Volume averaged fluid models are widely used in the plasma processing community for understanding how the plasma parameters influence each other and how they are effected by the operating conditions. Such models are simple to setup and fast to run, allowing for a detailed exploration of the multi-dimensional parameter space, which facilitates the construction of scaling laws with predictive capabilities.

Global models are often underlain by the (somewhat hidden) hypothesis of a Maxwellian electron energy distribution function (EEDF); in many cases this is a very poor assumption which introduces errors larger than those due to the spatial averaging.

In fact, for a given effective electron temperature, the EEDF shape strongly effects the collision rate coefficients, as well as the sheath-presheath structure and hence the wall losses.

In order to deal with this problem, some authors have relaxed the Maxwellian distribution assumption in different ways, either providing an EEDF parametrization from a separate kinetic simulation, or superimposing 2 or more Maxwellian distributions at different electron densities and temperatures. Here we present a novel kinetic global model, where the EEDF is evaluated during the simulation without any a priori assumption about its shape, by taking into account electromagnetic heating, collisional processes, wall losses, quasi neutrality, electron confinement, and creation/depletion of neutral species.

A peculiar characteristic of this model is the self-consistent calculation of the EEDF together with the plasma-wall voltage drop, which makes it particularly suitable for simulation of low pressure plasma sources.

The computational overhead due to the EEDF calculation becomes less relevant as the collisional model becomes more complex. When complex chemistry kinetics is included, our kinetic global model is not substantially slower than a more traditional global model. Moreover, an accelerated procedure for reaching a steady state solution is presented, based on a pseudo-transient simulation with time-scale separation.

The aforementioned kinetic global model is used to simulate different plasma sources, and the results are compared against those obtained with the assumption of Maxwellian EEDF.