JUSTIFICATION OF THE HYDROSTATIC APPROXIMATION OF THE PRIMITIVE EQUATIONS IN ANISOTROPIC SPACE $L^\infty_H L^q_{x3}(\mathbb{T}^3)$

KEN FURUKAWA
Institute of physical and chemical research (RIKEN)
7-1-26 Minatojima-minami-machi, Chuo-ku, Kobe, Hyogo 650-0047, Japan
(E-mail: ken.furukawa@riken.jp)

and

Takahito Kashiwabara
The university of Tokyo
3-8-1 Komaba Meguro-ku Tokyo 153-8914, Japan
(E-mail: tkashiwa@ms.u-tokyo.ac.jp)

Abstract. The primitive equations are fundamental models in geophysical fluid dynamics and derived from the scaled Navier-Stokes equations. In the primitive equations, the evolution equation to the vertical velocity is replaced by the so-called hydrostatic approximation. In this paper, we give a justification of the hydrostatic approximation by the scaled Navier-Stokes equations in anisotropic spaces $L^\infty_H L^q_{x3}(\mathbb{T}^3)$ for $q \geq 1$. 

Communicated by Editors; Received September 1, 2021
The first author was supported by RIKEN Pioneering Project “Prediction for Science”.
The second author was partly supported by JSPS Grant-in-Aid for Early-Career Scientists (No. 20K14357) and by Grant for The University of Tokyo Excellent Young Researchers.
AMS Subject Classification: 35K51, 35K55, 76B03.
Keywords: hydrostatic approximation, the primitive equations, the Navier-Stokes equations, anisotropic function spaces.