CORRIGENDUM: KARHUNEN-LOÈVE BASIS FUNCTIONS OF KOLMOGOROV TURBULENCE IN THE SPHERE

Richard J. Mathar

Leiden Observatory, Leiden University, Postbus 9513, 2300 RA Leiden, The Netherlands

Received March 2, 2010

Abstract. The previously published factor, which scales the matrix elements of the eigenvalue equation as a finite outer scale in the von-Kármán model is switched on, is corrected.

Key words: Turbulence, Atmospheric effects, Methods: Numerical

1. SCALE FACTOR CORRECTION

The scale factor for the matrix elements

\[ I^{(l)}_{n,n'} = (4\pi)^2 c_0 \int_0^\infty \sigma^2 \sigma^{-\beta} R^{(l)}_n(\sigma) R^{(l)}_{n'}(\sigma) d\sigma \] (19)

in equation (22) of my earlier publication (Mathar 2008) was incomplete. The correct factor is a sum of two terms as follows:

\[
\begin{align*}
3F_4 \left( \begin{array}{c}
1 + \frac{n'-n+\beta}{2}, 
\frac{\beta}{2} + 1, 
\frac{1+\beta}{2} + \frac{n+n'+\beta+5}{2}, 
\frac{\beta-1-n-n'}{2}
\end{array} | (2\pi\sigma_0)^2 \right) \\
&+ \frac{\Gamma(2+n'+3)\Gamma(\frac{\beta-3-n-n'}{2})\Gamma(\frac{n+n'+5+2\beta}{2})\Gamma(1+\frac{\beta+n-n'}{2})\Gamma(1+\frac{\beta+n'-n}{2})}{\Gamma(\beta/2)\Gamma(n+n'+\frac{\beta}{2})\Gamma(\frac{5+n+n'-\beta}{2})\Gamma(1+\beta)} \\
&\times (\pi\sigma_0)^{n+n'+3-\beta} 3F_4 \left( \begin{array}{c}
2 + \frac{n+n'}{2}, 
\frac{3+n+n'}{2}, 
\frac{5+n+n'}{2}, 
\frac{2+n+n'-\beta}{2}
\end{array} | (2\pi\sigma_0)^2 \right)
\end{align*}
\] (22)

Figure 1 demands an equivalent correction as shown below.
Fig. 1. The unitless factor \( I_{\bar{n}, \bar{n}'} \) as a function of the unitless outer scale parameter \( \sigma_0 \) for some index pairs \((n, n')\).

REFERENCES