Standish_module.f90 V1.0
Accuracy Check
2000 AD - 2050 AD

(by CumuloEpsilon Feb 2018)
(ref https://github.com/CumuloEpsilon/Standish-Ephemeris)

The planet position determined by the Standish approximation was compared to results from the NASA/JPL ephemeris DE430 over the period 2000 - 2050 AD. We take ephemeris DE430, used in US space missions and exploration, as presumptively authoritative for our purposes.

Given an authoritative position $\vec{R}$ and an approximate position $\vec{r}$ we calculate the magnitude of the difference $\Delta = |\vec{r} - \vec{R}|$ for 18000 julian days beginning Jan 1 2000 AD and concluding approximately 2050 AD. One point was calculated each 100 days. Results were obtained for the major planets, as shown below.

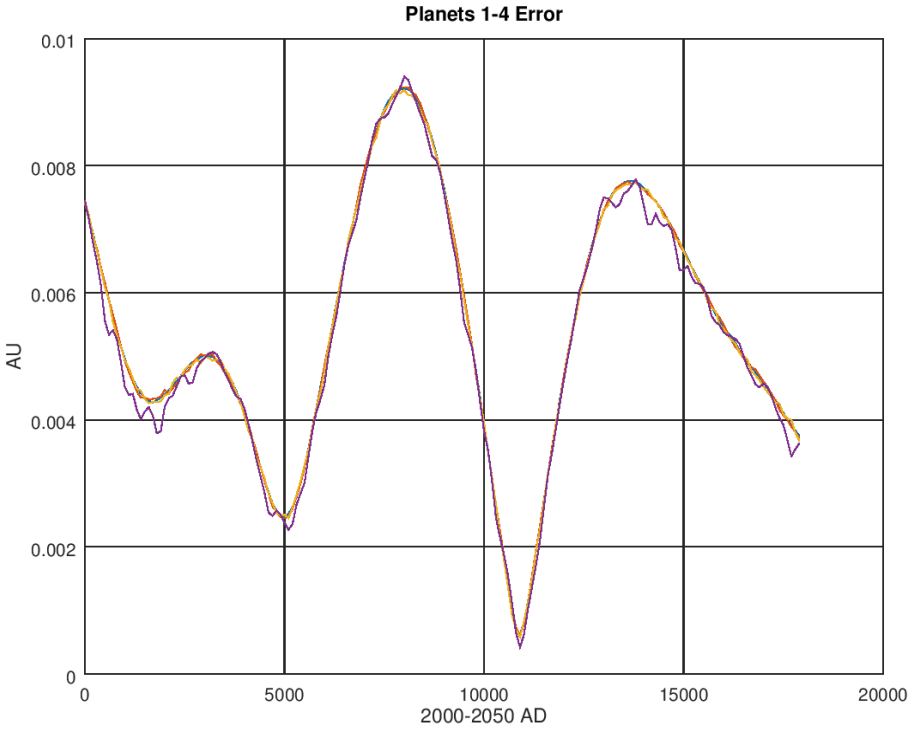

Figure 1. Error in planet positions calculated by Standish_Module.f90 V1.0 compared to DE430 (authoritative). Mercury through Mars. Mars is jittery line in blue.

For the inner planets the error curves are virtually superimposed. We needn't speculate about this, the Standish method is an approximation. These data indicate the approximation for position is generally good to within 0.01 AU

or better for the inner planets in the time range 2000-2050 AD. Mars missions are expected in the 2030's which is day 10000 - 14000 in the above figure where accuracy improves to as much as 0.002 AU. Considering the simplicity of the Standish model, even further considering it was data fit by a master in the field, this is impressive agreement, quite suited to many low accuracy uses.

Before our younger selves seize too quickly on this result and prepare to launch a younger sibling into Mars orbit, we remind that our high accuracy ephemeris data is between 10 meter to 10 kilometer accurate. While an error of 0.002 AU in this approxiation is impressive, it is still 300,000 kilometers. We match tools to tasks, always.

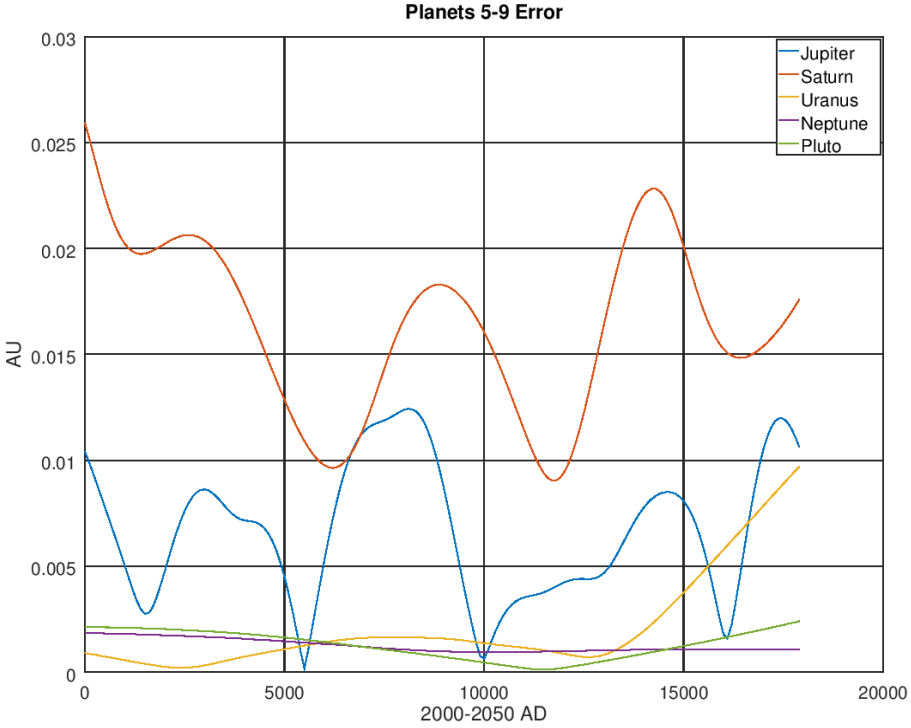

Figure 2. Error in planet positions calculated by Standish_Module.f90 V1.0 compared to DE430 (authoritative). Jupiter through Pluto.

Results for the outer planets shown in Figure 2 is more varied. The least accurate results is for Saturn and Jupiter, with between 0.01-0.02 AU accuracy. The data for the other outer planets, Uranus, Neptune, and Pluto is comparitively good, magnitude 0.002 AU, and similar to results for the inner planets.

Conclusion

This preliminary look at the Standish_Module.f90 results shows fair agreement with the DE430 ephemeris on the order of +-0.01 AU, indicating the coding is correctly done and that Standish's use of a Keplerian model is sound as an approximation for the positions of the major planets. We never really doubted it would be found so.