Traditionally, ocean tides have been modelled in frequency domain with forcing of selected tidal constituents. It is a natural approach, however, non-linearities of ocean dynamics are implicitly neglected. An alternative approach is time-domain modelling with forcing given by the full lunisolar potential, i.e., all tidal constituents are included. This approach has been applied in several ocean tide models, however, a few challenging tasks still remain to solve, for example, the assimilation of satellite altimetry data. In this thesis, we present DEBOT, a global and time-domain barotropic ocean tide model with the full lunisolar forcing. DEBOT has been developed “from scratch”. The model is based on the shallow water equations which are newly derived in geographical (spherical) coordinates. The derivation includes the boundary conditions and the Reynolds tensor in a physically consistent form. The numerical model employs finite differences in space and a generalized forward-backward scheme in time. The validity of the code is demonstrated by the tests based on integral invariants. DEBOT has two modes for ocean tide modelling: DEBOT-h, a purely hydrodynamical mode, and DEBOT-a, an assimilative mode. We introduce the assimilative scheme applicable in a time-domain model, which is an alternative to existing frequency-domain techniques used in other assimilative ocean tide models. The accuracy of DEBOT in both modes is assessed against tide gauge data through a series of tests. The tests demonstrate that DEBOT is comparable to state-of-the-art global ocean tide models for major tidal constituents. Furthermore, as the signals of all tidal constituents are included in DEBOT, modelling of minor tidal constituents and non-linear compound tides, which are often overlooked in other studies, are also discussed. Our modelling approach can be useful for those applications where the frequency domain approach is not suitable.