The goal of this talk is to provide a recipe to alleviate the spurious oscillations generally produced by full order models (FOMs) in marginally-resolved simulations of convection-dominated incompressible flows. In a parametric setting (in our case for time-dependent and physical parametric problems), these simulations can be unbearable in terms of computational time and resources. We propose Proper Orthogonal Decomposition-based reduced order models (ROMs) to solve them in a smaller amount of time. Specifically, we investigate whether the evolve-filter-relax (EFR) numerical stabilization is needed both at the FOM and the ROM level.

Indeed, we present two ROM strategies:

(i) the EFR-noEFR, in which the EFR stabilization is used at the FOM level and not at the ROM level.

(ii) The EFR-EFR, in which the EFR stabilization is used both at the FOM and at the ROM level.

We perform the reduction in terms with respect to both time and Reynolds number for a 2D incompressible flow past a circular cylinder. The results are both reconstructive and predictive and they suggest that FOM-ROM consistency is beneficial in the proposed setting [1].

References