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How does network design constrain optimal operation of intermittent water supply? ANNA LIEB, UC Berkeley, JON WILKENING, UC Berkeley Mathematics, CHRIS RYCROFT, Harvard School of Engineering and Applied Sciences — Urban water distribution systems do not always supply water continuously or reliably. As pipes fill and empty, pressure transients may contribute to degraded infrastructure and poor water quality. To help understand and manage this undesirable side effect of intermittent water supply—a phenomenon affecting hundreds of millions of people in cities around the world—we study the relative contributions of fixed versus dynamic properties of the network. Using a dynamical model of unsteady transition pipe flow, we study how different elements of network design, such as network geometry, pipe material, and pipe slope, contribute to undesirable pressure transients. Using an optimization framework, we then investigate to what extent network operation decisions such as supply timing and inflow rate may mitigate these effects. We characterize some aspects of network design that make them more or less amenable to operational optimization.

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