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The two-dimensional periodic β -equation on the diffeomorphism group of the torus

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In this paper, the two-dimensional periodic β -equation is discussed under geometric aspects, i.e., as a geodesic flow on the diffeomorphism group of the torus $T = S^1 \times S^1$. In the framework of Arnold's [V.I. Arnold, Sur la géométrie différentielle des groupes de Lie de dimension infinie et ses applications à l'hydrodynamique des fluides parfaits. Ann. Inst. Fourier (Grenoble) 16 (1966) 319-361] famous approach, we achieve some well-posedness results for the β -equation and we perform explicit curvature computations for the 2D Camassa-Holm equation, which is obtained for $\beta=2$. Finally, we explain the special role of the choice $\beta=2$ by giving a rigorous proof that $\beta=2$ is the only case in which the associated geodesic flow is weakly Riemannian.

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