Erratum document for

Applied Turbulence Modelling in Marine Waters

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1 Errors

On page 29-31, the reference pressure difference has been given as $\Delta P_0 \approx \mathcal{O}(10^2)\ \mathrm{N\,m^{-2}}$, which should be representative for an elevation difference of 0.1 m. This is wrong, and it should be $\Delta P_0 \approx \mathcal{O}(10^3)\ \mathrm{N\,m^{-2}}$, according to the hydrostatic formula. Furthermore, the calculation of $\Delta P_0/(\rho_0\mathcal{L})$ in table 3.1 is wrong. With the original value of $\Delta P_0 \approx \mathcal{O}(10^2)\ \mathrm{N\,m^{-2}}$, this value should be 10^{-6}, with the corrected value of $\Delta P_0 \approx \mathcal{O}(10^3)\ \mathrm{N\,m^{-2}}$, it should be 10^{-5}. Both values do not balance the Coriolis term, which is of order $\Omega\mathcal{U} \approx \mathcal{O}(10^{-4})$. The way out is to balance a surface elevation difference of 0.1 m by a geostrophic velocity scale of $\mathcal{U} \approx 0.1\ \mathrm{m\,s^{-1}}$ (which gives 10^{-5} for $\Delta P_0/(\rho_0\mathcal{L})$ and $\Omega\mathcal{U}$), or to balance a surface elevation difference of 1 m by a geostrophic velocity scale of $\mathcal{U} \approx 1\ \mathrm{m\,s^{-1}}$ (which gives 10^{-4} for $\Delta P_0/(\rho_0\mathcal{L})$ and $\Omega\mathcal{U}$). However, as pointed out in the last paragraph on page 29, these scalings are somehow arbitrary. But they give an idea how to obtain physically motivated hydrostatic equations. (Stefano Salon, National Instiute of Oceanography in Trieste, Italy)

On page 33, the equation (3.6) has been called the *mass* conservation equation. It should however be referred to as *volume* conservation equation, since mass is not conserved due to the Boussinesq approximation carried out here. (Martin Schmidt, Baltic Sea Research Institute Warnemünde, Germany)

On page 65, the equations (3.90) and (3.91) should have no minus sign in the leading exponent, such that the solutions should look like this (Christoph Holz, Hamburg, Germany):

$$k(t) = k_0 e^{\frac{t}{\tau_m}} \left[\frac{1+Ce^{-\frac{t}{\tau_1}}}{1+C}\right]^{\frac{\tau_\infty^2}{(c_{2\varepsilon}-1)\tau_k^2}} \left[\frac{1-Ce^{-\frac{t}{\tau_1}}}{1-C}\right]^{-\frac{1}{c_{2\varepsilon}-1}}, \tag{1}$$

and

$$\varepsilon(t) = \varepsilon_0 e^{\frac{t}{\tau_m}} \left[\frac{1+Ce^{-\frac{t}{\tau_1}}}{1+C}\right]^{\frac{\tau_\infty^2}{(c_{2\varepsilon}-1)\tau_\varepsilon^2}} \left[\frac{1-Ce^{-\frac{t}{\tau_1}}}{1-C}\right]^{-\frac{c_{2\varepsilon}}{c_{2\varepsilon}-1}}. \tag{2}$$

On page 71, I have stated that the structure equilibrium has been first defined by *Schumann* [1994]. This is not correct, the first mathamatical definition has been given by *Baumert and Peters* [2000] who defined the total equilibrium as the state with

$$\partial_t \tau = \partial_t \left(\frac{k}{\varepsilon} \right) = 0. \tag{3}$$

(Helmut Baumert, Wedel, Germany).

On page 186, equations (9.10) and (9.11) define for the non-dimensional buoyancy parameter G_H defined by Mellor and Yamada (1982):

$$G_H = \frac{L^2}{q^2} N^2,$$

$$G_H = \frac{c_L^2}{2} \alpha_N.$$

In both equations, there is a sign error, such that it should be corrected to:

$$G_H = -\frac{L^2}{q^2} N^2,$$

$$G_H = -\frac{c_L^2}{2} \alpha_N.$$

(Viktor Stepanenko, Moscow, Russia).

2 Literature updates

Since the publication of the Springer book, some literature citations have been updated. The correct forms are given below in the literature list.

- *Axell* [2002]
- *Bolding et al.* [2002] (former *Bolding et al.* [2000])
- *Burchard et al.* [2002] (former *Burchard et al.* [2001])
- *Demirov and Pinardi* [2002] (former *Demirov and Pinardi* [2001])
- *Mellor* [2002] (former *Mellor* [2001])
- *Simpson et al.* [2002] (former *Simpson et al.* [2001])

- *Stips et al.* [2002] (former *Stips et al.* [2001])
- *Thorpe et al.* [2003] (former *Thorpe et al.* [2002])
- *Umlauf and Burchard* [2003] (former *Umlauf and Burchard* [2001])
- *Umlauf et al.* [2003] (former *Umlauf et al.* [2001])

References

Axell, L., Wind-driven internal waves and Langmuir circulations in a numerical ocean model of the southern Baltic Sea, *J. Geophys. Res.*, p. 10.1029/2001JC000922, 2002.

Baumert, H., and H. Peters, Second-moment closures and length scales for weakly stratified turbulent shear flows, *J. Geophys. Res.*, *105*, 6453–6468, 2000.

Bolding, K., H. Burchard, T. Pohlmann, and A. Stips, Turbulent mixing in the Northern North Sea: a numerical model study, *Cont. Shelf Res.*, *22*, 2707–2724, 2002.

Burchard, H., K. Bolding, T. P. Rippeth, A. Stips, J. H. Simpson, and J. Sündermann, Microstructure of turbulence in the Northern North Sea: A comparative study of observations and model simulations, *Journal of Sea Research*, *47*, 223–238, 2002.

Demirov, E., and N. Pinardi, Simulation of the Mediterranean Sea circulation from 1979 to 1993: Part I. The interannual variability, *J. Mar. Sys.*, *33-34*, 23–50, 2002.

Mellor, G. L., Oscillating bottom boundary layers, *J. Phys. Oceanogr.*, *32*, 3075–3088, 2002.

Schumann, U., Correlations in homogeneous stratified shear turbulence, *Acta Mechanica*, *2*, 105–111, 1994.

Simpson, J. H., H. Burchard, N. R. Fisher, and T. P. Rippeth, The semi-diurnal cycle of dissipation in a ROFI: model-measurement comparisons, *Cont. Shelf Res.*, *22*, 1615–1628, 2002.

Stips, A., H. Burchard, K. Bolding, and W. Eifler, Modelling of convective turbulence with a two-equation k-ε turbulence closure scheme, *Ocean Dynamics*, *52*, 153–168, 2002.

Thorpe, S. A., T. R. Osborn, J. F. E. Jackson, A. J. Hall, and R. G. Lueck, Measurements of turbulence in the upper ocean mixing layer using Autosub, *J. Phys. Oceanogr.*, *33*, 122–145, 2003.

Umlauf, L., and H. Burchard, A generic length-scale equation for geophysical turbulence models, *J. Mar. Res.*, *61*, 235–265, 2003.

Umlauf, L., H. Burchard, and K. Hutter, Extending the k-ω turbulence model towards oceanic applications, *Ocean Modelling*, *5*, 195–218, 2003.