Integrated modelling of ITER scenarios with D-T Mix control

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An analysis of D and T fuelling requirements for DT mix control for ITER H-mode plasmas is presented in this paper. This includes the use of pellet injection for core plasma fuelling and ELM pacing, and gas fuelling for edge density and divertor power load control, consistent with the ITER fuelling and pumping systems capabilities. The simulations are carried out by 1.5D core transport modelling with separate treatment of D and T ions with the ASTRA suite of codes with boundary conditions and particle sources from gas puffing derived from scalings based on SOLPS simulations. The width and height of the pedestal evaluated by the EPED1+SOLPS scaling prediction which are compared with direct simulations of the pedestal stability limits by the KINX code. In this way the effect of the impact of core pressure from self-consistent core simulations with TGLF on the pedestal height is included. The ITER simulations have been carried out with GLF and TGLF transport models for the range of currents and densities foreseen to be required to develop the ITER baseline q_{95} = 3 scenario from low field 5 MA/1.8T, 7.5 MA/2.65T to high field operation 15 MA/5.3 T Q = 10 for DT plasmas with varying T levels in a wide range of plasma densities. In most plasma conditions, penetration of recycled neutrals is found to be very limited so that pellet fuelling is an efficient tool to control the DT mix with a timescale determined by the relaxation of the D and T profiles. TGLF modelling predicts highly stiff temperature profiles for ITER plasmas with T′~ const, rather than L_T~ const and more robust access to high Q conditions than previously evaluated with GLF23. A factor that also contributes to this H-mode access robustness is the rapid decrease of the fast particle energy associated with fast D ions from NBI and alpha particles in the low density phase which slow down as the density increases thus providing additional heating to the plasma to keep it in H-mode as the density increases in the core. This increase is predicted to occur on a faster timescale by TGLF than by GLF23.