GEOGRAPHIC COORDINATE SYSTEMS

A geographic coordinate system (GCS) is based on a spheroidal model of the earth. Sometimes a perfect sphere is used, but usually a slightly squashed "oblate spheroid" is used to reflect the fact that the earth bulges at the equator and is flattened at the poles.

The reference lines of a geographic coordinate system are parallels and meridians. Parallels are lines that circle the globe parallel to the equator. Meridians are lines perpendicular to the equator that converge at the poles. By convention, the origin of the system (its 0,0 coordinate) is the intersection of the equator and the prime meridian, the meridian passing through Greenwich, England.

Geographic coordinates, commonly called *latitude-longitude* values, are measurements of angle, not distance. Angles are a constant unit of measurement on a sphere, whereas distances are not (because meridians converge).

Angle measurements are usually expressed in degrees, minutes, and seconds. A degree has 60 minutes; a minute has 60 seconds.

Latitude is angular position north or south of the equator. The equator is 0° latitude, the North Pole is 90° north, and the South Pole is 90° south.

Longitude is angular position east or west of the prime meridian. The prime meridian is 0° longitude. Its anti-meridian (on the other side of the world) is both 180° east and 180° west.

A latitude-longitude pair defines a unique position on the earth's surface.

The unique location of Dodger Stadium, for example, would be written like this: **34°4′ 26″ N, 118°14′ 27″ W** and spoken like this:

"34 degrees, 4 minutes, 26 seconds north latitude; 118 degrees, 14 minutes, 27 seconds west longitude."

For computer calculations, these values are converted to decimals. The location of Dodger Stadium in "decimal degrees" is 34.073, –118.24. The minus sign is used for west longitude and south latitude.

The fact that there are many different geographic coordinate systems is a source of trouble for GIS users. What makes two systems different is disagreement about the exact latitude-longitude values of particular locations. Why is there disagreement about that? In simple terms, it's because different spheroid models of the earth have been developed over time by different earth scientists using different technologies. Changing the shape or size of the model ends up changing the coordinates of points on the surface—usually not by very much, but sometimes, in sensitive applications, enough to be of concern. This issue is taken up in more detail in the *"Datums"* sidebar later in this lesson.