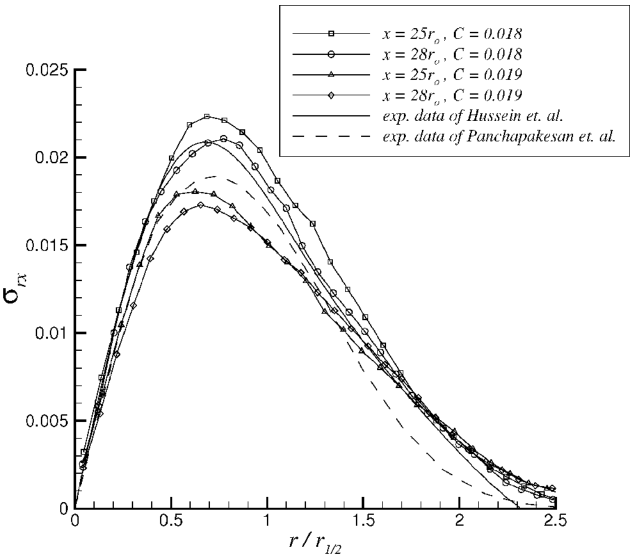

Fig. 2 Normalized Reynolds stress σ_{rx} profiles and comparison with experiments.

in the second simulation have significantly changed relative to the ones obtained in the first simulation done with $C = 0.018$. This must be due to the too dissipative nature of the Smagorinsky model. Although not shown here, similar discrepancies were observed in the other Reynolds stress components as well. The Reynolds stresses differ as much as 20% for a 5.56% change in the model constant.

We also looked at the effect of the Smagorinsky constant on transition in the shear layer. It was found that the constant did not have much influence on the level of disturbances in the shear layer. This is also evident from the fact that the jet potential core breaks up at approximately the same location in both simulations. The main finding from these simulations suggests that the value of the Smagorinsky constant has a much stronger influence on the turbulence downstream where the jet is fully turbulent.

Conclusions

Our findings in this study show some of the difficulties of using the classical Smagorinsky model as a predictive tool in turbulence simulations because the mean flow properties of our jets were found to be highly sensitive to the value of the model constants used in the computations. We believe that noise calculations will also be affected by the choice of the Smagorinsky constant. This leads us to the conclusion that one usually has no choice but to use a more robust and accurate dynamic subgrid-scale model in order to be able to do predictions using LES.

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References

[1]Freund, J. B., "Noise Sources in a Low-Reynolds-Number Turbulent Jet at Mach 0.9," *Journal of Fluid Mechanics*, Vol. 438, 2001, pp. 277–305.

[2]Bogey, C., Bailly, C., and Juvé, D., "Noise Investigation of a High Subsonic, Moderate Reynolds Number Jet Using a Compressible LES," *Theoretical and Computational Fluid Dynamics*, Vol. 16, No. 4, 2003, pp. 273–297.

[3]Constantinescu, G. S., and Lele, S. K., "Large Eddy Simulation of a Near Sonic Turbulent Jet and Its Radiated Noise," AIAA Paper 2001-0376, Jan. 2001.

[4]Zhao, W., Frankel, S. H., and Mongeau, L., "Large Eddy Simulations of Sound Radiation from Subsonic Turbulent Jets," *AIAA Journal*, Vol. 39, No. 8, 2001, pp. 1469–1477.

[5]Uzun, A., Blaisdell, G. A., and Lyrintzis, A. S., "Recent Progress Towards a Large Eddy Simulation Code for Jet Aeroacoustics," AIAA Paper 2002-2598, June 2002.

[6]Bogey, C., and Bailly, C., "Direct Computation of the Sound Radiated by a High-Reynolds-Number, Subsonic Round Jet," CEAS Workshop from CFD to CAA, Confederation of European Aerospace Societies, Nov. 2002.

[7]Smagorinsky, J. S., "General Circulation Experiments with the Primitive Equations," *Monthly Weather Review*, Vol. 91, No. 3, 1963, pp. 99–165.

[8]Germano, M., Piomelli, U., Moin, P., and Cabot, W., "A Dynamic Subgrid-Scale Eddy Viscosity Model," *Physics of Fluids A*, Vol. 3, No. 7, 1991, pp. 1760–1765.

[9]Erlebacher, G., Hussaini, M. Y., Speziale, C. G., and Zang, T. A., "Toward the Large-Eddy Simulations of Compressible Turbulent Flows," *Journal of Fluid Mechanics*, Vol. 238, 1992, pp. 155–185.

[10]Rizzetta, D. P., Visbal, M. R., and Blaisdell, G. A., "A Time-Implicit High-Order Compact Differencing and Filtering Scheme for Large-Eddy Simulation," *International Journal for Numerical Methods in Fluids*, Vol. 42, 2003, pp. 665–693.

[11]Lele, S. K., "Compact Finite Difference Schemes with Spectral-Like Resolution," *Journal of Computational Physics*, Vol. 103, No. 1, 1992, pp. 16–42.

[12]Visbal, M. R., and Gaitonde, D. V., "Very High-Order Spatially Implicit Schemes for Computational Acoustics on Curvilinear Meshes," *Journal of Computational Acoustics*, Vol. 9, No. 4, 2001, pp. 1259–1286.

[13]Bogey, C., and Bailly, C., "Three-Dimensional Non-Reflective Boundary Conditions for Acoustic Simulations: Far Field Formulation and Validation Test Cases," *Acta Acustica*, Vol. 88, No. 4, 2002, pp. 463–471.

[14]Hussein, H. J., Capp, S. C., and George, W. K., "Velocity Measurements in a High-Reynolds-Number, Momentum-Conserving, Axisymmetric, Turbulent Jet," *Journal of Fluid Mechanics*, Vol. 258, 1994, pp. 31–75.

[15]Panchapakesan, N. R., and Lumley, J. L., "Turbulence Measurements in Axisymmetric Jets of Air and Helium, Part 1. Air Jets," *Journal of Fluid Mechanics*, Vol. 246, 1993, pp. 197–223.

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Errata

Hybrid Simulation Approach for Cavity Flows: Blending, Algorithm, and Boundary Treatment Issues

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EQUATION (23) should read as follows:

$$P_k = \left[\mu_t\left(\frac{\partial\tilde{u}_i}{\partial x_j} + \frac{\partial\tilde{u}_j}{\partial x_i}\right) - \frac{2}{3}\delta_{ij}\left(\bar{\rho}\tilde{k} + \mu_t\frac{\partial\tilde{u}_k}{\partial x_k}\right)\right]\frac{\partial\tilde{u}_i}{\partial x_j}$$

$$\approx \mu_t\left(\frac{\partial\tilde{u}_i}{\partial x_j} + \frac{\partial\tilde{u}_j}{\partial x_i}\right)\frac{\partial\tilde{u}_i}{\partial x_j} \qquad (23)$$