Geophysical Research Letters

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Geophysical Research Letters publishes short, concise research letters that are likely to present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community.

Criteria and Submission Data

As GRL is a letters journal, limiting manuscript size expedites the review and publication process. A magazine-sized GRL can reach and be of interest to the largest AGU audience. With this goal, the Editorial Board evaluates manuscripts submitted to GRL according to the following criteria:

- Is it a short, concise research letter?
- Does it contain important scientific advances?
- Would it have immediate impact on the research of others?

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Highlights of this issue

Geophysical Research Letters, 15 December 2003

Special section on Eastern Turkey Seismic Experiment

This issue of *Geophysical Research Letters* features a collection of papers about the Eastern Turkey Seismic Experiment, which was designed to analyze the early stages and consequences from the ongoing continental collision occurring along a major fault line in Turkey. **Sandvol et al. [TUR 1]** summarize the research efforts to study the movements from shifts among three converging tectonic plates in the region over the past 10-20 million years. The seismic models, mapping and geochemistry studies can be used to estimate the lithospheric structure of the Anatolian plateau and to provide better earthquake hazard assessments in the highly active area. Some of the new findings in the papers include a report suggesting that widespread volcanism has changed the interpretation of the Anatolian plateau's depth.

East Anatolian Plateau rests on Earth's hot mantle

New seismic data indicates that the base of the East Anatolian High Plateau, which makes up the peaks and mountains of the Alpine-Himalayan mountain system of Europe and Asia, likely rests on the Earth's hot mantle rather than on the planetary crust. **Sengör et al. [TUR 8]** present data from a network of seismic stations in eastern Turkey that show the average thickness of the lithosphere below the mountain range is approximately 45 kilometers, or nearly 10 kilometers shallower than previously assumed. The findings indicate that there is no lithospheric mantle below the Anatolian complex plateau. The authors estimate that the high temperatures from direct contact with the mantle melted the material that formed the plateau during a tectonic subduction and subsequent continental collision. They further suggest that the elevated mantle temperatures during its post-collision evolution contributed to the rise and eventual remarkable altitude of the mountain range.

Martian basin may lend insight to planet's climate history

A Martian drainage basin with a different type of erosion than normally seen on the planet may indicate the way liquid once flowed on Mars. **Moore et al. [PLA 6]** analyzed the shape and size of presumably liquid-formed channels recently observed in a crater by the Mars Orbiter. Laser altimetry data show deep, river-like features on the surface that, if produced by periodic precipitation similarly as on Earth, would likely take thousands of years to carve. The authors, however, cannot rule out the possibility that the channels resulted from a few shorter episodes of heavy precipitation, perhaps caused by a major impact. They note that their report is consistent with previous studies that proposed that the early Martian climate was dry with brief episodes of warm, wet conditions following meteor impacts.

Possible explanation for phenomenon observed prior to solar storms

A theoretical study that simulates the effects of solar materials as they reach Earth's magnetosphere describes a possible cause for large magnetic fluctuations observed during the onset of a space weather substorm. **Ji and Wolf [SSC 5]** suggest that solar plasma ejected towards Earth can cause a temporary change in the normal incoming magnetic field, resulting in wild fluctuations that have previously been observed in near-Earth space early in the violent space weather phenomenon. The change slows the motion of magnetic waves coming towards Earth and causes a wrinkle of the magnetic field lines, termed a firehose instability, that affects the particle distribution in the region associated with the onset of a solar substorm. The authors conclude that the instabilities, which develop in only a few seconds, can explain the important and puzzling phenomenon.

Gravity waves can affect large-scale circulation patterns

Small-scale waves in the atmosphere and ocean likely have little impact on their large-scale flow, but may be able to significantly affect circulation patterns during unstable transition periods. **Williams et al. [ASC 3]** analyzed the effects of spontaneously generated gravity waves on global flow patterns. The authors note that the ubiquitous waves' interactions with larger atmospheric and oceanic patterns are usually inconsequential because of their small amplitude and fast speed. However, their study suggests that the waves, sustained by gravitational forces and the Earth's rotations, can play a significant role in determining the large-scale atmospheric and oceanic behavior during transitions between large wave activity. The researchers used both model and laboratory experiments to study the gravity waves' impact on ocean and tropospheric flow and suggest that such data can help refine weather prediction and climate models.

The connection between drought and global warming

Researchers have identified a mechanism that may play a major role in determining whether rainfall increases or decreases in a region because of global warming. **Neelin et al. [CLM 5]** analyzed tropical rainfall changes associated with El Niño variability and suggest that tropospheric warming linked with El Niño or global warming increases the amount of surface moisture contributing to cloud formation. Precipitation then rises as the moisture increases in the center of convective regions where small-scale atmospheric motion lead to cloud formation. The sum of the atmospheric processes leads to reductions in rainfall at the borders of convection zones that are near dryer regions. The authors used a climate model to simulate global warming and note that the mechanism is the leading cause of tropical drought and closely parallels a similar effect that causes El Niño drought areas.

Cover. *A topographic map showing the location of the Eastern Turkey Seismic Experiment (ETSE) that took place from October 1999 to August 2001. Each triangle shows the location of each broadband three component station in the network. The ETSE network spanned three different tectonic plates: the Arabian, Anatolian, and Eurasian.* See Sandvol et al. [TUR 1].

First tropical warm rain estimates could improve global climate models

Warm rain accounts for most of the precipitation in warm climates like the tropics, according to a new paper that breaks down the type of rainfall in the tropical zones. **Lau and Wu [CLM 7]** present microwave images and radar data from the Tropical Rainfall Measuring Mission and found for the first time that approximately 72 percent of the total rain area and 31 percent of the total rain amount in the tropics comes from warm rain. Previously, there were no reliable estimates for the amount of warm rain, or rainfall derived from non-ice water droplets in mid- and low-level clouds. The authors also measured the relationship between liquid water in a cloud and the rain rate, which is used in climate models to represent convection cycles and their role in global warming. Warm rain is important in regulating the tropical water cycle, including potentially changing the amount of high clouds that produce cold rain and upper-level cloudiness in tropical and subtropical areas.

Amazon discharge drives tropical Atlantic carbon sink

Data obtained from a German research vessel in the tropical Atlantic Ocean revealed the strong impact of the Amazon River discharge on the region's carbon balance. Körtzinger [OCE 8] found that the Amazon's average discharge of approximately 200,000 cubic meters of river water per second gives rise to a marked carbon dioxide sink in the open ocean that can be traced thousands of kilometers away from the coast. The finding is in contrast to typical surface waters in the tropical Atlantic, which act as sources of atmospheric CO_2. Kortzinger's research provides a biological and hydrochemical explanation for the change from highly CO_2-supersaturated Amazon River water to markedly CO_2-undersaturated plume water in the open ocean.