We determine the image of the Penrose transform, from the Dolbeault cohomology group on the indefinite Grassmann manifold consisting of maximal positive $k$-planes to the space of holomorphic functions over the bounded symmetric domain. Furthermore, we generalize twistor transforms, and prove that there is a duality between Dolbeault cohomology groups on two indefinite Grassmann manifolds, namely, that of positive $k$-planes and that of negative $k$-planes. (Received September 22, 2011)