1154-35-1415 **Sara Calandrini*** (scalandrini@fsu.edu), **Max Gunzburger** and **Konstantin Pieper**.

Exponential Time Differencing for the Tracer Equations Appearing in Ocean Models.

The tracer equations are part of the primitive equations used in ocean modeling and describe the transport of tracers, such as temperature, in the ocean. Depending on the number of tracers considered, several equations may be added to and coupled to the dynamics system. In many relevant situations, the time-step requirements of explicit methods imposed by the transport and mixing in the vertical direction are more restrictive than those for the horizontal, and this may cause the need to use very small time steps if a fully explicit method is employed. To overcome this issue, we propose an exponential time differencing (ETD) solver where the vertical terms (transport and diffusion) are treated with a matrix exponential, whereas the horizontal terms are dealt with in an explicit way. In my talk, I will describe the method and discuss the implementation challenges. I will present the computational speed-ups that can be obtained over other semi-implicit methods and analyze the advantages of the scheme in the case of multiple tracers. Finally, I will present comparisons with existing ocean models, to make sure that our ETD solver is able to reproduce similar results under the same physical conditions. To do so, the whole primitive equations system will be solved. (Received September 15, 2019)