



**Figure 5.** Magenta curve in panel (b) is  $E_{Heavy+}$  the calculated drift energy of heavy population from the data points between the two white dashed lines while the black curve is  $E_{H+}$  the drift energy of the proton population that calculated from the data points under the lower white dashed line. The ratio between the two calculated drift energy (running-averaged with 1 min width) is visualized in panel (c) as black curve. The blue (magenta) dashed line in (c) is the expected line if the heavy ion population contains  $O^+$  ( $O_2^+$ ) corresponding to 16 (32) assuming all species have the velocity. Panel (d) shows the calculated velocity ratio (also running-averaged with 1 min width) if the heavy ions are considered atomic oxygen  $O^+$ . Panel (e) is the proton velocities. (f) and (g) are the densities and fluxes calculated for the proton (black color) and heavy (red color) populations. (h) and (i) are histograms of the calculated energy and velocity ratios respectively. No assumption for the ions' mass is needed in (h) and no running averaging are performed for the histograms.  $O^+$  for the heavy ions was assumed in velocity ratio calculations same as (d).