

## CXFORM vs HelioCoords test results

Positions are in geocentric cartesian coordinates in units of Earth radii [Re = 6378.14 km]  
for the date Aug 28, 1996 16:46:00 TT.

	System	X	Y	Z
HelioCoords	GEO_T	6.90274	-1.63624	1.91669
CXFORM	(GEO):	6.90274	-1.63624	1.91669
<i>Absolute Difference:</i>		0	0	0
<i>Percent Difference:</i>		0	0	0
HelioCoords	GEI_T	-5.786434	-4.103936	1.91669
CXFORM	(GEI):	-5.786406	-4.103974	1.91669
<i>Absolute Difference:</i>		2.75E-05	3.83E-05	0
<i>Percent Difference:</i>		0.000475	0.000933	0
HelioCoords	GEI_{J2000}	-5.784045	-4.108238	1.914682
CXFORM	(J2000):	-5.782714	-4.108298	1.918569
<i>Absolute Difference:</i>		0.001331	6.05E-05	0.003887
<i>Percent Difference:</i>		0.023019	0.001473	0.202588
HelioCoords	GSE_D	4.037847	5.118257	3.390876
CXFORM	(GSE):	4.032994	5.121997	3.391003
<i>Absolute Difference:</i>		0.004853	0.00374	0.000127
<i>Percent Difference:</i>		0.120332	0.073026	0.003733
HelioCoords	GSM_D	4.037847	6.007192	1.268165
CXFORM	(GSM):	4.032994	6.010572	1.26759
<i>Absolute Difference:</i>		0.004853	0.00338	0.000574
<i>Percent Difference:</i>		0.120332	0.056239	0.045322
HelioCoords	SM_D	3.360137	6.007192	2.573311
CXFORM	(SM):	3.354186	6.010572	2.573182
<i>Absolute Difference:</i>		0.005951	0.00338	0.000129
<i>Percent Difference:</i>		0.177423	0.056239	0.005005
HelioCoords	MAG_D	3.334456	6.021511	2.57325
CXFORM	(MAG):	3.328769	6.024685	2.573182
<i>Absolute Difference:</i>		0.005687	0.003174	6.77E-05
<i>Percent Difference:</i>		0.170835	0.052687	0.002631
HelioCoords	HAE_D	-5.786492	-3.002877	3.390876
CXFORM*	(HAE):	-5.786406	-3.002899	3.391003

<i>Absolute Difference:</i>		8.58E-05	2.19E-05	0.000127
<i>Percent Difference:</i>		0.001483	0.000729	0.003733

HelioCoords	HEE_D	-4.037847	-5.118257	3.390876
CXFORM*	(HEE):	-4.032994	-5.121997	3.391003
<i>Absolute Difference:</i>		0.004853	0.00374	0.000127
<i>Percent Difference:</i>		0.120332	0.073026	0.003733

HelioCoords	HEEQ_D	-4.413267	-5.192444	2.749619
CXFORM*	(HEEQ):	-4.408831	-5.19614	2.749752
<i>Absolute Difference:</i>		0.004436	0.003696	0.000133
<i>Percent Difference:</i>		0.100612	0.07113	0.004848

HelioCoords	HGRTN_E	4.03603	5.19319	-3.277199
CXFORM**	(RTN):	-4.032994	-5.198153	3.508909
<i>Absolute Difference:</i>		8.069024	10.39134	6.786108
<i>Percent Difference:</i>		200.0753	199.9045	193.3965

Tests performed on 2004/12/01 using CXFORM v0.6

Absolute differences:  $ABS((\text{HelioCoords result}) - (\text{CXFORM result}))$   
 Percent differences:  $ABS(100.0 - ((\text{HelioCoords result})/(\text{CXFORM result})) * 100.0)$

Averages taken from 1 data point (position in Re) from HelioCoords documentation  
 Source coordinate system was taken to be GEO.

\* = CXFORM's heliospheric coordinate transformations translate along X the distance from the Earth to the sun, whereas HelioCoords does not. For this test, CXFORM was modified in the gse\_twixt\_hee function to compensate.

\*\* = The RTN system has not been fully implemented/tested, so the results are poor.

CXFORM: [http://nssdcftp.gsfc.nasa.gov/selected\\_software/coordinate\\_transform/](http://nssdcftp.gsfc.nasa.gov/selected_software/coordinate_transform/)  
 HelioCoords: <http://www.space-plasma.qmul.ac.uk/heliocoords/>