HLWYM HEmails

From: Stuart Stothoff
Sent: Friday, October 06, 2006 2:35 PM
To: Eugene Peters; Randall Fedors
Cc: James Winterle
Subject: ITYM/UZFLOW question

Gene, Randy

I am writing a revision to the UZFLOW documentation and in the process I'm thinking about the implementation.

There is are modes in the UZFLOW calculation where the ITYM results are directly used. As it is implemented now, two dtbl input files may be used, maydtbl.dat and smaydtbl.dat, which represent the mean and standard deviation of log-10 MAI for each pixel. ITYM is also capable of creating maidtbl.dat, which is the mean of MAI for each pixel.

In one mode, maydtbl.dat is used for the spatial patterns and tpa.inp determines the magnitude of present-day repository-average MAI, which scales the spatial patterns.

In another mode, both maydtbl.dat and smaydtbl.dat are used, with MAI for a realization determined by 10^(Y + s*N), where Y and S are the maydtbl and smaydtbl values, N is a N(0,1) random parameter, and the truncation points for N are determined by tpa.inp.

In both modes, Y and s are averaged over each subarea and the sampling is done on the subarea-averaged values.

I am a little concerned about how the averaging of s is done. I can come up with 4 ways:

* sYs = mean(S), where S is the set of pixel values (this is the current approach in UZFLOW)
* sYv = sqrt(mean(S^2)), which preserves variance
* sYd = log10(mean(10^(Y+S))) - Y, which is some odd mixture
* sYl = sqrt((2/log(10)) * (log10(I) - Y), which is the standard deviation for a lognormal distribution

Note that the first three use the maydtbl.dat and smaydtbl.dat files, whereas the last uses the maidtbl.dat and maydtbl.dat files.

I ran a case with statistics from all pixels (no ITYM pixel averaging) in a 6 x 9 km domain. The results of the calculations are

MAP	MAT	MAIi	MAIy	sYs	sYv	sYd	sYl
100	0.00	9.3	3.3	0.75	0.76	0.81	0.62
200	0.00	30.1	14.2	0.70	0.72	0.72	0.53
400	0.00	85.1	53.4	0.58	0.60	0.58	0.42
800	0.00	215.0	168.4	0.40	0.43	0.41	0.30
100	7.33	6.3	1.7	0.79	0.79	0.88	0.70
200	7.33	20.4	6.8	0.82	0.83	0.86	0.64
400	7.33	65.1	29.9	0.74	0.76	0.75	0.54
800	7.33	176.9	107.7	0.61	0.64	0.62	0.43
100	14.67	4.1	0.9	0.77	0.77	0.91	0.75
200	14.67	14.4	3.5	0.87	0.88	0.97	0.73
400	14.67	46.2	14.1	0.89	0.91	0.93	0.67
800	14.67	139.9	61.6	0.78	0.82	0.79	0.56

100	22.00	2.6	0.5	0.72	0.72	0.90	0.78
200	22.00	9.2	1.6	0.89	0.89	1.04	0.81
400	22.00	31.7	6.8	0.96	0.97	1.05	0.76
800	22.00	101.4	29.2	0.95	0.98	0.98	0.69

In general, there is very little difference between sYs and sYv but sYv may be preferred on theoretical grounds. The sYd is generally comparable to or larger than the sYs and sYv values.

The major difference is in the sYl approach, which yields smaller standard deviations than the sYv approach in all but one case (the warmest and driest extreme). The sYl approach yields increasingly smaller values relative to sYv as conditions become cooler or wetter. The deviation may be due to negative correlations between pixels somewhat compensating during the averaging process - I'd need to revise ITYM output to investigate further.

It is not clear to me what the correct theoretical approach should be. If I were starting UZFLOW from scratch, I would likely implement the sYl model, because in some sense it accounts for correlations.

We need to modify UZFLOW to implement long-term-average conditions and a few other minor changes. I suggest that at the same time we also modify the option that calculates net infiltration directly from ITYM results in two ways that we have not discussed before:

* implement the sYl model instead of the sYs model (preferred); otherwise implement the sYy model
* add one additional tpa.inp parameter multiplying the MAI values calculated by ITYM, which would account for climatic variability between the decadal and sub-orbital time scales

We could also provide the user an option to run either the sYy or sYl approach, but this would require providing all three input dtbl files (maidtbl.dat, maydtbl.dat, and smaydtbl.dat) instead of just two.

None of these are large coding changes.

Please think it over, and we can finalize the decision when we talk with Jim.

stu

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