship Window

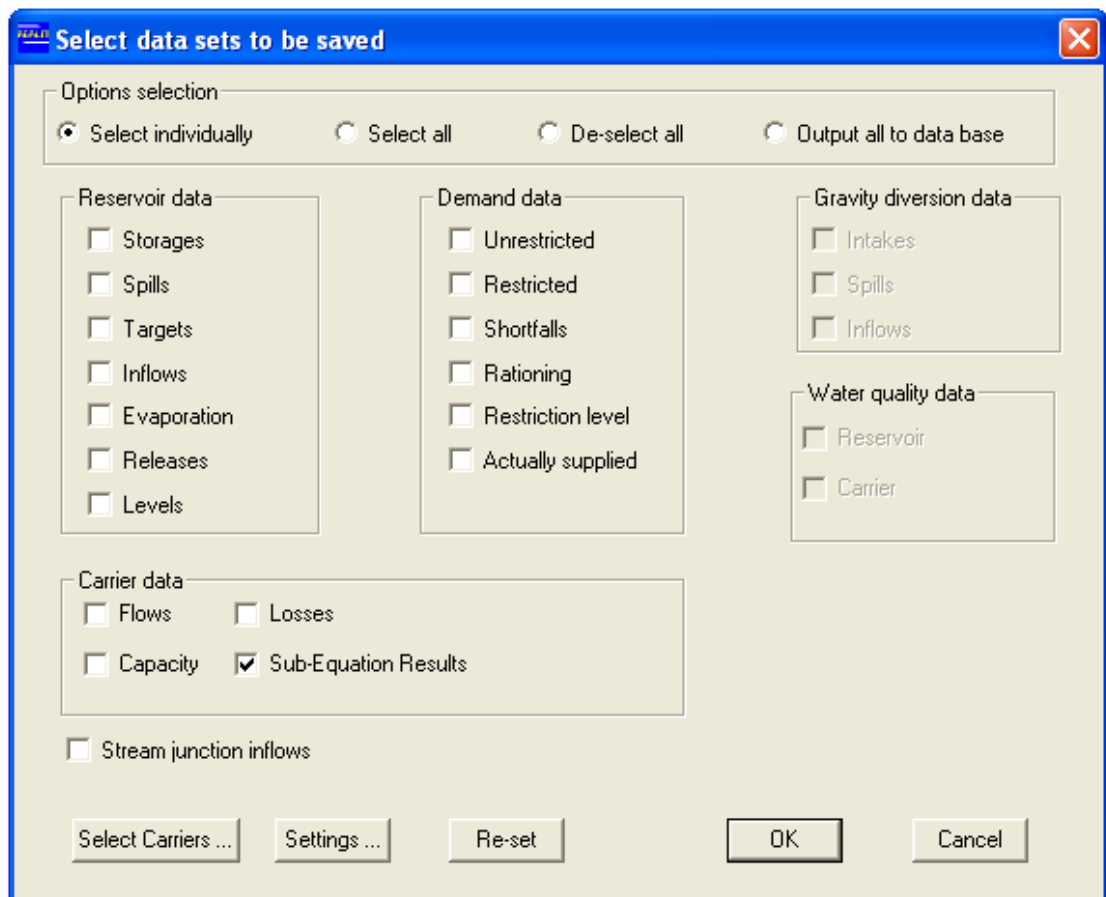


■ **Figure 2-2: Sub-Equations Window**

The sub-equation editor window is shown in Figure 2-2. It includes the same list of system variables shown in the main capacity editor window on the left hand side. On the right hand side, the user can include up to 24 sub-equations labelled as ‘A, ‘B through to ‘Z. Sub-equations can refer to any variable from the system variables list, or the result of any preceding sub-equation. Sub-equations can also be referenced in the *Primary Equation*.

As for all equations in REALM, comments can be added by the use of an exclamation mark to denote the start of a comment. The primary equation and sub-equations can be up to 80 characters long, including comment text.

