Using a 1960–2004 hindcast simulation of the eddy-resolving Ocean general circulation model For the Earth Simulator (OFES) and available observations, we show that in the Kuroshio Extension (KE) meridional shifts of the jet axis are the dominant mode of the variability on decadal time scales and include a 150 km southward shift in the early 1980s associated with the climate regime shift in 1976/77. The jet position fluctuations have wave-length of about 4,000 km, originate east of the dateline, and propagate westward with a speed comparable to linear Rossby waves. The trajectory of signals and the concentration of associated sea level fluctuations along the mean jet axis are consistent with the displacement of a sharp, time-independent front, and cannot be captured by traditionally used linear long Rossby waves model for sea level anomalies. The framework of the thin-jet describes the temporal evolution of the location of a sharp potential vorticity front and is well suited to the strong jet and potential vorticity gradients of the KE. For scaling appropriate to the decadal adjustments in the KE, the thin-jet model successfully reproduces the westward propagation and decadal shifts of the jet latitude simulated in OFES. These results give a physical basis for the prediction of decadal variability in the KE.