Description of updating methods

Direct updating of discharge (quseobs)

To use direct updating of discharge set `update quseobs` in info.txt. Subbasins chosen for updating are given in the file update.txt. Recorded values are given in Qobs.txt. It is possible to force updating on all stations in Qobs.txt by setting `update quseobs allstation` in info.txt. It is also possible to force no updating by setting `update quseobs nostation` in info.txt. In case of these latter two options, the settings in update.txt are ignored.

The updating method replaces modeled discharge with observed discharge when available.If Qm = modelled discharge and Qr = recorded discharge, then for timesteps with observations (Qr<>-9999):

Qm = Qr

AR – updating of discharge (qar)

To use AR-updating of discharge set `update qar` in info.txt. Subbasins chosen for updating and their AR-factor are given in the file update.txt. Recorded values are given inQobs.txt. It is possible to force no updating by setting `update qar nostation` in info.txt. In this case, the settings in update.txt are ignored.

The updating method applies AR-updating on discharge. Timesteps with observations are not updated but the modelled error saved. The AR-updating is then applied on following timesteps without any observation. Let t0 be a timestep with an observation followed by timesteps (t+n) without any observations. Let AR be the AR-factor (usually 0-1) set by user, Qm = modelled discharge and Qr = recorded discharge. Err is the calculated error on the last timestep with observation, then the updated discharge (Qar) is:

$$Err\left(to\right)=Qm\left(to\right)-Qr\left(to\right)$$

$$Qar\left(t+n\right)=Qm\left(t+n\right)-Err\left(to\right)\times AR^{n}\ \left(Qar\geqslant 0\right)$$

The change made in the last timestep is saved for the next timestep and then multiplied with AR again. The change for the last timestep is saved to the statefiles when an output state is asked for. This change is used for continued AR-updating after the model is restarted from the saved state.

Updating of lake water stage (wendupd)

To use lake water updating set `update wendupd wstr` in info.txt. Subbasins chosen for updating are given in the file update.txt. Recorded values (`wstr`) are given in Xobs.txt.

The updating method replaces modeled water stage of outlet lake with water stage when available. If *Wm* = modelled waterstage and *Wr* = recorded waterstage, then for timesteps with observations (*Wr*<>-9999):

$$Wm = Wr$$

Both state variables and output variables are updated by the subroutine. For lake basins, only the last lake basin may be updated. The output variable will be updated to the water stage of the whole lake. The state variable(s) of the last lakebasin will be updated to recorded waterstage recalculated to represent the area of the last lakebasin.

AR - updating of lake water stage for discharge (warupd)

To update discharge with AR used on lake water stage set `update warupd wstr` in info.txt. Subbasins chosen for updating are given in the file update.txt. Recorded values (`wstr`) are given in Xobs.txt. This method cannot be used in combination with updating methods `qar` or `wendupd`. This method cannot be used for regulated lakes.

The updating method applies AR-updating on error of water stage in outlet lake. The output variable for water stage is updated with the current AR-changed error or a saved AR-change. Let t0 be a timestep with an observation followed by timesteps(t+n) without any observations. Let *AR* be the AR-factor (usually 0-1) set by user, *Wm* = modelled water stage and *Wr* = recorded water stage. Err is the calculated error on the last timestep with observation, then the updated discharge (*War*) is:

$$Err\left(to\right) = Wm\left(to\right) \square Wr\left(to\right)$$

$$War\left(t+n\right) = Wm\left(t+n\right) - Err\left(to\right) \times AR^{n} \quad \left(War \geqslant 0\right)$$

The change made in the last timestep is saved for the next timestep and then multiplied with AR again. The change for the last timestep is saved to the statefiles when an output state is asked for. This change is used for continued AR-updating after the model is restarted from the saved state.

The AR-updated water stage is then used to calculate the current discharge. The current discharge is calculated as the mean of the discharge (at the end of) last time step and the discharge (at the end of) current time step with a rating curve.

The updating method does not replace the state of modeled water stage of outlet lake with observed water stage. Only the modeled water stage that are printed to file are changed.

For lake basins, only the last lake basin may be updated. The output variable will be updated to the water stage of the whole lake. The state variable(s) of the last lakebasin will be updated to recorded waterstage recalculated to represent the area of the last lakebasin.

Updating of total phosphorus (TP) and total nitrogen (TN) concentration

To use updating on TP concentration set `update tpcorr` in info.txt. Similarly for nitrogen set `update tncorr`. Subbasins chosen for updating and how much are given in the file update.txt. Column headings subid, tpcorr and tncorr. Use fraction 0 for excluding a updating for a subbasin.

The updating method changes modeled TP or TN concentration out from the subbasin by a fraction (e.g. tpcorr). If TPm = modelled TP concentration and TPc = changed TP concentration, then for all timesteps:

TPc = TPm* (1+tpcorr)

Updating of local phosphorus and nitrogen concentration

To use updating on local TP or TN concentration set `update tploccorr` or `tnloccorr` in info.txt. Subbasins chosen for updating and how much are given in the file update.txt. Column headings subid, tploccorr and tnloccorr. Use fraction 0 for excluding a updating for a subbasin.

The updating method changes modeled TP concentration out from the local river in the subbasin to the main river by a fraction (e.g. tploccorr). If TPm = modelled local TP concentration and TPc = changed local TP concentration, then for all timesteps:

TPc = TPm* (1+tploccorr)