Local horizon needed for clear GOES view
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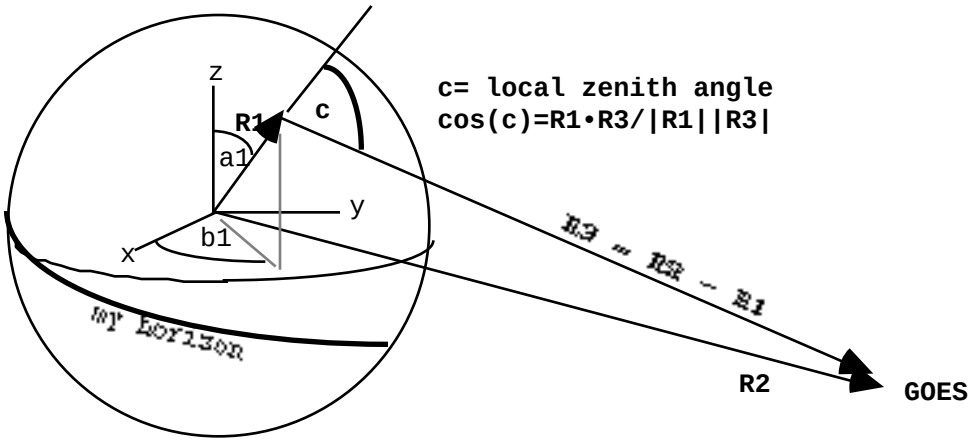

VECTOR SOLUTION FOR ANGLE ABOVE HORIZON (altitude)

R1 = vector to me on a sphere, polar angle a1 and equitorial angle b1.
= r1 [sin(a1)cos(b1), sin(a1)cos(b1), cos(a1)], x,y,z-components
r1 = |**R1**| = radius of the earth

R2 = vector from center of earth to satellite in orbit

R3 = vector from me to satellite in orbit = **R2** - **R1**

c = angle from local zenith to satellite,
determined by dot product of local zenith with vector from me to satellite
cos(c) = **R1•R3**/|**R1**||**R3**|

Azimuthal angle from me to GOES is computed using projections of R3 onto my horizonal plane by first removing its projection onto my zenith vector:
R4 = **R3** - [(**R3•R1**)/r1][**R1**/r1] = part of R3 in my horizontal plane
Rs = [cos(a1)cos(b1), cos(a1)cos(b1), -sin(a1)]
= unit vector to my south horizon
and then computing the direction cosine between R4 and my south-look point
cos(azimuth) = **R4•Rs**/|**R4|**

Tabular results

SATELLITE STATION	geo-longitude (°W)	azimuth angle, east of south (°):	altitude angle, up from horizon (°):
METEOSAT	0	82	1
METEO-alt	30	60	24
METEO-now	50	39	37
GOES-EAST	75	3	45
GOES-I/M	90	-20	43
GOES-7now	110	-46	33
GOES-7alt	120	-56	27
GOES-WEST	135	-69	16
GOES-WEST+	140	-72	12