

Review of “Quantum Data Assimilation: A New Approach to Solve Data Assimilation on Quantum Annealers” by S. Kotsuki, F. Kawasaki, and M. Ohashi.

General comments:

This manuscript proposes a novel approach named quantum data assimilation and claims that execution time is reduced significantly with the D-Wave System’s physical quantum annealing machine. In my opinion, this work is valuable, combining data assimilation and quantum computation. However, several problems prevent me from recommending the manuscript for publication in its present form.

Specific comments:

- (1) In this manuscript, the introduction to data assimilation methods and quantum computation, especially the quantum annealers, is a little brief. Some essential references should be also included.
- (2) In line 54 of the manuscript, the authors explain briefly how to solve the 4D-VAR using the quantum annealers. The authors should elucidate the algorithm in the method section.
- (3) To my knowledge, in quantum computation, quantum states are operated, like $|0\rangle$, $|1\rangle$, $\alpha|1\rangle + \beta|0\rangle$, nor binary variables (0 or 1). So, actually, the algorithm proposed in this work may be not relevant to the quantum computation. The authors need to explain this query clearly.
- (4) Can the proposed method be used for real numerical models (for example the WRF model) and what are the operational difficulties?
- (5) How does the method affect the accuracy of numerical forecasts in the design of numerical experiments? Please provide additional experiments.