Centre of mass

In the chapter 7.1.1 “Calculating the centre of mass” the altitude in which single gas measurements of a cycle can be placed. This is called centre of mass, regarding this experiment, and is equivalent with the centre of mass of the air sample collected during one cycle.

In the abovementioned chapter the following formula has been derived:

where h0 is the experiment’s altitude at the start of a new cycle and h(t) is the experiment’s altitude at the moment t. From the chapter “Environmental and Experiment’s conditions” it is clear that the ascending phase was linear with a mean value of υ = 3.7 m/sec, thus:

Furthermore, from the chapter “Pump modeling” the flow-rate function Π(t) has been expressed as:

where d is a constant depending on the cycle number, and c =0.95318. With that being said, the center of mass can be expressed as:

where T is the duration of the corresponding cycle. By solving the integrals, hcm is calculated:

The above result is very important because it is independent of the corresponding cycle’s number.