Estimates of iron inputs to the ocean from atmospheric deposition and sedimentary release have uncertainties that range over an order of magnitude. In this study, we use GEOTRACES dissolved iron observations to constrain atmospheric and sedimentary iron sources in a global ocean biogeochemistry model (UVic-Kiel). We test model simulations with global inputs ranging between 1.4-3.4 Gmol yr^{-1} for atmospheric deposition and 14.5-117 Gmol yr^{-1} for sedimentary release. Note that for each model experiment, iron scavenging was altered to maintain the global iron inventory at the observed level. Our model simulations with the highest tested inputs for atmospheric deposition (3.4 Gmol yr^{-1}) and sedimentary release (117 Gmol yr^{-1}) are able to best reproduce the global dissolved iron observations. In particular, model simulations with high source inputs better resolve strong gradients of high iron concentrations near sources and depleted concentrations farther away due to enhanced scavenging. Our model-data analysis suggests a global marine iron cycle with rates of atmospheric deposition, sedimentary release, and scavenging that are on the high-end of current uncertainty ranges.