A simplified consistency formulation for P_k/ε (production to dissipation ratio) is devised to obtain a non-singular C_μ (coefficient of eddy-viscosity) in the explicit algebraic Reynolds stress model of Gatski and Speziale. The coefficient C_μ depends non-linearly on both rotational/irrotational strains and is used in the framework of an improved RAS (Rahman–Agarwal–Siikonen) one-equation turbulence model to calculate a few well-documented turbulent flows, yielding predictions in good agreement with the direct numerical simulation and experimental data. The strain-dependent C_μ assists the RAS model in constructing the coefficients and functions such as to benefit complex flows with non-equilibrium turbulence. Comparisons with the Spalart–Allmaras one-equation model and the shear stress transport k-ω model demonstrate that C_μ improves the response of RAS model to non-equilibrium effects.