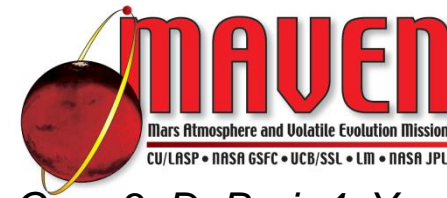


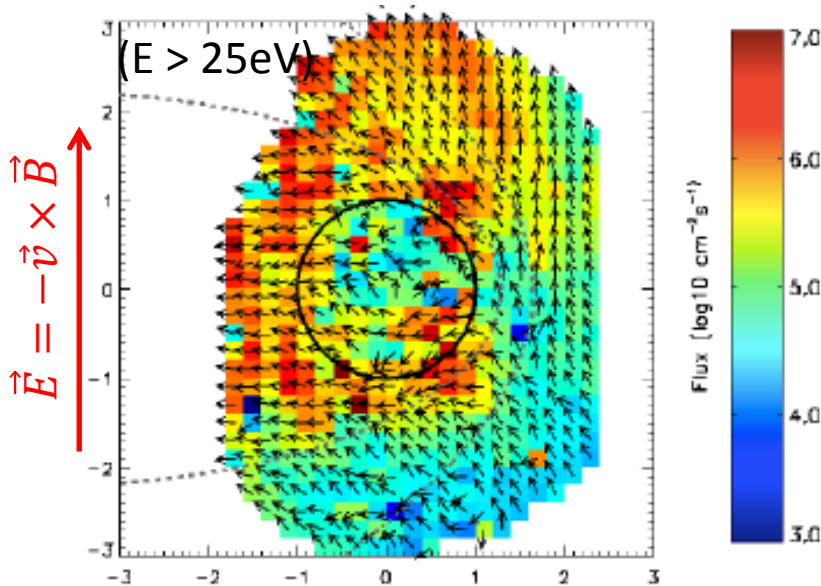
Dynamics of O+ ions in the Martian environment: Comparison between hybrid simulations and MAVEN observations



R. Modolo¹, F. Leblanc¹, JY. Chaufray¹, L. Leclercq², N. Romanelli¹, S. Curry³, D. Brain⁴, Y. Dong⁴, C. bowers⁴, J. Luhmann³, J. Halekas⁵, J. McFadden³, J. Connerney⁶, J. Espley⁶, B. O+ ion flux map (for E > 25eV) Jakosky⁴

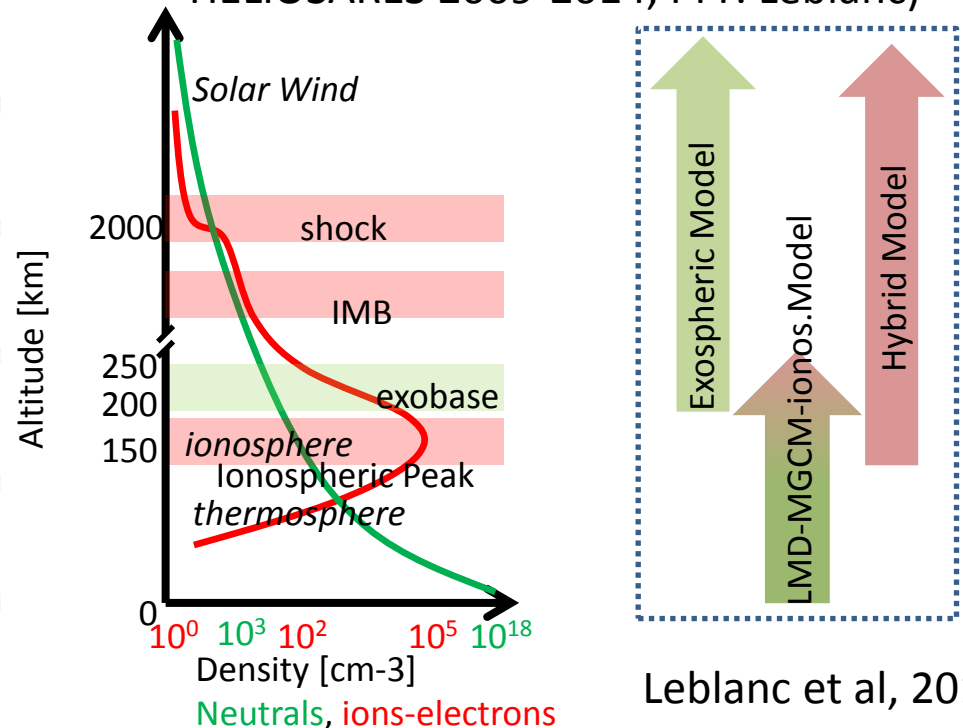
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MAVEN observed a **widespread spatial distribution of O+ ion fluxes** in the **Martian wake** and in the Northern MSE hemisphere (**plume**) => escaping ions



