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Erratum: A review on the systematic formulation of 3-D multiparameter full waveform inversion in viscoelastic medium

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Erratum of the paper ‘A review on the systematic formulation of 3-D multiparameter full waveform inversion in viscoelastic medium’, by Yang *et al.*, published in *Geophys. J. Int.* (2016) 207, 129–149.

The following equations were erroneously displayed in this paper and should be read as follow.

The gradient of the misfit function with respect to model parameters \mathbf{m} is the same as the gradient of the Lagrangian at the saddle points considering \mathbf{w} and \mathbf{m} are independent variables when performing derivatives:

$$\frac{\partial \mathbb{L}}{\partial \mathbf{m}} = \left\langle \bar{\mathbf{w}}, \frac{\partial F(\mathbf{m}, \mathbf{w})}{\partial \mathbf{m}} \right\rangle_T \Leftrightarrow \frac{\partial \chi}{\partial \mathbf{m}} = \left\langle \bar{\mathbf{w}}, \frac{\partial F(\mathbf{m}, \mathbf{w})}{\partial \mathbf{m}} \right\rangle_T \quad (61)$$

$$\begin{aligned} \left\langle \frac{\partial \chi}{\partial \mathbf{m}}, \delta \mathbf{m} \right\rangle_{\Omega} &= \int_{\Omega} \mathbf{d}\mathbf{x} \delta \rho \left(\int_0^T dt \bar{\mathbf{v}}^\dagger \partial_t \mathbf{v} \right) \\ &+ \sum_{l=1}^6 \sum_{j=1}^6 \int_{\Omega} \mathbf{d}\mathbf{x} \delta C_{lJ} \left(\int_0^T dt \bar{\sigma}^\dagger \frac{\partial C^{-1}}{\partial C_{lJ}} \left(\partial_t \sigma - \mathbf{f}_\sigma + (C :: \Gamma) \sum_{\ell=1}^L y_\ell \xi_\ell \right) \right) + \sum_{l=1}^6 \sum_{j=1}^6 \int_{\Omega} \mathbf{d}\mathbf{x} \delta C_{lJ} \left(\int_0^T dt \bar{\sigma}^\dagger C^{-1} \frac{\partial(C :: \Gamma)}{\partial C_{lJ}} \sum_{\ell=1}^L y_\ell \xi_\ell \right) \\ &+ \sum_{\ell=1}^L \sum_{l=1}^6 \sum_{j=1}^6 y_\ell \int_{\Omega} \mathbf{d}\mathbf{x} \delta Q_{lJ}^{-1} \left(\int_0^T dt \bar{\sigma}^\dagger C^{-1} \left(C :: \frac{\partial \Gamma}{\partial Q_{lJ}^{-1}} \right) \xi_\ell \right), \end{aligned} \quad (66)$$

$$\begin{aligned} \frac{\partial \chi}{\partial \rho} &= \int_0^T dt \bar{\mathbf{v}}^\dagger \partial_t \mathbf{v}, \\ \frac{\partial \chi}{\partial C_{lJ}} &= \int_0^T dt \bar{\sigma}^\dagger \frac{\partial C^{-1}}{\partial C_{lJ}} \left(\partial_t \sigma - \mathbf{f}_\sigma + (C :: \Gamma) \sum_{\ell=1}^L y_\ell \xi_\ell \right) + \int_0^T dt \bar{\sigma}^\dagger C^{-1} \frac{\partial(C :: \Gamma)}{\partial C_{lJ}} \sum_{\ell=1}^L y_\ell \xi_\ell, \\ \frac{\partial \chi}{\partial Q_{lJ}^{-1}} &= \int_0^T dt \bar{\sigma}^\dagger C^{-1} \left(C :: \frac{\partial \Gamma}{\partial Q_{lJ}^{-1}} \right) \left(\sum_{\ell=1}^L y_\ell \xi_\ell \right), \quad \text{with } \left(\frac{\partial C :: \Gamma}{\partial C_{lJ}} \right)_{ij} = \begin{cases} (Q_{lJ}^{-1})_{ij}, & \text{if } ij = lJ, JI \\ 0, & \text{otherwise.} \end{cases} \end{aligned} \quad (69)$$

$$\begin{aligned} \frac{\partial \chi}{\partial \rho} &= \int_0^T dt \bar{\mathbf{v}}^\dagger \partial_t \mathbf{v}, \\ \frac{\partial \chi}{\partial C_{lJ}} &= - \int_0^T dt \bar{\sigma}^\dagger C^{-1} \frac{\partial C}{\partial C_{lJ}} C^{-1} D^T \mathbf{v} + \int_0^T dt \bar{\sigma}^\dagger C^{-1} \frac{\partial(C :: \Gamma)}{\partial C_{lJ}} \sum_{\ell=1}^L y_\ell \xi_\ell, \\ \frac{\partial \chi}{\partial Q_{lJ}^{-1}} &= \int_0^T dt (D^T \bar{\mathbf{u}})^\dagger \left(C :: \frac{\partial \Gamma}{\partial Q_{lJ}^{-1}} \right) \left(\sum_{\ell=1}^L y_\ell \xi_\ell \right), \end{aligned} \quad (70)$$

$$\Gamma = \begin{bmatrix} \frac{\rho\alpha^2 Q_\alpha^{-1}}{\rho\alpha^2} & \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & 0 & 0 & 0 \\ \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & \frac{\rho\alpha^2 Q_\alpha^{-1}}{\rho\alpha^2} & \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & 0 & 0 & 0 \\ \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & \frac{\rho\alpha^2 Q_\alpha^{-1} - 2\rho\beta^2 Q_\beta^{-1}}{\rho\alpha^2 - 2\rho\beta^2} & \frac{\rho\alpha^2 Q_\alpha^{-1}}{\rho\alpha^2} & 0 & 0 & 0 \\ 0 & 0 & 0 & \frac{\rho\beta^2 Q_\beta^{-1}}{\rho\beta^2} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{\rho\beta^2 Q_\beta^{-1}}{\rho\beta^2} & 0 \\ 0 & 0 & 0 & 0 & 0 & \frac{\rho\beta^2 Q_\beta^{-1}}{\rho\beta^2} \end{bmatrix} \quad (86)$$

$$\frac{\partial \Gamma}{\partial Q_\alpha^{-1}} = \begin{bmatrix} 1 & \frac{\alpha^2}{\alpha^2 - 2\beta^2} & \frac{\alpha^2}{\alpha^2 - 2\beta^2} & 0 & 0 & 0 \\ \frac{\alpha^2}{\alpha^2 - 2\beta^2} & 1 & \frac{\alpha^2}{\alpha^2 - 2\beta^2} & 0 & 0 & 0 \\ \frac{\alpha^2}{\alpha^2 - 2\beta^2} & \frac{\alpha^2}{\alpha^2 - 2\beta^2} & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}, \quad \frac{\partial \Gamma}{\partial Q_\beta^{-1}} = \begin{bmatrix} 0 & \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & 0 & 0 & 0 \\ \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & 0 & \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & 0 & 0 & 0 \\ \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & \frac{-2\beta^2}{\alpha^2 - 2\beta^2} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \quad (87)$$

$$\partial_t \xi_\ell^{ij} + \omega_\ell \xi_\ell^{ij} = \omega_\ell \epsilon_{ij} \Rightarrow \xi_\ell^{ij} = -\frac{1}{\omega_\ell} \partial_t \xi_\ell^{ij} + \epsilon_{ij}, \quad (B8)$$

The online version of this paper has been corrected. The publisher apologise for these errors.