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Space-time constrained FOSLS with AMGe upscaling

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We consider time-dependent PDEs discretized in combined space-time domains. We first reduce the PDE to a first order system. Very often in practice, one of the equations of the reduced system involves the divergence operator (in space-time). The popular FOSLS (first order system least-squares) method is then applied modified by keeping the divergence equation as a constraint which we refer to as CFOSLS (constrained FOSLS). Applying finite elements to discretize the CFOSLS problem leads to a saddle-point system. To alleviate the high memory demand of the combined space-time approach (due to the increased dimension), we apply element agglomeration AMG upscaling on space-time elements. This leads to substantially reduced problem sizes with controlled accuracy. Initial numerical results for model parabolic and scalar hyperbolic problems illustrate the potential of the method.