

**WORLDS OF FIRE: A FIELD- AND CLASSROOM-BASED EDUCATIONAL OUTREACH PROGRAM FOR HIGH SCHOOL TEACHERS.** Steven D. Kadel<sup>1,2</sup> and David A. Williams<sup>1</sup>; <sup>1</sup>School of Earth and Space Exploration, Arizona State University, Box 871404, Tempe, Arizona, 85287 ([s.kadel@cox.net](mailto:s.kadel@cox.net)); <sup>2</sup>Physical Sciences Department, Glendale Community College, Glendale, Arizona.

**Introduction:** In spite of many advances and ever-increasing access to educational outreach activities for K-12 teachers, not all bodies in our solar system have been made equally accessible. To wit, there are many excellent opportunities and formats in which Mars-related data are available to secondary teachers. Ample Lunar, Venus, Europa, and even small-body exercises exist. However, educational outreach exercises involving the most volcanically/geologically active body in our solar system, Jupiter's moon Io, have been extremely sparse to date. Fortunately, we are now at a point, post-*Galileo*, when existing imaging data sets have been largely optimized for Io, and when Earth-based geologic studies are at an all-time high. Therefore, the time is ripe for a field- and remote-sensing based outreach project that gives full attention to volcanic eruptions on Io and Earth using the best resources available to date. To this end, we have embarked upon a project that involves the following components: 1) Image-based exercises, in English and Spanish-language versions, that familiarize the user (teacher and/or student) with the variety of volcanic deposits, landforms and eruption styles observed on Io; 2) Equivalent image-based data on volcanic landforms and eruptions on Earth, including 3-D terrain models and fly-overs via the widely available GoogleEarth™ resource; and 3) A field study of volcanic landforms in north-central Arizona that simultaneously provides real-world context for the features discussed in the exercises and college credit for participating K-12 teachers.

**Io Exercises:** Images of a variety of volcanic landforms on Io are presented, particularly in areas where active volcanism has been observed during the *Voyager* and/or *Galileo* eras (or between the two). See [1] for an up-to-date review of the geology of Io. Such landforms include *paterae* (circular volcanic features, thought to be analogous to terrestrial calderas), *flucti* (lava flow fields), *montes* (isolated peaks), and extensive ring-like deposits that appear to be the Ionian equivalent of explosive ash-fall materials (**Figure 1**). Discussion and practice with shadow-measurement techniques for mountain height determination (**Figure 2**), and a discussion of how temperature estimates (from both *Galileo* NIMS and PPR datasets) are determined are also included.

**Earth-based Exercises:** Images of effusive and explosive mafic volcanic landforms and deposits on Earth are presented, covering volcanoes in North America, Hawaii, Europe and Africa (**Figure 3**). Emphasis is given to recently observed eruptions in Hawaii, including time-lapse flow movement over a perspective terrain model provided by V. Realmuto (pers.

comm., 2006). Perspective and overhead views, as well as fly-over/-around video clips from GoogleEarth™ are included for enhanced visualization and student engagement impact (**Figure 4**).

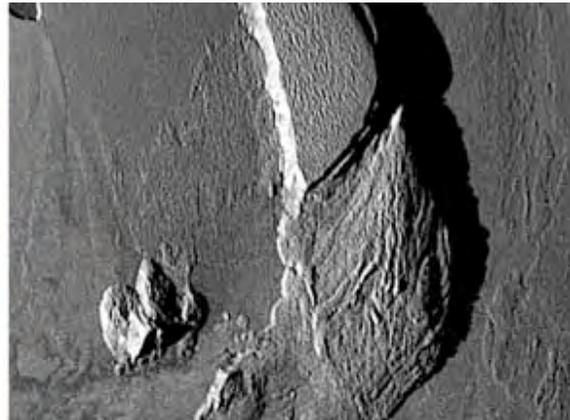
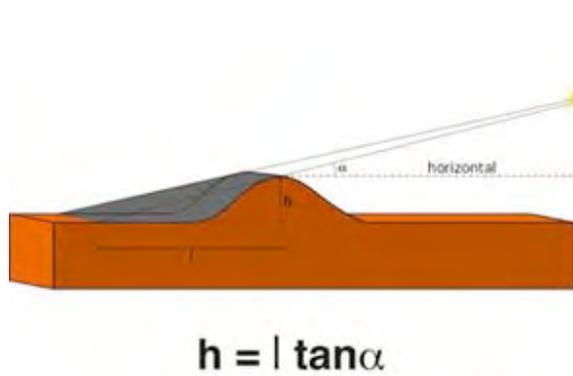


**Figure 1.** *Galileo* SSI image of a red ring of sulfurous pyroclastic material around Io's Pele Patera.

**Field Excursion:** As a companion to the planned half-day exercise and introductory teacher training seminar, a field excursion has been organized to provide teachers with hands-on experience with cinder cone volcanoes, lava flow fields, lava tubes, basaltic flow bases in cross-section, and extensive pyroclastic deposits within a 50-mile radius of Flagstaff, Arizona. This field course will also provide 0.5 credit-hours of continuing education college credit for registered participants through Glendale Community College, via GLG231 – Special Topics in Geology. Participants will complete and submit detailed field journals with photos and descriptions of the volcanic features studied. The field excursion (and the classroom training seminar) will be presented concurrently in both English and Spanish.

This program will provide an overview of the basic volcanic processes and landforms common to Io and Earth, and the data sets and techniques used to study them. It is intended that the multiple data types, as well as the integrated field experience will provide a meaningful and content-rich experience, as well as a user-friendly, ready-made set of tools and resources for

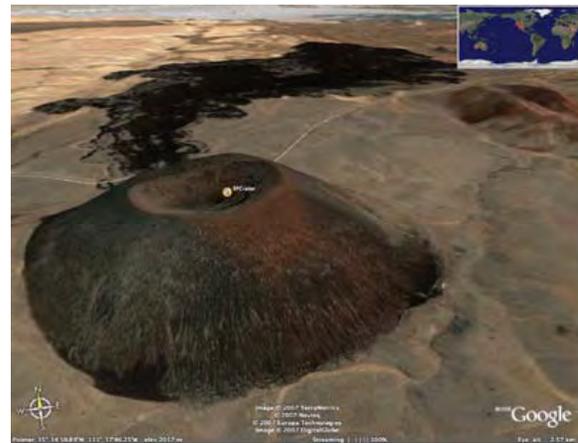
the participating teachers to take back to their respective classrooms.



**Figure 2.** Galileo SSI image of south Hi'aka Montes, which can be used for height determination from shadow lengths.



**Figure 3.** Satellite image of Nyamagura shield volcano, Congo, from GoogleEarth™.



**Figure 4.** Perspective view of SP Crater and lava flow, Arizona, from GoogleEarth™.

**References:** [1] Lopes, R.C.M., and Spencer, J.R., 2006, *Io After Galileo*, Springer/Praxis, Chichester, UK, 342 pp.