In this work, two biocide-based antifouling (AF) coatings (a model and a full commercial system) were considered in a leveling study. Using an optical three-dimensional (3D) profilometer, an advanced rheometer, and evaporation rate measurements, the transient effects of wet film thickness, application wavelength, and coating viscosity on leveling could be investigated. The model coating was able to level faster and had better final leveling performance than the commercial coating. This was attributed to the different viscosity profiles of the two coatings, the main difference being that the commercial coating contained additives (thixotropic and wetting agents) that affect the coating rheology. A semi-empirical model, based on the so-called Orchard equation for ideal conditions, but modified here to take into account solvent evaporation and non-Newtonian rheology, was developed for the leveling kinetics. Due to the differences in rheological behavior for the two coatings considered, adjustable model parameters needed to be fitted for each coating case. Overall, viscosity build-up was found to be the dominating parameter for leveling.