

# A Rotating Dishpan Laboratory Experiment with both Baroclinicity and Planetary beta effect

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The most intrinsic nature of atmospheric motion as a geophysical fluid may be that the motion is a natural convection which is confined by strong gravity between two rotating concentric spherical shells. Two important factors which create this nature are considered as atmospheric baroclinicity and planetary beta effect. Both factors commonly due to spherical shape of the Earth. The baroclinicity and planetary beta effect. Both factors commonly due to spherical shape of the Earth. The baroclinicity creates not only the westerlies but also its meander. And the beta effect practices re-distribution of vorticity in planetary scale by using properties of planetary waves. It is probably certain that the Earth's general circulation is maintained or changed through these actions.

In traditional annular rotating water tank experiment, various regimes of fluid motion were observed. However, the latitudinal structure is primarily decided, because its device has channel shape. In our preliminary experiment by using dishpan type rotating water tank where inner cooling cylinder is slanted down extremely, it was found that the flow field makes abrupt transition from axisymmetric to unaxisymmetric beyond a critical value of rotating speed. However we can't discuss also about spherical effect for latitudinal structure, because its device has no beta effect. On the other hand, in rotating dishpan experiment with not only baroclinicity but also planetary beta effect, it was found that the polar vortex sudden reversal (stratospheric sudden warming) is easily simulated. However, it is not a spontaneous general circulation model, because initial polar vortex and planetary waves are excited compulsorily.

Main motive of this study is to deepen the understanding of non-periodic phenomena such as abnormal weather or the blocking. In our rotating dishpan experiment with both baroclinicity and planetary beta effect, next two points were found so far; as follows.

1: By the analysis of surface flow field, it was found that the axisymmetry breaks down according to the increase of system rotating speed and this critical value is shifted to higher rotation side according to the increase of temperature difference between heating and cooling sections. And this tendency is consistent with the traditional annular experiment.

2: By analysis of inner structure of flow and temperature field, it was found that the westerly flow is more strong according to increase of height from the bottom and also the westerlies are more strong according to increase of temperature difference between heating and cooling sections. And this flow and temperature field is consistent with the thermal wind relation.