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Mathematical Model for the Behavior of Wildfires KEVIN DELBENE, DONALD DREW, Rensselaer Polytechnic Institute — Wildfires have been a long-standing problem in today's society. In this paper, we derive and solve a fluid dynamics model to study a specific type of wildfire, namely, a two dimensional flow around a concentrated line of fire, resulting in a narrow plume of hot gas rising and entraining the surrounding air. The model assumes that the surrounding air is constant density and irrotational, and uses an unsteady plume model to describe the evolution of the mass, momentum and energy inside the plume, with sources derived to model mixing in the style of Morton, Taylor, and Turner (Proc. Roy. Soc. London, A 234, 1-23, 1956). The sources to the dynamical processes in the plume couple to the motion through the surrounding air through a Biot-Savart integral formulation to solve the equations of motion with a line of singularities along the plume. The singularities model a vortex sheet in the same manner as Alben and Shelley (Phys. Rev. Letters, 100, 074301, 2008), except that we include a sink term in the Biot-Savart integral to couple the entrainment. The results show that this model is capable of capturing a complicated interaction of the plume with the surrounding air.

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