@Dr B

In calculating fuel limited range there is a small factor that I have not seen addressed hitherto; the effect on the weight vs mass relationship to speed at constant altitude around the earth: thence with weight, drag.

KL is at the equator, or near enough for these purposes, so has an easterly speed of around 1000 knots. Consequently aircraft static there will weigh less, just as satellites in orbit would weigh zero on scales up there. Static on the ground at higher latitudes they also would weigh less than their mass.

At 1000 knots and attributing to earth an indicative radius of 4000 nm, at KL weight would be less than mass (i.e. weight at the poles) by about 0.0036g, 0.36%. Similarly an aircraft aloft there with an easterly speed component of 350 knots, say, would be 0.655% lighter than its mass.

Conversely, one flying with a like westerly component at zero latitude would be the same heavier than on the ground but still would weigh 0.152% less than its mass. To equal that mass it would need to be flying at a latitude where the earth's rotational speed was 350 knots.

Even so the above generality needs qualification when applied to MH370. Fuel quantity is measured in the aircraft by its volume multiplied by density, as I expect are water and oil. Being incompressible, sensibly, these will be loaded by mass, not weight and so will weigh less in the aircraft than indicated, as above. Similarly, passengers with their hand luggage are attributed a standard weight (an implied mass, i.e. unaltered by their location's ground speed) as possibly are such as galley loading and any items of equipment etc whose attributed weight is taken from data sheets. Since the site where these were assessed is unknown it is not possible to say what the weight difference would be but since the Safety Investigation Report's p.51 weight attribution of "passengers and luggage" (from its size, hand luggage) amount to about 7.5% of 'Take-off Weight', suppose with crew and other that the total come to 10%. With fuel added, at about 22%, around a third only of the aircraft mass will be subject to the 0.36% above effect on aircraft weight when static on the ground: aircraft structure and freight, including baggage, will have been weighed locally so the effect on these will have been discounted already.

However during and after take-off all the aircraft's mass is subject to the weight change above from east or west speed components; the 350 knot examples illustrating the principle. (Such as those could be applied more correctly by converting the local KL weight elements back to mass, thence applying easterly and westerly speeds of 1350 knots and 650 to come up with in-flight weight.)

Whether the overall effect on MH370 range is appreciable depends firstly on the size of the weight changes from its flight's easterly and westerly components; easterly after take-off, then westerly after the turn back until the turn south, then secondly on the relationship between weight and drag, and then thirdly on that between fuel consumption per air mile and aircraft drag.

I suspect that the net outcome would be insignificant amongst other variable unknowns such as unknown temperature and wind changes, all-up weight inaccuracies (e.g. the passengers' actual weight) and drag changes from such as aircraft cleanliness and trim and outflow valve deployment extent. Then there would be the weight consequences of reduced fuel consumption for galley power, saved fuel after possible deselection of engine air bleed and air circulation fans; or of course, if piloted to the end, a yet different list.

Even so, I have not heard discussion in general aviation of day-to-day easterly flights consuming less fuel than westerly mirror flights, ceteris paribus (though hard to arrange!). (Or also for that matter the separate effect on fuel consumption during northern and southern components of swinging the heading vector to counter Coriolis). Maybe incidental.

As to whether the Rolls Royce fuel consumption, to which you have access, takes account of east-west flight components or of the latitudes of operation; and specifically whether MH370 fuel consumption derived from 9M-MRO flights could be biased inadvertently, (e.g. from a flight with major easterly or westerly components such as a flight to the Middle East or Europe or one to the east); no, as above that is measured by mass.

Overall the effect may well prove inconsequential amongst other uncertainties such as unknown temperature and wind changes, all-up weight inaccuracies (e.g. assumptions as to passengers' and crew's actual weight, with take-ons) and drag changes from the likes of aircraft skin cleanliness and trim and outflow valve deployment extent, the weight consequences of reduced fuel consumption for galley power, saved fuel weight after possible deselection of engine air bleed and air circulation fans; or of course, if piloted to the end, a yet different list, including RAT drag were there a glide.

But as to taking this further, I do not know the relationships between weight and drag or between fuel consumption per air mile and aircraft drag so cannot hazard whether it would be worth doing.

Your reaction please?

<u>Footnote:</u> Re aircraft mass vs weight I remember a talk by Dr Paul MacCready after his aircraft won the Kremer prize for a figure 8 manpowered flight in 1977's. In trials he had been puzzled that it accelerated more slowly on the runway than expected. The cause proved to be that this very light aircraft had comparatively a large volume wing. He had not included the mass of air in it as needing acceleration also. I assume that these days the mass of air in aircraft is looked into in assessing linear acceleration and 'g' forces.