MIS22-08          会場:106                    時間:5 月 27 日 11:00-11:15

## 全ての緯度帯の波を対象とした Eliassen-Palm 理論と渦度力学
## A divergence-form wave-induced pressure for extending the Eliassen-Palm theory to all waves at all latitudes

相木 秀則 [1]* ; 高谷 康太郎 [2] ; Greatbatch Richard[3]
AIKI, Hidenori[1]* ; TAKAYA, Koutarou[2] ; GREATBATCH, Richard[3]

[1] 海洋研究開発機構, [2] 京都産業大学, [3]GEOMAR / University of Kiel
[1]Japan Agency for Marine-Earth Science and Technology, [2]Kyoto Sangyou University, [3]GEOMAR / University of Kiel

   Classical theory concerning the Eliassen-Palm relation is extended in this study to allow for a unified treatment of mid-latitude inertia-gravity waves (MIGWs), mid-latitude Rossby waves (MRWs), and equatorial waves (EQWs). A conservation equation for (what the authors call) the impulse-bolus (IB) pseudomomentum is useful because it is applicable to ageostrophic waves and the associated three-dimensional flux is parallel to the direction of the group velocity of MRWs. The equation has previously been derived in an isentropic coordinate system or a shallow water model. The authors make an explicit comparison of prognostic equations for the IB pseudomomentum vector and the classical energy-based (CE) pseudomomentum vector, assuming inviscid linear waves in a sufficiently- weak mean flow, to provide a basis for the former quantity to be used in an Eulerian time-mean (EM) framework. The authors investigate what makes the three-dimensional fluxes in the IB and CE pseudomomentum equations look in different directions. It is found that the two fluxes are linked by a gauge transformation, previously unmentioned, associated with a divergence-form wave-induced pressure (symbolized as $\Lambda$ in the present study). The quantity $\Lambda$ vanishes for MIGWs and becomes nonzero for MRWs and EQWs, and may be estimated using the virial theorem. Concerning the effect of waves on the mean flow, the quantity $\Lambda$ represents an additional effect in the pressure gradient term of both (the three-dimensional versions of) the transformed EM momentum equations and the merged form of the EM momentum equations (the latter of which is associated with the nonacceleration theorem).

   http://dx.doi.org/10.1175/JAS-D-14-0172.1

キーワード: 慣性重力波, 中緯度ロスビー波, 各種赤道波
Keywords: inertia-gravity waves, mid-latitude Rossby waves, equatorial waves



Figure 1



Figure 2

SEM  : standard Eulerian mean
TEM  : transfromed Eulerian mean — Eliassen-Palm theory
MEM  : merged form of Eulerian mean —
WIM  : thickness-weighted isopycnal-mean — isopycnal-mean theory
UIM  : unweighted isopycnal-mean —
DLM  : direct expression of Lagrangian mean — generalized Lagrangian mean theory
TLM  : transformed expression of Lagrangian mean —