THE ASYMPTOTIC LAKE EQUATIONS FOR VANISHING OR EMERGING ISLANDS

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The lake equations arise as a 2D shallow water model describing the evolution of the vertically-averaged horizontal component of the 3D velocity field. A lake is characterized by the geometry of its surface and its depth function. The equations are degenerate if vanishing topographies are included in the description.

Motivated by physical phenomena such as flooding, sedimentation and seismic activity, we investigate the stability of these equations under changes of both the geometry and the topography.

More precisely, we consider different scenarios leading to the appearance of a degenerate island, consisting of one point and zero depth, for which the lake equations become singular. In the singular limit of an island collapsing to a point we prove that the asymptotic lake equations include an additional point vortex. Second, we discuss the scenario of an emergent island.

We highlight differences and analogies to the small obstacle problem for the 2D incompressible Euler equations (lake equations with flat topography). New uniform estimates in weighted spaces are introduced that enable us to prove the compactness result.

This is joint work with Christophe Lacave and Evelyne Miot (Université Grenoble Alpes).

References

[1] L.E. Hientzsch, C. Lacave, E. Miot, *Lake equations with an evanescent or emergent island*, Commun. Math. Sci. Vol. 20, No. 1, pp. 85–122, 2022.

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