Predicting core transport in ITER baseline discharges with neon injections

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We present the results of an integrated modeling analysis examining the compatibility of ITER baseline scenario core transport modeling with independent edge and scrape-off layer SOLPS-ITER simulations, as a function of impurity content. This study gives confirmation that the required core plasma conditions can be achieved in ITER baseline scenario that are compatible with predicted parameters in the edge. A Corsica-generated ITER 15MA Q_{DT} = 10 baseline scenario with $T_{e,ped}$ = 4.5 keV and $n_{e,ped}$ = 6.2e19 m^{-3} was used as a starting point for the core transport simulations. First, a set of equilibria and core profiles was created for a range of Z_{eff} values by adjusting the relative ratios of the deuterium, tritium, helium and neon concentrations. The OMFIT STEP module workflow consisting of the EFIT, ONETWO and TGYRO steps was then used for the constructed set of model equilibria to predict the transport and the power flow across the boundary. It was found that Z_{eff} = 1.75 ITER case had the power flow of 100 MW across the last closed flux surface that corresponded to the boundary condition used in the corresponding SOLPS-ITER simulations. This value for Z_{eff} is within the range of acceptable values in ITER baseline scenarios. The determined relation between the impurity content in the core and power flow across the LCFS will provide guidance for ITER impurity seeding modeling and experiments. An additional set of equilibria was constructed for a range of core plasma rotation values between -20 km/s and +20 km/s as the core rotation velocity is not well known in ITER. Preliminary results show little effect of core rotation direction on TGYRO predictions in the examined range of rotation values. Results from ongoing benchmarking TGYRO calculations of line, bremsstrahlung and synchrotron radiation losses vs. more detailed calculations with the AURORA module using ADAS atomic rates will be reported, as well as implications of including trace tungsten impurity and radiation on the predictions.

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