I. Objectives

1. Use Google Earth (GE) and HiRISE quickview to explore eolian features
2. Recognize prominent dune types by their shape
3. Determine prevailing wind direction from dune shape and other clues.

II. Introduction

Deserts cover a third of Earth's surface area. A portion of this area is covered by various kinds of sand dunes. Like many other land surface features we have been investigating, sand dunes can look spectacular from above and are the culmination of the persistent action of the wind over a surface with a mobile supply of fine grains. Not surprisingly, other planets, notably our close neighbor, Mars is covered with spectacular dune fields too.

Some public science centers have clear Plexiglas boxes full of sand and a wind machine that the user can control. If you have ever had a chance to play with one of these, it is clear that wind direction and speed are key factors in the generation and propagation of dunes. Although dunes may look fairly static, they are constantly on the move, "flowing" relentlessly across the desert terrain. This lab will give you the opportunity to explore various areas of our planet and Mars that are covered by dunes. Remember that, at least on Earth, deserts tend to lie in the vicinity of the sub-tropical highs where descending Hadley circulation patterns persist and rain is scarce.

III. Materials

Internet and Google Earth

Figure 1: Martian longitudinal dunes

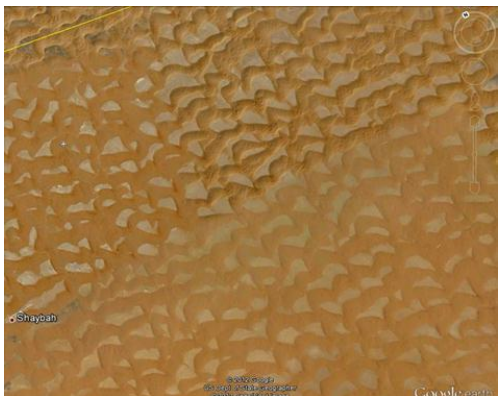

Figure 2: Saharan barchan dunes

IV. Prelab Definitions

1. desert

2. deflation

3. saltation

4. losess

5. playa

6. alluvial fan

7. barchans dune

8. linear or longitudinal dune

9. star dune

10. reversing dune

11. parabolic dune

12. dome dune

V. Lab Procedure

1. Working in groups of 2, use Google Earth, Google Maps, NASA's Earth Observatory and the Mars HiRISE Image Archive to explore four different eolian environments, as described below.

2. Investigate four eolian environments around the world or contrast a type of dune on Earth with a similar dune type on Mars. Subdivide the four views into two different groups, from different parts of the world. Each of these groups should be of similar types of structures or environments (such as listed in Table 1a) or related to similar processes (such as listed in Table 1b) so that you can compare and contrast what you find from different locations.

Table 1: Examples of Features to be Investigated		
a. Features	b. Processes	c. Locations
playa alluvial fan barchan dune linear or longitudinal star dune reversing dune parabolic dune dome dune	sediment transport erosion sediment flow seasonal effects change over time (eons) man-made mitigation	N. Africa / Sahara S. Africa / Kalahari N. America / SW borderlands S. America / Atacama Arabian Peninsula Asia / Gobi Australia

3. For each profile, copy and paste an image similar to Figure 2 above into a Powerpoint or Word document.

4. Resize the images so there are two images per page.

5. Label any features you find particularly interesting using the Word *Insert Text Box* tool.

6. Include your name on the first page and as part of the filename, for example, lastname_eolian.doc.

7. Submit the document into the MyPima class folder labeled "Eolian_Processes."

8. Complete Table 2 below and answer the discussion questions below for each image. For the scale, enter the repetition distance, the start of one dune to the same point on the next dune.

Table 2: Physical Characteristics of Selected Eolian Locations						
Descriptive name	Start point latitude	Start point longitude	Desert	Features	Prevailing wind direction	Scale x dimension in km

VI. Lab Discussion

1. Compare and contrast the prominent features in your <u>first pair</u> of images. How do they differ?

2. How are they similar?

3. What visual clues suggest wind direction? Be specific.

4. What features limit the extent or bound of this dune field?

5. Focus on one image in group 1. Would you find this feature anywhere or only in specific climatic or geographic settings? Be specific.

6. Propose three questions that could be investigated about the features you selected
   a.

   b.

   c.

7. Compare and contrast the prominent features in your second pair of images. How do they differ?

8. How are they similar?

9. What visual clues suggest wind direction? Be specific.

10. What features limit the extent or bound of this dune field?

11. Focus on one image in group 2. Would you find this anywhere or only in specific climatic or geographic settings? Be specific.

12. Propose three questions that could be investigated about the features you selected.
   a.

   b.

   c.

13. It may have been difficult to find dunes in some desert areas. Why are dunes found only in some areas and not in others?

Lab courtesy of Dr. Jim Washburne