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The reactivation and monitoring of Steamboat geyser, the tallest geyser on Earth

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After 34 years of isolated and erratic activity, Steamboat Geyser in Norris Geyser Basin, Yellowstone, USA began a period of frequent major eruptions in March 2018. The geyser is positioned near a variety of monitoring equipment which allows for a multiparameter study of potential triggering mechanisms for its reactivation and to evaluate how well eruption attributes can be determined from monitoring data. Prior to 2018, Norris Geyser Basin experienced an increase in regional seismicity, a slight rise in radiant temperature, and a period of uplift. These signals might indicate magmatic processes promoted the reactivation. But because no other dormant geysers became active, previous earthquakes with greater seismic moment release did not noticeably change Steamboat's behavior, and geothermometry indicates no significant change in geothermal reservoir temperature, we conclude that the reason for reactivation remains ambiguous. Eruption intervals are modulated seasonally, with shorter intervals in the summer, until May 2021 when the pace of eruptions slowed. We find that erupted volumes calculated from streamflow data is affected by wind speed, and after accounting for this, we identify no relation between eruption volume and interval. Based on data from geysers worldwide, we find a correlation between eruption height and shallow reservoir depth, implying that Steamboat has tall eruptions because water is stored deeper there than at other geysers. Finally, we observe that the amplitude of ground motion recorded by a seismometer ~330 m distant from the vent depends on the depth of snow cover, and that higher frequencies are diminished more than lower frequencies. This is consistent with the seismometer recording sound generated by the eruption that is attenuated by the snow.