Let $X = U/K$ be a simply connected compact symmetric space. For each point $p \in X$, the set $A_p$ of all midpoints of shortest closed geodesics through $p$ is called the midpoint locus of $p$. The set $A_p$ is both a totally geodesic submanifold and a compact symmetric space. When $\text{rank}(X) = 1$, the midpoint locus $A_p$ is the set of all points at maximum distance from $p$. We consider the transform that integrates any continuous function on $X$ over all midpoint loci $A_p$ of $X$, including questions of injectivity and inversion. (Received February 07, 2014)