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ERRATUM

The effect of non divergence-free velocity fields on field scale ground water solute transport

Hakan Sirin

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Since the variable name ''β'' is already used for the time-wise integration of velocity, Eqs. 22 and 23 should be replaced with

$$\rho = \rho_0(1 + \varepsilon c) = \rho_0 \sigma \tag{22}$$

$$\varepsilon n \frac{\partial \langle c \rangle}{\partial t} = \frac{\partial \left(\langle \sigma \rangle K_G \frac{\partial (\langle p \rangle / \gamma)}{\partial x} \right)}{\partial x} \tag{23}$$

The last integrant in Eq. 31 should have a closing ''>>''.

The Lie operator properties given in Appendix C should be replaced with the following equalities.

$$\exp[w \cdot \nabla] F(x) = F(\exp[w \cdot \nabla] x)$$

$$\exp[w \cdot \nabla](F_1(x) F_2(x)) = (\exp[w \cdot \nabla] F_1(x)) (\exp[w \cdot \nabla] F_2(x))$$

in which w is a vector and F, F_1, F_2 are functions. The left time ordering symbols in Eqs. 37 through 44 should be placed before the ''exp'' for the homogeneity of the notation in the paper. The definition of ''v'' appearing in Eqs. 42 through 45 should be

$$v = \int_{t-s}^{\tau} \langle v_x(x, \eta) \rangle \mathrm{d}\eta$$

The definition of ''β'' appearing in Eq. 44 and 45 should be

$$\beta = \int_{t-s}^{t} \langle v_x(x, \eta) \rangle \mathrm{d}\eta$$

The definition of ''$\overline{v}_x$'' appearing in Eq. 45 should be

$$\overline{v}_x = v_x - \langle v_x \rangle$$

If the analysis of the transport problem in Sirin (2006) is broken into more than one short time intervals one can show that the new velocity correction for a standing plume during the kth time interval can be calculated by using

$$\sum_{l=1}^{k} \overline{Cov}[v_x, v_x]_l \, t_l \left[\frac{t_l}{2} \frac{\partial}{\partial x} \left\{ \left(\int_{\text{Over } l\text{th interval}} \mathrm{d}\tau \frac{\partial \langle v(x,\tau) \rangle}{\partial x} \right) \Big/ t_l \right\} + \sum_{\substack{m=l+1 \\ m \le k}}^{k} t_m \frac{\partial}{\partial x} \left\{ \left(\int_{\text{Over } m\text{th interval}} \mathrm{d}\tau \frac{\partial \langle v(x,\tau) \rangle}{\partial x} \right) \Big/ t_m \right\} \right]$$

where $\overline{Cov}[v_x, v_x]_l$ is the average value of covariance function corresponding to lth time interval, t_l and t_m are the length of lth and mth time intervals, respectively. The formula used for the calculation of the new velocity

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H. Sirin (✉)
Civil Engineering Department,
Anadolu University, 26555 Eskisehir, Turkey
e-mail: hsirin@anadolu.edu.tr

Table 1 Effect of the new velocity correction

Time (days)	Maximum ⟨c⟩[a]	Maximum ⟨c⟩[b]	Difference (%)
40	0.994348	0.994355	0.00
60	0.960035	0.958508	+0.16
80	0.902803	0.898489	+0.48
100	0.837441	0.833721	+0.44
200	0.588064	0.599140	–1.88
300	0.466976	0.479081	–2.59
400	0.401047	0.408561	–1.87

[a] With density dependent flow equation and the new velocity correction term

[b] With density dependent flow equation only

Table 2 Effect of using density dependent flow equation

Time (days)	Maximum ⟨c⟩[a]	Maximum ⟨c⟩[b]	Difference (%)
40	0.994355	0.998047	–0.37
60	0.958508	0.976774	–1.91
80	0.898489	0.929430	–3.44
100	0.833721	0.870795	–4.45
200	0.599140	0.631644	–5.43
300	0.479081	0.503084	–5.01
400	0.408561	0.427252	–4.57

[a] With density dependent flow equation only

[b] Without density dependent flow equation (i.e. Eq. 23 with $\varepsilon = 0$)

correction in Sirin (2006) corresponds to the first term only in the formula above. The solution of the transport problem broken into 50 day time intervals in Sirin (2006) with the correct formula above and with finer finite element mesh should be as in Table 1 and Table 2.

Reference

Sirin H (2006) The effect of non divergence-free velocity fields on field scale ground water solute transport. Stoch Environ Res Risk Assess 20:381–390