The results of each sub-equation can be output from the REALM model by clicking on the *Sub-Equation Results* tick box in the output selection window (Figure 2-3). This is accessed through the REALM setup menu.

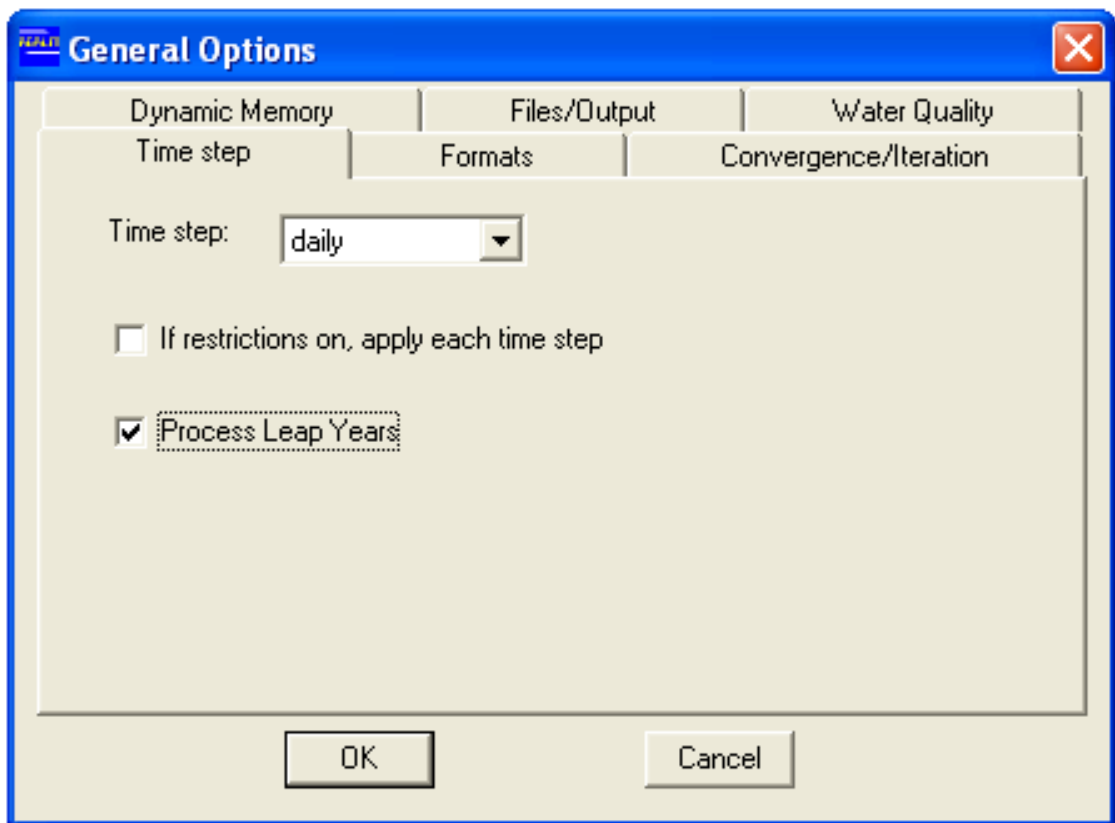


■ **Figure 2-3: Output Selection Window**

### 3. Leap Year Modelling

To improve the functionality of daily REALM models, version 6.00 has been enhanced to include the ability to model leap years. Prior to version 6.00, leap years were not recognised by REALM.

To access the leap year functionality in REALM, open the options window (shown in Figure 3-1) from the main REALM menu by clicking Run::Options. Click on the *Time Step* tab and tick the *Process Leap Years* box.



