Suppose \( k \) is a field, and \( k[X] \) is a polynomial ring over \( k \), where \( X = [x_{ij}] \) is an \( r \times s \) matrix of indeterminates. Let \( I \) be the ideal generated by the maximal minors of \( X \). Interestingly, certain local cohomology modules \( H^i_I(R) \) that have been found to vanish by Peskine and Szpiro when \( i \) is strictly larger than the height of \( I \) and \( k \) has positive characteristic have been found to be nonzero when \( k \) has characteristic zero by Hochster, Bruns, and Schwänzl. However, in the characteristic zero case, very few of these modules have been computed: the calculation has seemed difficult. Using results of Lyubeznik on \( D \)-modules, as well as the invariant theory of linearly reductive groups, we will determine the structure of these local cohomology modules in the characteristic zero case, including for which \( i \) they are nonzero, what their associated primes are, complete information for \( i = rs - r^2 + 1 \) (the top non-vanishing one), and substantial information about the nonzero \( H^i_I(R) \) for other values of \( i \). (Received April 13, 2010)