Replay to Reviewer 2

Clearly, there is a strict analogy between space and time, at least in the case of one-dimensional space. Hence, under the hypothesis of isotropy, analytical methods are to a broad extent equivalent. Typically, time series analysis allows us to analyse spatial structure in terms of auto-correlation functions and generalisation of state-space models. For this particular method of regression in the time and space domain, unlike the methods of kriging and cokriging (Vieira et al., 1983) the assumption of stationarity of observations is not required.

1) Justification of isotropy hypothesis for \( \theta \) and \( h \) series of our experiment

In the isotropic case the structure of series in question is usually very straightforward and can be approximated by an AR(1) given by \( Z_t = \phi Z_{t-1} + \omega_t \), or in the anisotropic case, by a SAR(1) model given by \( Z_t = \phi_1 Z_{t-1} + \phi_2 Z_{t-1} + \omega_t \).

We will show by means of calculation reported below that if \( \phi_1 = \phi_2 \) then the SAR(1) reduces to the AR(1) model.

Model estimation (\( \theta_3 \) serie)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.085814</td>
<td>0.041861</td>
<td>2.049984</td>
<td>0.0462</td>
</tr>
<tr>
<td>( \theta_3 )(-1)</td>
<td>0.395646</td>
<td>0.140920</td>
<td>2.807588</td>
<td>0.0074</td>
</tr>
<tr>
<td>( \theta_3 )(1)</td>
<td>0.353370</td>
<td>0.148806</td>
<td>2.374701</td>
<td>0.0219</td>
</tr>
</tbody>
</table>

R-squared 0.456772
Adjusted R-squared 0.432628
S.E. of regression 0.014369
Sum squared resid 0.009291
Log likelihood 137.0889

F-statistic 18.91907
Prob(F-statistic) 0.000001

Figure 1a: signal and noise for \( \theta \); 1b: 95% confidence region of \( \phi_1 \) and \( \phi_2 \) parameters.
Model estimation (h serie)

Dependent Variable: h₃
Method: Least Squares
Date: 12/11/10   Time: 11:34
Sample (adjusted): 2 49
Included observations: 48 after adjustments

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>29088.27</td>
<td>12629.00</td>
<td>2.303292</td>
<td>0.0259</td>
</tr>
<tr>
<td>h₃(-1)</td>
<td>0.331742</td>
<td>0.134150</td>
<td>2.472924</td>
<td>0.0172</td>
</tr>
<tr>
<td>h₃(1)</td>
<td>0.317556</td>
<td>0.137405</td>
<td>2.311101</td>
<td>0.0255</td>
</tr>
</tbody>
</table>

R-squared 0.290757    Mean dependent var 83018.23
Adjusted R-squared 0.259235    S.D. dependent var 10382.31
S.E. of regression 3.59E+09    Akaike info criterion 21.09398
Sum squared resid 3.59E+09    Schwarz criterion 21.21093
Log likelihood -503.2556    Hannan-Quinn criter. 21.13818
F-statistic 9.223967    Durbin-Watson stat 2.748824
Prob(F-statistic) 0.000439

![Graph](image)

Figure 2a: signal and noise for h serie, 2b: 95% confidence region for f₁ and f₂ parameters.

We note from the tables and figures reported, that the estimated \( \phi_1 \) and \( \phi_2 \) parameters are statistically identical. This implies that the soil water status measured in our experiment, in terms of volumetric moisture content \( \theta \) and soil water potential \( h \), has an isotropic distribution and therefore SAR and SARMA models reduce to AR and ARMA models on the transect which can be analyzed by means of typical statistical analysis of the time series.

2) Bivariate analysis
Consistent with the objective of analyzing the parameters in question has a bivariate dynamic system and statistically modelling their intrinsic variability in space, attempts will be made to verify once again the usefulness of the multivariate approach based on the use of the state-space models. In our case soil water status under transient condition (drainage without evaporation) can be described with sufficient accuracy by suitable resolution of space mesh along the examined transects. Both used sensor (TDR and tensiometer) cannot be placed to closer distance (<30 cm) due to interference. However is useful to remember that soil water potential \( h \) is a continuous function in the flow field.

Best regards the Authors