Distance to the Horizon

Note: The balloon launch site is around the area of Mount Barker. The proposed launch site is at a farmer's property in Wistow. Pictures of the launch site are at: http://pipe2.darklomax.org/pics/2012-10-07_Horus_29/ and the location is: https://www.google.com.au/maps/place/35%C2%B007'39.2%22S+138%C2%B050'51.4%22E/@-35.1279687,138.847769,388m/data=!3m1!1e3!4m2!3m1!1s0x0:0x0. The proposed launch is scheduled for the third week in September.

Description of problem

Satellites can be used to make range of physical earth measurements and observations, including direct observation of the curvature of the Earth. If the GoPro camera is positioned to photograph the horizon, we can use the photographs to calculate the distance to the horizon and calculate the curvature of the earth. The team will need to recommend the appropriate orientation of the camera for these observations.

Background

Balloon pictures showing the curvature of the horizon are quite beautiful, but we can also use these pictures to calculate distances from the balloon to the horizon. This could be useful in estimating the distance to visible features.
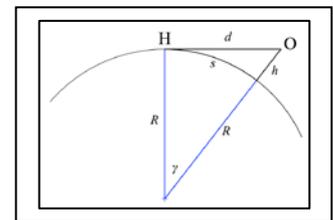
To do this we can use simple Pythagoras triangle calculations. The balloon is at point O, h is the height above the ground, R is the radius of the earth, d is the distance to the horizon from the balloon. All distances are in metres.

$$d = \sqrt{2Rh + h^2}$$

Calculate the distance to the horizon for 10,000m (10km), 20,000m and 35,000m (the projected maximum height of the balloon. You can work out how this formula is derived using the diagram.

Investigation

The experimental design will need to take into consideration how the collected data can be presented and analysed after the flight. Investigate how you can determine the balloon altitude for particular photos and how we can match altitude and time in flight with the images (either still or video) from the camera. You could work with Atmospheric Investigations group in this exercise. From this you can determine the distance to the horizon. After the flight, these distance calculations can assist the group investigating Land Use under the Flight path to correctly place their photos or descriptions on a map of southern South Australia.

Report

Prepare a report which:
- Describes the goals of your task
- Describe the results of your calculations for the distance to the horizon
- Describe how you will graphically represent your results once the data has been retrieved after the flight and how distances to the horizon and images can be synchronized with the inflight times.