Abstract The blue continuous radiation from hydrogen flames is studied experimentally and numerically in a laminar hydrogen-oxygen jet flame at variable pressure and oxidizer composition. Self-absorption of the blue radiation is not observed. Two chemiluminescence models from literature, forming either excited water vapor or excited hydrogen peroxide, are investigated. Their performances to predict total and spatially resolved blue emissivity is assessed by comparison between numerical and experimental data. Optimum parameters for the two unknown modeling parameters, activation energy and quenching, are presented. Although the H2O2* chemiluminescence model delivers slightly better results, it cannot be proven axiomatically that it is the only physical source of the blue radiation. However, the emissivity of the blue radiation can well be simulated numerically by taking the square of the OH concentration for high temperatures and pressures. For lower temperatures, temperature and quenching need to be considered additionally to model the blue radiation.