• How can we better quantify thermal structures of SZs?
• What are the mass and energy fluxes in arcs, and how do they influence arc structure and evolution?
• How can we differentiate steady state processes from transient events in SZs, and how are these related to tectonic forcing functions?
• What is the composition of the mantle wedge, how does it melt, and what does it produce?
• What are the effects of the 'crustal filter' in modifying mantle magmatic inputs and/or in producing the observed compositional spectrum of arc magmas?
• How does the slab impart its signal (chemical/physical) to arc systems?
• How can we reconcile the disparate time scales implied by U-Th series radioisotopes?
• How can we better constrain the systematics and effects of degassing in the crust?
• What drives crystallization and degassing in magmas?

In Conclusion

Complex variations within and between volcanic arcs are products of the inherent variability in composition and history of the slab, wedge, and crustal reservoirs involved. Depending on experience and perspective, one may see different parts of the anecdotal elephant.

Conferences like SOTA increase communication and integrate expertise among many disparate specialists that may lead to a "unifying theory" to bring all these parts into common focus and eventually serve as a useful predictive tool.

Details of the conference, a participant list, and submitted abstracts are available at http://www.ruf.rice.edu/~leeman/SOTA2003/info.html. In the next year, a compilation of thematic papers submitted by conference participants will be published as a special volume of the *Journal of Volcanology and Geothermal Research*.

The SOTA meeting was held 16–21 August 2003.

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FORUM

Comment on "Can Slow Variations in Solar Luminosity Provide Missing Link between the Sun and Climate?"

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Peter Foukal (*Eos*, 3 June 2003) has written an interesting and informative article on solar luminosity and climate. He mentions recent evidence correlating solar activity to climate changes during the last millennium and the last Ice Age and discusses possible mechanisms. He also presents the case for the importance of determining the correlation between solar variation and climate.

Foukal's discussion is mainly about "slow variations," which appears to mean centennial-to-millennial time scales. However, in the "Future Direction" section, he discusses the desirability of the determination of the "climate sensitivity to the small irradiance changes so far observed [1979 to present]."

I wish to point out that this has already been done. *Douglass and Clader* [2002], using the same irradiance data I shown in Figure 1 of Foukal's paper and the temperature anomaly data *T* of *Christy et al*. [2000], have determined the solar sensitivity k to be $k = CT/CI = 0.10 K/(W/m^2)$. This is for the range 1979 to present, and thus is only for decadal time scales. Whether or not this is true for centennial or longer time scales is less certain. However, *Douglass and Clader* point out that studies of T versus I by *White et al*. [1997] (range: 1955–1994) and *Lean and Rind* [1998] (range: 1610–1800) yield values of k close to this value. In addition, *Douglass and Clader* state that if this sensitivity can be assumed on centennial scales, then "we calculate 0.2°C surface warming over the last 100 years."

Foukal also discusses *The Case of the Missing Amplitude*, where he suggests that "the models are underestimating the climate sensitivity to I by a factor of 3 to 5." He does not say which models or what data. The *Douglass and Clader* result, however, shows a gain g of ~2 when compared to a no-feedback radiation model. Although a gain greater than one is expected from a feedback mechanism based on water vapor, *White et al*. [2003] have proposed an alternate scenario, whereby a coupling to El Niño on decadal time scales would also give a gain greater than one.

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Reply: Evaluation of Climate Sensitivity to Solar Influences Is an Important Goal

PAGES 532–533

The detection of an 11-year global temperature signal by Douglass and Clader, and in other studies cited by David Douglass in his letter, is an important achievement. However, these studies assume that the driver is the measured 11-year variation in total solar irradiance. They do not attempt to estimate the possible contributions of the equally well-measured 11-year variations in solar ultraviolet flux, and in solar modulation of galactic cosmic rays. Both of these variable solar influences are under study as possible drivers of 11-year global temperature variation [e.g., *Haigh*, 1996; *Svensmark and Friis-Christensen*, 1997].

These suggested mechanisms operate differently from the direct coupling of total irradiance to climate. So it may be premature to claim that the sensitivity to total irradiance has been measured. Also, to the extent that the sign of possible climate influences from solar UV [e.g., *Shindell et al.*, 1999] and plasma output variations remains model-dependent, it seems uncertain in what sense the reported sensitivities represent limits.

Progress in this interpretation may come from comparison of the spatial fingerprints of the 11-year temperature variations [e.g., *Gleisner and Thejll*, 2003] expected for the different drivers; comparison of the different time behavior of the total and UV irradiances [e.g., *Foukal*, 2002], and of the plasma outputs, may also be useful.

Regarding Douglass' second point, perhaps my *Eos* article didn't emphasize enough that