Reply

HERMAN G. GADE

Geophysical Institute, University of Bergen, Bergen, Norway

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As evident from my own contribution (Gade 1998) and thoroughly discussed by Fang (2000), my paper aims at showing a possible approximate relationship between the neap to spring tide ratio and tidal age in cooscillating basins by the use of a simplified form of the conservation of energy equation. An essential feature of the theory is that to any locality in the system energy is transferred from some source function in the ocean, while simultaneously energy is being lost by radiation. The difference between the latter and the former is a form of energy divergence, contributing to the total energy divergence. Furthermore, some energy is also lost locally to dissipation. It appears from Dr. Fang's comments that he does not support my formulations of the two parts of said divergence, particularly that of the incoming energy flux density, which was assumed related to the amplitude of the source function without frictional loss, time delay, and transformation in transit being specified. A discussion of the two latter processes was given. Although unrealistic, a linear model was presented because of the simplicity of the theory and also of the results, the latter not departing very much from a more realistic nonlinear model. It has been stressed that the virtue of both models lies in their simplistic approach to a complicated problem, aiming to explain in an approximate way some observed features of the tides of the North Sea.

Fang (2000) proceeds with a presentation of two well known factors causing changes of the N/S ratio and the T age, one being that of resonance and the other being caused by nonlinear friction. A comprehensive analysis is given in order to elucidate features of the latter on progressive waves. This discussion is followed by analysis of neap–spring modulation of area-integrated tidal energy. Both presentations are undoubtedly valuable for understanding tidal behavior of progressive waves. However, it is doubtful that Fang's results apply to a system of standing waves, in particular resonant standing waves. The reason for this is that at any point the disturbance is the sum of the contributions from single or multiple reflections added to that of the incident wave. Each of these reflected waves may possibly be characterized by the phase relationship shown by Fang, however depending on the number of reflections involved or distance travelled. Furthermore, the uniqueness of the neap to spring ratio shown in his (3.7) does not seem to hold for even the simple composition of an incident and one reflected wave. For the more general case of multiple reflections the resultant wave behavior will be a composite with a neap to spring ratio and a phase relationship that is likely to depart significantly from that of the incident wave as from any one of the reflected waves in the system.

Corresponding author address: Dr. Herman G. Gade, Geophysical Institute, University of Bergen, Allegaten 70, N-5007 Bergen, Norway.
E-mail: gade@gfi.uib.no

REFERENCE

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