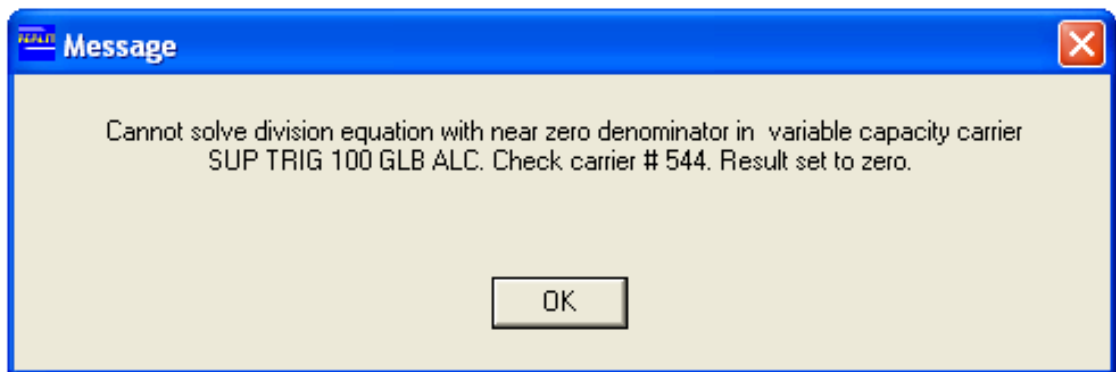
■ **Figure 3-1: REALM General Options Window**

#### **4. Enhanced Equation Error Messages**

Error messages have been added to version 6.00 that warn the user if an invalid calculation is being attempted in a carrier equation. Such invalid operations include:

- Division with a denominator of or close to zero;
- Square root of a number less than zero;
- Logarithm of a number less than or equal to zero.

The model will warn during run time that such a numeric calculation has been encountered. The user will be told the name and number of the carrier where the error was found. Similar to the situation where an iteration failure is encountered, the run is paused while this message is displayed. If the user clicks “OK”, or does not respond to the message within 10 seconds, the erroneous calculation result is set to zero and the run resumes. Additionally, the error message is also noted in the log file, and the user is informed again at the end of the run that an error has occurred and to check the log file for details. An example message is shown below.



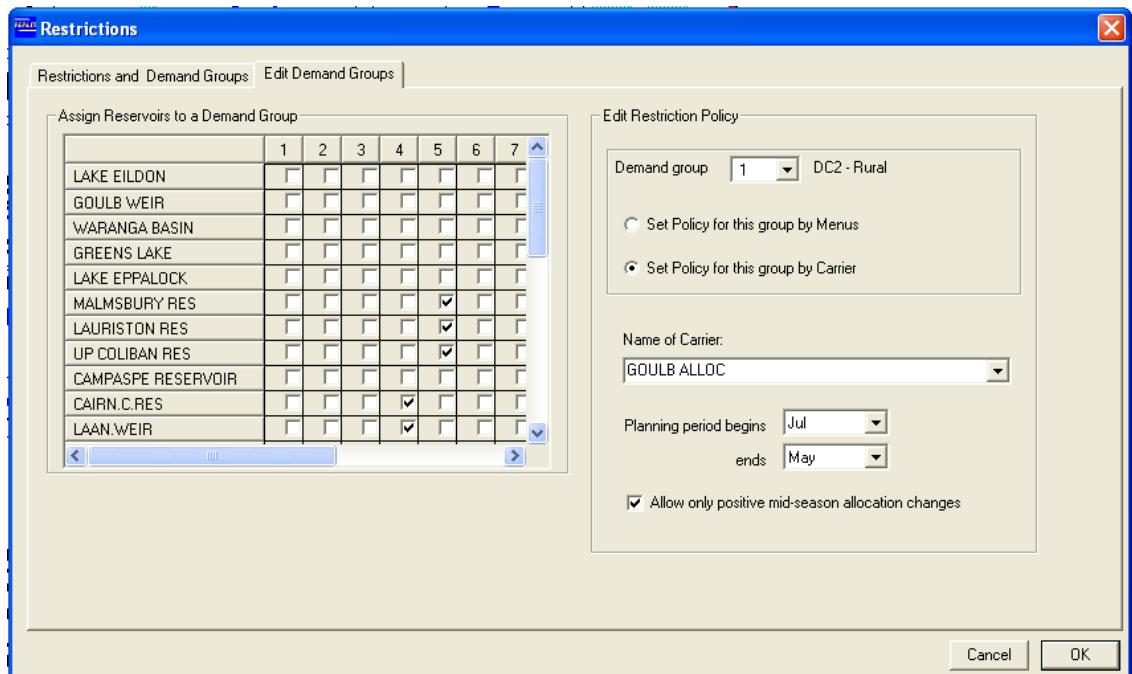
To overcome this error, the relevant carrier equation needs to be edited to remove the occurrence of such calculations. If appropriate, this could be done with an IF statement, such that if the denominator of the division is equal to zero then set the equation to zero.

