ABSTRACT. For a family of smooth curves, we have the associated family of moduli spaces of stable bundles with fixed determinant on the curves. There exists a so-called theta line bundle on the family of moduli spaces. When the Kodaira–Spencer map of the family of curves is an isomorphism, we prove in this paper an identification theorem between sheaves of differential operators on the theta line bundle and higher direct images of vector bundles on curves. As an application, the so-called Hitchin connection on the direct image of (powers of) the theta line bundle is derived naturally from the identification theorem. A logarithmic extension to certain singular stable curves is also presented in this paper.