RELIEF DISPLACEMENT

Relief displacement is radially away from the nadir point. There is no relief displacement at the nadir point.


- Buildings toward the edge of the image appear to lean away from the nadir point: PanAm Building (top, right of center).
- Buildings near the nadir point show little relief distortion: Empire State Building (look for the shadow).
STEREO VIEWING
Hong Kong stereo pair.

A. Verify that the photographic center has been plotted on each of the photos.

B. Use a pocket stereoscope to view the stereo pair.
   i. Line up the photos so that they are in the order and orientation that existed when they were photographed. The edge of the film should be at the top or bottom. Film annotation (clock, altimeter, frame number, etc.) appears between frames during photography and should be to your right or left when setting up the photos for viewing. If the photos are set up properly the words "KODAK SAFETY FILM" should be at the top or bottom of the photo.
   
   ii. Adjust the stereoscope by holding it up to your eyes and setting the distance between the lenses to correspond your eye base.
   
   iii. Place the stereoscope in position on the stereopair paralleling the flight line direction with one lens directly over a selected feature on the top photograph and the other lens over the same feature on the bottom one. The photographic center is a good place to start since it is marked in red and is very easy to find.
   
   iv. Adjust the top photo until the stereo model appears. You may need to shift and rotate the top photo somewhat to get a good match. To view an area that is hidden on the bottom photo by the top photo, gently bend the top photo back until the same area from both photos is visible.

C. Observe
   i. The pit near the land end of the runway.
   
   ii. The two tanks near the photographic center and opposite the runway.
   
   iii. The area near the clock (annotation).

D. Once you have seen the stereo views, note:
   i. The vertical features are highly exaggerated.
   
   ii. Stereo viewing is made possible by relief displacement. Notice the difference in displacement on the two photos for each of the observed features.

   iii. There is no relief displacement at the nadir point.

Supplemental stereo examples.
A. North Campus circa 1970. Note the level of detail and the extreme vertical exaggeration in this low-altitude image.

B. Landform Analysis. A text in landform analysis with an extensive set of examples is on the table at the window (for the light). Examine a few of the image sets in this book.
PHOTOGRAMMETRY/SCALE
(Making measurements from an image)

Use the USGS topo sheet (photocopies) for Ithaca East and West) along with the set of 1968 airphotos. The map scale is 1:24,000.

A. Measure the following distances on both the airphoto and the topo sheet (measure to the nearest 0.5 mm, measured from the center of the road or intersection):

i. Downtown: Albany St. from Cascadilla St. to Prospect St.

ii. South Hill: Intersection of Troy and King Rds. to Rt. 96B @ Nelson Rd.

<table>
<thead>
<tr>
<th>Distance Description</th>
<th>Map Distance (mm)</th>
<th>Photo Distance (mm)</th>
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<tr>
<td>Albany St. from Cascadilla St. to Prospect St.</td>
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B. Compute the ground distances using the map scale: $S_m = \frac{\text{map distance}}{\text{ground distance}} = \frac{1}{24,000}$

C. Using the ground distances, compute the photo scale, $S_p = \frac{\text{photo distance}}{\text{ground distance}}$, at both locations.

D. Estimate the error in your estimate.

1. Repeat the procedure several times.
2. Estimate uncertainty
   a. Compute a mean, $S_p$, and standard deviation, $\sigma_p$, of the estimate of the photo scale. This will require computing the Scale as would be determined by each of the individual sets of measurements and then using the set of scales to find a mean and standard deviation. Use one standard deviation as the measure of uncertainty.
   b. Alternatively, use propagation of errors to estimate the error in the scale.

   An estimate of the uncertainty in scale is given by:
   $$\frac{\sigma_{sp}^2}{S_p^2} = \frac{(\sigma_m)^2}{m^2} + \frac{(\sigma_p)^2}{p^2} + \frac{\text{cov}(\sigma_m, \sigma_p)}{mp}$$

   where: $\sigma_{sp}^2 =$ Variance of the scale determination
   $m =$ map distance
   $\sigma_m =$ uncertainty in map distance (1 std. dev.)
   $p =$ photo distance
   $\sigma_p =$ uncertainty in photo distance (1 std. dev.)
   $\text{cov}(\sigma_m, \sigma_p)$ is the covariance of the map and photo measurements. If the measurements are independent (e.g., made by different people), we can assume that the covariance is zero.
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stddev \( \sigma_m = \) \( \sigma_p = \) \( \sigma_S = \) \( \sigma_m = \) \( \sigma_p = \) \( \sigma_S = \)