## 5. Zero Allocations

A bug has been fixed in version 6.00 that prevented a demand group with an allocation of zero in the planning period from being restricted. This fix has the potential to cause significant changes to the model results, and it is strongly recommended that all model results be checked for instances of zero allocations when being converted from version 5.00 to version 6.00.

## 6. Implementing Rural Restrictions by Carrier

In REALM version 5.00, the user has the option of setting restrictions for a rural demand group to be calculated using a carrier. However, the user could not access some fields used by the model to determine start and end dates of the planning period. This has been fixed in version 6.00 to include fields for *Planning period starts, ends* and *Allow only positive mid-season allocation changes* in the rural restrictions by carrier window (shown in Figure 10-1).



■ Figure 6-1: Restrictions Window

## 7. Capacity Shared Carriers

The number of capacity shared carriers permitted in any group has been increased from three to ten. Additionally, the functionality to specify shares to two decimal places has been added.

In the first iteration, the capacity of all carriers in a group is set to be equal to that of the key carrier. In the second iteration, the capacity of each carrier is set to its percentage share multiplied by the capacity of the key carrier and spare capacity (based on flow in each carrier from the 1<sup>st</sup> iteration) is shed to other carriers in the group. During testing, it was found that this was causing an excess of capacity shedding. Thus the code was changed to prevent capacity shedding until the third iteration. This has reduced the number of instabilities and non-convergent solutions observed in models with capacity shared carriers, but may also cause changes to model results. It is strongly recommended that all model results be checked for instances of capacity shared carriers when being converted from version 5.00 to version 6.00.

## 8. DC1 Base Demand

A bug was fixed in version 6.00 where if the base demand of a DC1 restriction group was specified as a percentage of the demand, the percentage specified was not being converted to a decimal place. For example, if the base demand was specified in the system file as 74.00%, the restricted demand calculated using this base demand was equal to unrestricted demand times 74 instead of unrestricted demand times 74/100. This bug would only occur if the very first demand group was **not** a DC1 group with base demand expressed as a percentage. It is strongly recommended that model results be checked for instances of this bug when being converted from version 5.00 to version 6.00.

