William Fitzjames Oldham was born in Bangalore, India, where his father was an English officer in the Indian Regiment. He and became a Methodist at Poona while attending evangelistic services held by William Taylor in 1873. In 1879, Oldham committed himself to work as a Methodist missionary and traveled to Allegheny College in Meadville, Pennsylvania, for training. In 1885 he was sent to Singapore to initiate a Methodist mission. There, he found access to the Chinese merchant population through schools. Oldham established what became the first of a large number of Methodist schools in what was then British Malaya and the Dutch East Indies (Indonesia), as well as the first Methodist Church in Singapore.

Oldham left Singapore in 1889 because of ill health. For the next 15 years he resided in the United States and served as a pastor, lecturer and secretary for the Methodist Board of Missions. In 1904, he was elected a missionary bishop with responsibility for India and Southeast Asia. In that role, Oldham oversaw the rapid expansion of Methodism in the Malay peninsula, the Philippines and Sumatra. In 1912, he left the missionary episcopacy to serve for four years as one of the three corresponding secretaries of the Methodist Board of Missions in New York. In 1916 Oldham was elected bishop and took over the supervision of South America until he retired in 1928. He died in Los Angeles in 1937.

Oldham's upbringing in India convinced him of the need for missionaries to understand the religious and cultural context of their work. He was a strong supporter of early efforts at church union in the Philippines and supported the interdenominational Committee on Cooperation in Latin America.