1154-65-1851 **Konstantin Pieper*** (pieperk@ornl.gov), **K. Chad Sockwell** (kcsockw@sandia.gov) and **Max Gunzburger** (mgunzburger@fsu.edu). *Exponential time differencing for mimetic multilayer ocean models.*

Towards the goal of designing accurate time-stepping methods for global ocean models, we develop a time discretization framework based on exponential integrators for a stacked rotating shallow-water ocean model. The methods are based on a splitting of the forcing term into a linear rotating multi-layer wave-operator and a non-linear residual, capturing the advective forces. Solution strategies for the linear part are based on skew-adjoint Krylov methods. The resulting exponential integrators can take large time steps up to the advective time scale, independent of the speed of internal and external gravity waves. Additionally, the vertically coherent structure of the fastest waves can be used to compress the wave operator into a few vertical modes. In a special case, employing a reduction only to the barotropic component, we obtain a method with similar features to the well-known split-explicit method. Numerical experiments in the context of the SOMA testcase show that the methods are stable over decade-long simulation horizons and accurately reproduce solution statistics. (Received September 16, 2019)