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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A scheme for calculating soil moisture content by using routine weather data" *by* K. Z. Shang et al.

Anonymous Referee #1

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A soil moisture calculation scheme was developed by Shang et al. through establishing statistical relationship between soil moisture and routine meteorological measurements in China. By implementing soil moisture from the developed scheme, the authors demonstrated that the dust-storm forecast can be improved in a forecast model.

The method itself should be interesting to fellow scientists who would like to derive soil mositure for various purposes indirectly by utilizing routine meterological measurements that are easier to obtain than soil moisture. But the validation and application part seem to be weak and need further enhancement. A few things should be explained in great detail to make this paper better.

1. Intuitively, ground vegetation cover plays an important role in modulating soil mois-

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ture and also the formation of sand storm. In the derived equation, I didn't see the explicit role of vegetation. Can the authors explain this?

2. The soil moisture scheme is established based upon 79 stations. But the validation is only conducted at 7 stations which seems not very convincing. On the other hand, from the operational point, for sand-storm forecast, I assume spring/early summer soil moisture is very important. Thus, a comparison between calculated soil moisture time series to those of observations are highly desirable.

3. The calculation scheme is for irregular observational points, the authors should explain how the results then were transfered to the regular model grids, e.g., via interpolation etc. Then how such transformation will affect the results.

4. Almost all current numeric models have soil hydrology scheme that will calculate spatial-temporal-varying soil moisture. In addition, there are many land surface schemes too. Then, it would be very interesting to see, compared to some of them (e.g., reanalysis soil moisture or offline model simulated soil moisture), how much improvements this method can produce in estimating soil miosture and forecasting sand-storm in the retrospective sense. A reason for this is that such products (e.g., reanalysis soil moisture) is routinely updated through the assimilation system.

5. Observations are not always handy, while numerical model outputs are easy to get. What's the propect to use model outputs or hybrid forcing (a combination of model outputs and obs.) to derive soil moisture in the scheme instead of using observations only. This may be easier to implement as there is no to worry about missing data or lacking of observations. Also, in a changing climate, the relationship can change too. Using model outputs may help to resolve this problem. Can the authors comment on this aspect?

6. The authors should check the reference in the paper and review the introduction more carefully. E.g, P3, "In most numerical models, soil moisture content in China is treated as a constant ...". This shouldn't be the case. Almost all GCMs, though differing

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in the treatment of land surface hydrology, treat soil moisture as a time-dependent variable. This can be easily seen by looking at the recent IPCC AR4 models. Also P3, "Entin et al., 1999" is not about calculation soil moisture content. Also P3, "But this type needs real-time soil moisture content data of multiple layers as initial values and thus can not be used widely". This is definitely not true. Although true soil moisture initial conditions are hard to obtain, there are many spin-up methods available to reduce if not complete remove the effects of unrealistic initial conditions. P4 Line 2 "This type is good for drought mornitoring and the climatic evaluation of soil moisture, but not so good for daily soil moisture content retrieval". The authors should expain why as not all readers have the necessary background.

7. The application part, when comparing the forecasting result, the authors should explain in more detail of Figure 4 to demonstrate that soil moisture from their scheme help to improve the forecasting.

5. With respect to conclusions part, Conclusion 1 seems ungrounded or at least is not the results of this paper. This has to be done by. e.g., looking at auto-correlation between sm and P. Additional contents are needed to support (3) and (4) [refer 1-5,7].

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7451, 2007.