

## Review of ESSD

Authors describe use of 'coordinated' model (CoSEB) to understand surface energy and heat budgets. Their paper presents reasons that (many?) others might do likewise.

Two reviewers offered good thoughtful comments, including substantive suggestions and concerns. Authors responded in detail, including by revising perview and re-running some calculations. This reviewer considers that authors have made useful appropriate response. Authors now present a well-written well-organized manuscript. Data prove easy to access and to use.

I raise general questions, focused more on impact and utility. Topical editor will need to decide based on these comments

Their product covers, unfortunately, northern hemisphere land. Admittedly we can't escape land only. But, without Australia, we would basically have no data from southern hemisphere. Not in any way the fault of these authors, but they do need to admit up front these limitations. Do we miss significant ecosystems or soil types from South America or South Africa?

This reader remains confused about how CoSEB assures surface energy or surface heat budgets close to 'zero'. Authors state this closure multiple times as a positive feature. I suppose multiple internal calculations and iterations must assure this result, and I applaud their 'clean' outcome, but what artificial corrections will we have introduced or accepted to ensure this outcome? I doubt that we know (can measure) LE or RN to that accuracy? But the model can do it? What happens seasonally, as ecosystems burn or migrate, or as one feature or multiple features change? CoSEB always ensures zero net offset? I appreciate what we might gain. What might we lose?

The standard deviations in time series (Fig 14) give me pause. All high! Very high. Hard to tell exactly, but CoSEB seems no better than any individual or cumulative product. So what have we lost or gained? If no product shows significant trends, why have we made such effort? If no product show significant change with time, over 20 years, we do not track relevant features? We all know that global atmospheric CO<sub>2</sub> rises significantly over that time. Likewise atmospheric temperature. But none of these 'measured' fluxes? Land static, everything driven by ocean?

I likewise doubt differences between coordinated (CoSEB) and uncoordinated analyses. In Figs 3 vs 4, considering  $r^2$ , CoSEB shows no significant differences to uncoordinated RF analyses. If true, why do authors and readers need to spend additional time comparing validations or imaging geographic differences?

I emphasize: I like coordinated integrated approach! I respect authors skill in pulling this together. I worry - and authors can correct - that we might oversell.