GIQE derivatives

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GIQEv4

$$\frac{\partial g_4}{\partial \mathrm{GSD}} = -\frac{0.16\,\theta(\mathrm{RER}-0.9)+3.16}{\mathrm{GSD}\log(10)}$$

$$\frac{\partial g_4}{\partial \mathrm{RER}} = -\frac{0.16}{\log(10)}\log(\mathrm{GSD})\,\delta(\mathrm{RER}-0.9) - \frac{1.258}{\log(10)}\log(\mathrm{RER})\,\delta(\mathrm{RER}-0.9) - \frac{1.258\,\theta(\mathrm{RER}-0.9)-2.817}{\mathrm{RER}\log(10)}$$

$$\frac{\partial g_4}{\partial G} = -\frac{0.344}{\mathrm{SNR}}$$

$$\frac{\partial g_4}{\partial H} = -0.656$$

$$\frac{\partial g_4}{\partial \mathrm{SNR}} = \frac{0.344G}{\mathrm{SNR}^2}$$

$$\iint \frac{\partial g_4}{\partial \mathrm{GSD}}\,\mathrm{dGSD}\,\mathrm{dRER} = -\frac{\log(\mathrm{GSD})}{\log(10)}((0.16\mathrm{RER}-0.144)\,\theta(\mathrm{RER}-0.9)+3.16\mathrm{RER})$$

$$\iint \frac{\partial g_4}{\partial \mathrm{RER}}\,\mathrm{dRER}\,\mathrm{dGSD} = \frac{1}{\log(10)}\mathrm{GSD}[\theta(\mathrm{RER}-0.9)(0.16(1-\log(\mathrm{GSD}))-1.258\log(\mathrm{RER}))+2.817\log(\mathrm{RER})]$$

$$\iint \frac{\partial g_4}{\partial G}\,\mathrm{d}G\,\mathrm{dSNR} = -0.344G\log(\mathrm{SNR})$$

$$\int \frac{\partial g_4}{\partial H}\,\mathrm{d}H = -0.656H$$

$$\iint \frac{\partial g_4}{\partial \mathrm{SNR}}\,\mathrm{dSNR}\,\mathrm{d}G = -0.172\frac{G^2}{\mathrm{SNR}}$$

GIQEv5

$$\frac{\partial g_5}{\partial \mathrm{GSD}} = -\frac{3.32}{\log(10)}\frac{1}{\mathrm{GSD}}$$

$$\frac{\partial g_5}{\partial \mathrm{RER}} = \frac{3.32}{\log(10)}\frac{1-e^{-1.9/\mathrm{SNR}}}{\mathrm{RER}} - \frac{8}{\log^4(10)}\frac{\log^3(\mathrm{RER})}{\mathrm{RER}}$$

$$\frac{\partial g_5}{\partial \mathrm{SNR}} = \frac{1.8}{\mathrm{SNR}^2} - \frac{6.308}{\log(10)}\frac{e^{-1.9/\mathrm{SNR}}\log(\mathrm{RER})}{\mathrm{SNR}^2}$$

$$\int \frac{\partial g_5}{\partial \mathrm{GSD}}\,\mathrm{dGSD} = -\frac{3.32}{\log(10)}\log(\mathrm{GSD})$$

$$\iint \frac{\partial g_5}{\partial \mathrm{RER}}\,\mathrm{dRER}\,\mathrm{dSNR} = -\frac{3.32}{\log(10)}\big(-1.9\,\mathrm{Ei}(-1.9/\mathrm{SNR})+\mathrm{SNR}(1-e^{-1.9/\mathrm{SNR}})\big)\log(\mathrm{RER}) - \frac{2}{\log^4(10)}\mathrm{SNR}\log^4(\mathrm{RER})$$

$$\iint \frac{\partial g_5}{\partial \mathrm{SNR}}\,\mathrm{dRER}\,\mathrm{dSNR} = \mathrm{RER}\left(-\frac{3.32}{\log(10)}e^{-1.9/\mathrm{SNR}}(\log(\mathrm{RER})-1)-\frac{1}{\mathrm{SNR}}\right)$$