A main characteristic of biological systems is their capacity to dynamically adapt to environmental changes. In the brain, synaptic plasticity enables the strengthening or weakening of connections between neurons, allowing neural circuits to adapt based on experience, learning, and environmental changes. Yet, it is homeostatically regulated such that it avoids excessive proliferation of synaptic contacts. These mechanisms can be studied with large-scale models of brain activity. Here, we embed a biologically grounded inhibitory-homeostatic plasticity rule into the Dynamic Mean Field (DMF) model, creating a Homeostatic Dynamic Mean Field (HDMF) model that dynamically tunes local excitation–inhibition balance. Convergence of excitatory firing rates is reached by mapping a large range of coupling strength to parameters of inhibitory synapses. The HDMF reproduces empirical observables of brain activity as well as the original DMF, and can robustly sustain neuromodulatory perturbations without overhead computations. The HDMF can generate unprecedented sleep-like slow-wave activity, which can also coexist with wake-like asynchronous dynamics, permitting to model dissociated states of consciousness such as parasomnias and post-stroke dynamics. Together, these results show that a single homeostatic rule broadens the stability and expressiveness of the DMF, providing a unified platform for studying how local adaptive processes shape the diverse global dynamics of the human brain.