Remote atmospheric sounding employs a wide range of models for representing the complex physical principles exploited by various measurement techniques (refraction, transmission, absorption, scattering, etc.), retrieving various physical properties (water vapor, temperature profile, wind profile, chemical constituents, etc.), and assimilating the observations from various platforms (satellites, aircrafts, sondes, etc.). These models collectively facilitate a comprehensive Observation System Simulation Experiment (OSSE) toward design optimization, performance validation, and operation planning. The Sensor-web Operations Explorer (SOX) system establishes an atmospheric sounding simulation experiment service that helps scientists plan integrated air quality campaigns and explore future atmospheric science mission and instrument concepts. The SOX system infuses state-of-the-art information technologies for achieving inter-operability among a wide range of the science community tools and data products, as well as maintaining computational effectiveness of the simulated experiments.