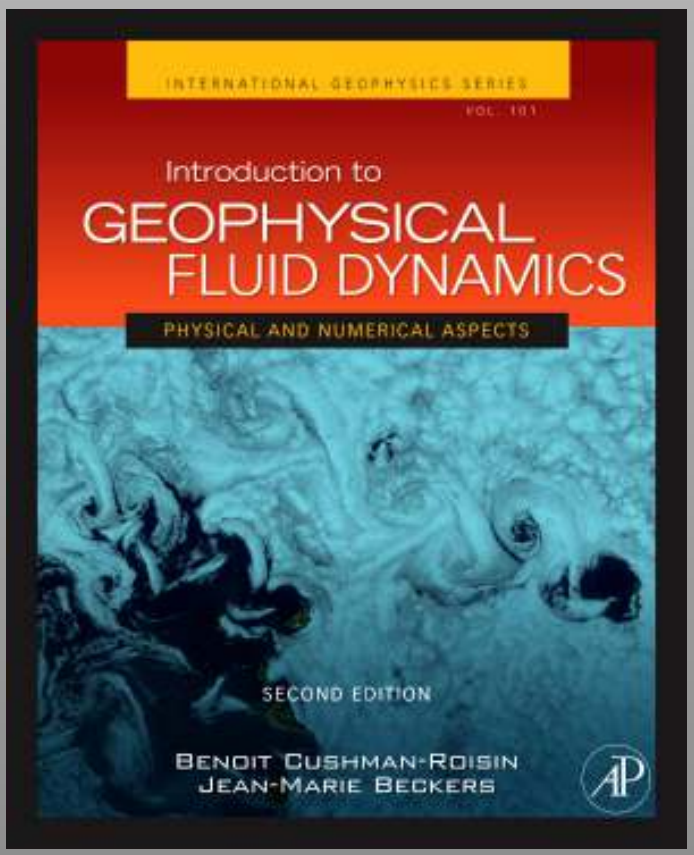
Introduction to Geophysical Fluid Dynamics

Physical and Numerical Aspects



Benoit Cushman-Roisin and Jean-Marie Beckers

Errata

September 19, 2014

This is the list of errata found up to September 19, 2014. Please forward any errors you might have spotted to JM.Beckers@ulg.ac.be.

Note that additional material (including corrections for MATLAB™ codes) can be found at http://booksite.academicpress.com/9780120887590/index.php

- page 15, Table 1.2, replace "Tides Basin scale 1-100m/s Hours" by "Tides Basin scale 0.01-1m/s Hours"

- page 58, eq. (2.32), replace

$$\begin{aligned}\frac{\tilde{u}^{n+1}-\tilde{u}^n}{\Delta t} \; - \; f[(1-\alpha)v^n \; + \; \alpha\tilde{v}^{n+1}] &= 0\\ \frac{\tilde{v}^{n+1}-\tilde{v}^n}{\Delta t} \; + \; f[(1-\alpha)u^n \; + \; \alpha\tilde{u}^{n+1}] &= 0,\end{aligned}$$

by

$$\begin{aligned}\frac{\tilde{u}^{n+1}-\tilde{u}^n}{\Delta t} \; - \; f[(1-\alpha)\tilde{v}^n \; + \; \alpha\tilde{v}^{n+1}] &= 0\\ \frac{\tilde{v}^{n+1}-\tilde{v}^n}{\Delta t} \; + \; f[(1-\alpha)\tilde{u}^n \; + \; \alpha\tilde{u}^{n+1}] &= 0,\end{aligned}$$

- page 220, eq. (7.40), replace

$$\begin{aligned}&\frac{1}{\Delta x}\left(h_{i+1/2}\frac{\tilde{p}_{i+1}-\tilde{p}}{\Delta x}-h_{i-1/2}\frac{\tilde{p}-\tilde{p}_{i-1}}{\Delta x}\right)+\frac{1}{\Delta y}\left(h_{j+1/2}\frac{\tilde{p}_{j+1}-\tilde{p}}{\Delta y}-h_{j-1/2}\frac{\tilde{p}-\tilde{p}_{j-1}}{\Delta y}\right)\\ &\quad=\rho_0\left(\frac{F_{xi+1/2}\;-\;F_{xi-1/2}}{\Delta x}\;+\;\frac{F_{yj+1/2}\;-\;F_{yj-1/2}}{\Delta y}\right)\\ &\quad+\frac{\rho_0}{2\Delta t}\left(\frac{h_{i+1/2}\tilde{u}^{n-1}_{i+1/2}-h_{i-1/2}\tilde{u}^{n-1}_{i-1/2}}{\Delta x}+\frac{h_{j+1/2}\tilde{v}^{n-1}_{j+1/2}-h_{j-1/2}\tilde{u}^{n-1}_{j-1/2}}{\Delta y}\right),\end{aligned}$$

by

$$\begin{aligned}&\frac{1}{\Delta x}\left(h_{i+1/2}\frac{\tilde{p}_{i+1}-\tilde{p}}{\Delta x}-h_{i-1/2}\frac{\tilde{p}-\tilde{p}_{i-1}}{\Delta x}\right)+\frac{1}{\Delta y}\left(h_{j+1/2}\frac{\tilde{p}_{j+1}-\tilde{p}}{\Delta y}-h_{j-1/2}\frac{\tilde{p}-\tilde{p}_{j-1}}{\Delta y}\right)\\ &\quad=\rho_0\left(\frac{F_{xi+1/2}\;-\;F_{xi-1/2}}{\Delta x}\;+\;\frac{F_{yj+1/2}\;-\;F_{yj-1/2}}{\Delta y}\right)\\ &\quad+\frac{\rho_0}{2\Delta t}\left(\frac{h_{i+1/2}\tilde{u}^{n-1}_{i+1/2}-h_{i-1/2}\tilde{u}^{n-1}_{i-1/2}}{\Delta x}+\frac{h_{j+1/2}\tilde{v}^{n-1}_{j+1/2}-h_{j-1/2}\tilde{v}^{n-1}_{j-1/2}}{\Delta y}\right),\end{aligned}$$

- page 236, Exercise 7.8: $h(x,y) = 50 - (x^2 + 4y^2/10)$ should read $h(x,y) = 50 - (x^2 + 4y^2)/10$

- page 315 : replace "Akio Arakawa 1927-2010" by "Akio Arakawa 1927-"

- page 547, eq. (16.88) : replace

$$\frac{\partial q}{\partial t} \;=\; J(\psi, q) \quad \text{with} \quad q = \nabla^2 \psi - \frac{\psi}{R^2} + \beta_0 y$$

by

$$\frac{\partial q}{\partial t} \;=\; -\, J(\psi, q) \quad \text{with} \quad q = \nabla^2 \psi - \frac{\psi}{R^2} + \beta_0 y$$

- At two places in the text (page 350 line 15 and page 351 line 7), the words ”internal energy” should be replaced by ”total energy”. The point is that air parcels all have the same amount of energy per mass; this energy content per mass is shared between internal energy (CvT), ”pressure” energy (p/rho), and potential energy (gz), with the first two components adding to what is called enthalpy (CvT + p/rho = CpT). Per mass, the total energy is CpT + gz, which is uniform over height (z-derivative = 0).