Dong et al, GRL, 2015

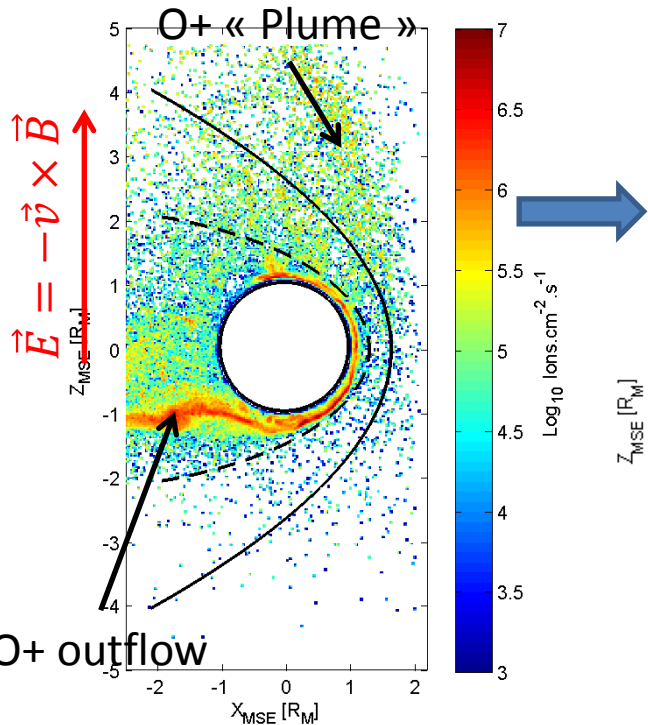
Three 'coupled' model to have a realistic description of the Martian environment from the surface to several R_M (ANR HELIOSARES 2009-2014, PI F. Leblanc)



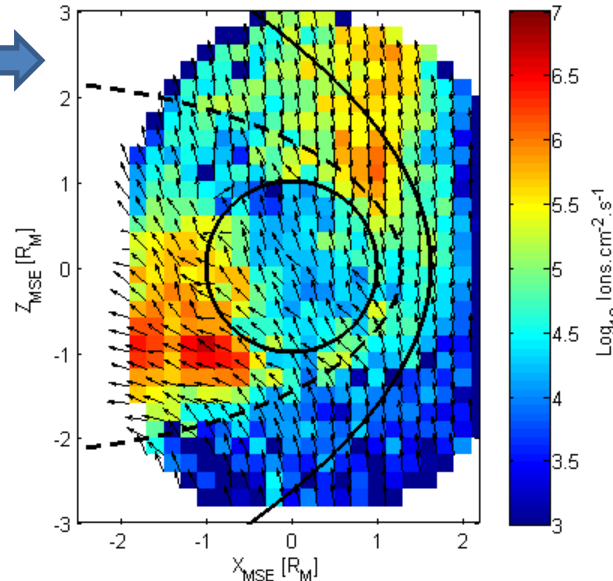
Leblanc et al, 2017

Observations vs steady simulations

2D plane cut of O+ flux (simu)



Compute ion flux along MAVEN track + Energy selection ($E > 25$ eV)



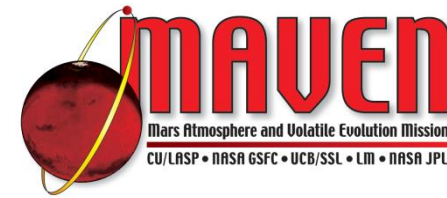
Simulation **diagnostic** along the **MAVEN trajectory** (in MSE) and projected in the XZ MSE plane \Rightarrow Simulation emphasizes **two distinct escape channels** for O+ ions

Why such « discrepancy » ?
 A- Something missing in the simulation ?
 B- Simulation results are valid for a given condition (upstream SW, local time, ...) while MAVEN results incorporate many different conditions

Parameters which affect the Solar wind – Mars interaction :

- Crustal Field locations
 - Solar wind density
 - Solar wind speed
 - IMF magnitude
 - θ_{VB}
 - Planet obliquity, EUV,....
- } Change P_{dyn}
- } Change $\vec{E} = -\vec{v} \times \vec{B}$

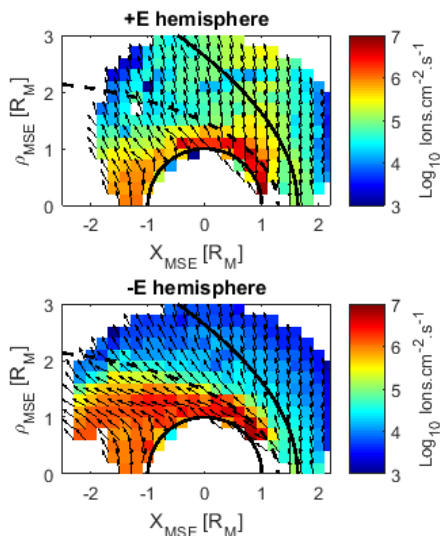
Variability of O+ ion flux



Performing simulations for different upstream conditions

Run 1	Ref	Run 2	Effect on the O+ ion flux distribution
SSL=0	ref	SSL=90 (SSL=270)	No major influence
n=1 cm ⁻³	ref	n=5cm ⁻³	No major change
V=350km/s	ref	V=600km/s	V \searrow \Rightarrow lower ion escape flux
B=2nT	ref	B=6 nT	B \nearrow \Rightarrow plume tilted tailward and less fluxes in the plume for low B
$\theta_{VB}=20^\circ$	ref	$\theta_{VB}=90^\circ$	Low θ_{VB} \Rightarrow almost no plume

Averaging O+ ion flux maps to assess the different upstream conditions seen by MAVEN



Simulated global distribution and flux in fair agreement with observations

Variability of Solar Wind conditions during the orbit might contribute for the spread distribution of O+ ion fluxes observed by MAVEN

