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Understanding the boundary layer flow over surface gravity waves is of great importance as various atmosphere-ocean processes are essentially coupled through these waves. Nevertheless, there are still significant gaps in our understanding of this complex flow behaviour. The present work investigates the fundamentals of the boundary layer air flow over progressive, small-amplitude waves. It aims to extend the well-known Blasius solution for a boundary layer over a flat plate to one over a moving wavy surface. The current analysis proclaims the importance of the small curvature and the time-dependency as second order effects, with a meaningful impact on the similarity pattern in the first order. The air flow over the ocean surface is modelled using an outer, inviscid half-infinite flow, overlaying the viscous boundary layer above the wavy surface. The assumption of a uniform flow in the outer layer, used in former studies, is now replaced with a precise analytical solution of the potential flow over a moving wavy surface with a known celerity, wavelength and amplitude. This results in a conceptual change from former models as it shows that the pressure variations within the boundary layer cannot be neglected. In the boundary layer, time-dependent Navier-Stokes equations are formulated in a curvilinear, orthogonal coordinate system. The formulation is done in an elaborate way that presents additional, formerly neglected first-order effects, resulting from the time-varying coordinate system. The suggested time-dependent curvilinear orthogonal coordinate system introduces a platform that can also support the formulation of turbulent problems for any surface shape. In order to produce a self-similar Blasius-type solution, a small wave-steepness is assumed and a perturbation method is applied. Consequently, a novel self-similar solution is obtained from the first order set of equations. A second order solution is also obtained, stressing the role of small curvature on the boundary layer flow. The proposed model and solution for the boundary layer problem overlaying a moving wavy surface can also be used as a base flow for stability problems that can develop in a boundary layer, including phases of transitional states.