Poloidal asymmetry of plasma flow in Tore Supra tokamak

L. Vermare[1], Y. Asahi[2], F. Clairet[2], G. Dif-Pradalier[2], X. Garbet[2], J-C. Giacalone[2], V. Grandgirard[2], O. Gürcan[1], P. Hennequin[1], C. Honoré[1], P. Morel[1] and the TORE SUPRA team[2]

[1] LPP, Ecole Polytechnique, CNRS, 91128 Palaiseau, France
[2] CEA, IRFM, F-13108 Saint Paul Lez Durance, France

Simultaneous measurements of binormal velocity of density fluctuations using two separate Doppler backscattering systems at the low field side and at the top of the plasma show significant poloidal asymmetry. The measurements are performed in the core region between the radii (0.7<r/a<0.95), over a limited number L-mode discharges covering a wide range of plasma conditions in the Tore Supra tokamak.

Ripple effect is an option to explain this poloidal asymmetry since non-ambipolar particle flux induced by ripple losses have been shown to be the dominant mechanism that sets the radial electric field in the plasma core on Tore Supra. In this previous work, only the flux surface average of the radial electric field was derived and compared to measurements. In reality, since the magnetic ripple decreases significantly from low field side toward high field side, a possible poloidal dependence of the radial electric field induced by ripple losses is conceivable.

In addition, a possible generation mechanism by the ballooned structure of the underlying turbulence, especially in the form of convective cells, has proposed for explaining the observation of these poloidally asymmetric mean flows.

In the present contribution, the both possible origins of this unexpected poloidal asymmetry are discussed and investigated through comparisons with numerical simulations. For this purpose, simulations are performed using a full-f, semi-Lagrangian, global gyrokinetic simulations obtained using the GYSELA code and as much as possible, the experimental radial profiles as well as a simplified synthetic Doppler backscattering diagnostic to reconstruct the perpendicular velocity of density fluctuations.