1. Introduction

GW radiation from rotational flow (Spontaneous GW radiation)
Observational study
Yoshiki and Sato (2000): polar night jet.
Pfister et al. (1993): hurricane.

Experimental study
Williams et al. (2005): 2-layer fluid in rotating annulus.
Numerical study (GCM, Meso scale model)
Sato et al. (2005): polar night jet.
Plougonven and Snyder (2005): sub tropical jet.

Numerical study (simplified model= F-plane Shallow Water)
unsteady jet with relaxation forcing.

Energy of gravity waves << Energy of rotational flows
We need a special numerical model.

2. Experimental setup

Basic equation
\[
\begin{align*}
\frac{\partial u}{\partial t} + \nabla \times (u \times \mathbf{v}) &= f - \alpha \frac{\partial \eta}{\partial y} - \beta \eta \\
\frac{\partial \eta}{\partial t} + \nabla \cdot (\eta u) &= 0
\end{align*}
\]

Basic state
\[
\eta_0 = \frac{\alpha}{2} \left( \frac{g}{\Omega^2} \right)^{1/2} \sin \theta
\]

Experimental condition
Resolution : 1/12° x 1/12° = 1° x 1°
Boundary condition:
no grid at open boundary
Numerical filter : low pass filter
Time integration : 4th-order Runge-Kutta (full reality)

Experimental parameter:
\[
\begin{align*}
\alpha &= 3 \times 10^{-4}
\end{align*}
\]
\[
\frac{g}{\Omega^2} = 6.317 \times 10^{-3}
\]
\[
B = 2 \times 10^9
\]
\[
Ro = \frac{\beta}{\alpha} = 1.5 - 10
\]
\[
Fr = \frac{\bar{u}}{\bar{v}} = 0.7
\]
\[
\theta = 11.25 - 78.75
\]

3. Results

Time evolution of flow fields (Ro=10, Fr=0.7)

GW source with fixed F-plane approx.

GW source is not so much affected
by the changes of parameter.

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4. Summary

We investigate spontaneous GW radiation from unsteady jet flows in SH on a rotating sphere, using CCD scheme.

GW flux depends on latitude of the jets, since the effects of the earth rotation and size are different.

GW source and its analysis on the basis of F-plane approx. is useful to understand spontaneous GW radiation from rotational flows.