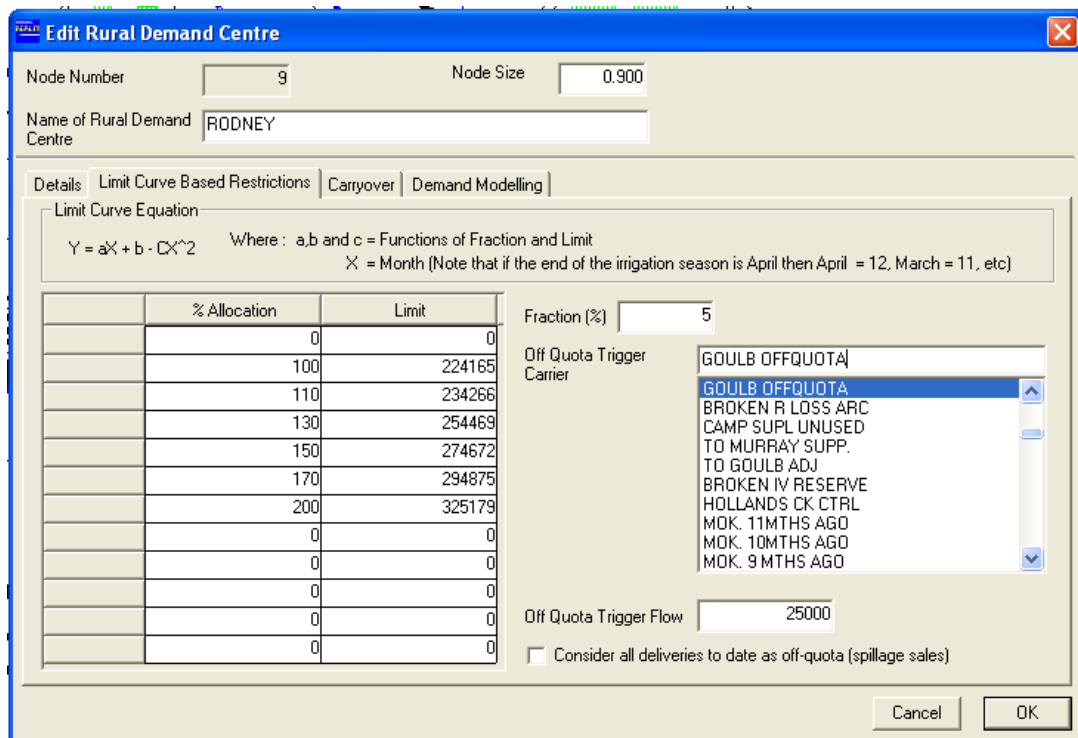
## 9. File Format Changes

Enhancements to increase the maximum number of carriers in a model to 1500 and to increase the maximum number of iterations to 999 have also taken place for version 6.00. This required a change to the format of the scenario file, ans\_file.dat, the system file and output files. The user is warned if a system file in the old format is being converted to the new format. System files saved in the new format cannot be used in versions of REALM prior to version 6.00.

## 10. Modelling Spillage Sales

The ability to model 'spillage sales' has been added to version 6.00. Spillage sales refers to a situation used in some systems where supply to date during the season is reset to zero if an off-quota event occurs. For example, an irrigator with an allocation of 100 ML may divert say 40 ML, after which an off-quota event occurs. Normally the irrigator can then only divert the remaining 60 ML of their allocation to the end of the season. Under spillage sales rules, the allocation reverts back to 100 ML.

To turn on spillage sales rules, click the *Consider all deliveries to date as off-quota (spillage sales)* box in the rural demand centre node window (shown in Figure 10-1).



■ **Figure 10-1: Rural Demand Centre Window**

## 11. Other Changes

A number of other general bug fixes and enhancements have also been made to improve general useability of the model in version 6.00, and include:

- The model no longer crashes out if an infeasible solution or read only files are encountered.
- The number of characters allowed in directory and file names has been increased to 256, which is the current limit of Windows.
- The length of comments on nodes and carriers in the system file has been increased from 80 characters to 400 characters.
- The functionality to plot target curves (refer User Manual Section 5.8.2) and urban demand group restriction curves (User Manual Section 5.7.1.1) is now operational.
- A bug fix has been implemented to ensure that target groups and restriction groups are not thrown out of order when a reservoir node or a demand node is deleted from the system file.
- A button has been added to the target curve editor window allowing linear target curves to be easily calculated.
- The maximum number of iterations allowed in a time step has been increased from 99 to 999.
- A bug fix was undertaken in version 6.00 in regards to the calculation of off-quota supply at rural demand nodes. It was found that some rural demand nodes with off-quota supply were not in fact being recognised as such. This bug fix has the potential to change the model results and it is recommended that models be checked for rural demand nodes with off-quota supply when being converted from version 5.00 to version 6.00.
- A bug fix was implemented to ensure that correct results were provided when multiple items are extracted from a results database via the Utilities::Database Extraction tool.

- An optional command line argument has been added to the stand-alone version of REALM. This allows REALM stand-alone to run a model in a different directory to the one it is currently located in. The argument should simply be the name of the directory containing the model the user wishes to run. If the argument is omitted, REALM stand-alone runs the model in the same directory as it is located.