

Guidelines for Authors

Preparation of Manuscripts

1. General

Papers for *Accuracy 2004: The 6th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences* and *TIES 2004: The 15th Conference of The International Environmental Metrics Society* will be published electronically and available at the symposium on CDs, rather than printed in hard copy. The entire proceedings will then be posted on a web site so they can be read by an internet browser. This format will reduce costs, extend the manuscript submission deadline giving authors more time, and make the proceedings available to a much broader audience. Readers can then print those articles in which they have a specific interest. We will still want authors to prepare their manuscripts in a prescribed format, however, for consistency of appearance. To have the complete CDs available at the symposium, we will have to meet strict—but not as close—deadlines. Properly formatted manuscripts must be received by Todd Mowrer, symposium co-chair, by April 1.

The following guidelines and attached sample should make manuscript preparation and electronic submission relatively easy. Please e-mail a PDF file to Todd at the Rocky Mountain Research Station: tmowrer@fs.fed.us. For more information on the symposium proceedings, e-mail or call Todd in the United States at (970)498-1255. If you still have questions on manuscript preparation after reading the following guidelines, contact Connie Lemos (Visual Information Specialist at the Rocky Mountain Research Station) in the United States at (970)498-1397.

2. Manuscript

Manuscripts must be composed on a computer using Times-Roman or similar font (Times, Times-New Roman, Dutch, Toronto, Palatino, or Palm Springs) so that pages look like the attached sample. Text and illustrations should fill a space 6-½" by 9-½" (16.5 cm by 24 cm). Although outer page size and margins are not really relevant to the final electronic product, the following margin specifications may be helpful in setting up the page format for an 8-½" by 11" (21.5 cm by 28 cm) page: All margins—top, bottom, left, and right—should be ¾" (2 cm). Submit a single PDF document of your paper, which will be copied to the proceedings CD and posted on the web. If you cannot produce a PDF, then submit a single Word document of your paper or a folder that contains the various components of your manuscript. These documents can be copied to the symposium CD, but the difficulties associated with converting them to a PDF format may prevent us from posting them on the web.

To accommodate CD capacity limitations, keep your manuscript within 8 pages, or about 10 megabytes, including figures, tables, and references. The author is responsible for clearance of the manuscript through his or her organization, and for obtaining any necessary clearances for using copyrighted material.

2.1 Format

2.1.1 Title of Paper

Type the title of your paper in 16-point bold type, centered on the page, in capital and lowercase letters. Center author names, affiliations, and addresses under the title in 12-point bold (see attached sample).

2.1.2 Abstract

Include a one-paragraph abstract of not more than 200 words at the beginning of the paper. It should summarize the content and significance of the paper. Type the abstract, and all subsequent text, in 11-point type with 2-point leading, right and left justified.

2.1.3 Headings

Type all headings in 12-point type, upper and lower case, using numbers and decimals (as in these instructions and the attached sample) to indicate heading weight.

2.1.4 Text

Type body text in 11-point type, with 2-point leading. Justify left and right margins. Do not indent the first line of a paragraph, but leave a half-space between paragraphs. Leave a full space between text and the following heading.

2.1.5 Footnotes

Mark footnotes in the text numerically throughout the manuscript using superscript type. Place footnotes at the bottom of the page. Type them in 8-point italic type with a 2" (5 cm) ruling line above. Maintain a ¾" (2 cm) margin at the bottom of the page.

2.1.6 References

List bibliographic references alphabetically at the end of the paper. Each reference should follow this sequence: Author's name as it appears on the publication, last name first; year of publication; title of referenced material; name of book and publisher, or name of journal, volume (number), and inclusive pages. Type citations in text font, but indent the first line 3 spaces. When citing references in text, use "Jones and Smith (2003) reported..." or "...(Jones and Smith 2003)."

2.1.7 Equations, Symbols, and Abbreviations

Each equation should be numbered and referred to in text as "equation 1" and so on. Enclose the number in parentheses and place it flush right, as in the attached example. Use standard symbols and abbreviations.

3. Figures and Tables

Refer to all graphs, drawings, and photos as "figures." Refer to them in text as "figure 1" and so on, numbered consecutively throughout the manuscript. Refer to tables as "table 1" and so on, also numbered consecutively throughout the manuscript.

3.1 Graphs and Line Drawings

Embed figures electronically within the text. Type captions below the figure in bold 10-point italic. Capitalize the first word and proper nouns only. Place figures as close to text reference as possible, preferably at the top or bottom of the page.

3.2 Photographs

Embed photographs in the text electronically. Since the proceedings will not be printed, color can be used, within the constraints of CD capacity.

3.3 Tables

Refer to tables in text as "table 1" and so on. Locate tables as close to their text reference as possible, preferably at the top or bottom of the page, and number them consecutively throughout the manuscript. Type the table title in 11-point type (those in the example are too small). Capitalize the first word and proper nouns only. Use three horizontal ruling lines in a table: above the column headings, below the column headings, and at the end of the table (before any footnotes).

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Identification of Appropriate Spatial and Temporal Resolution in Integrated Systems

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Keywords: decision support, resolution, aggregation, environmental modelling, spatio-temporal uncertainty

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Abstract

A common problem faced during the design of an integrated system model is how to select the appropriate spatial resolution and time step for each submodel. The general tendency is that scientists model processes as accurately as possible. This can lead to unnecessary system complexity, which complicates the interpretation of the model results, reduces computational efficiency, and makes the design a matter of arbitrary choices. Therefore, a different approach is suggested in this paper. An approximate model is used to represent a subsystem. Sensitivity analyses and uncertainty analyses (*Morgan and Henrion, 1993*) are then conducted to determine the influence of spatial and temporal resolution on the decision variables. Based on the results a first estimate can be made for the appropriate cell size and time step for the subsystem. The impact of suspended sediment on coral reefs serves as case example.

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1. Introduction

The RAMCO model (*Uljee, Engelen, and White, 1996*) is a prototype decision-support system for coastal-zone management. The model is based on field research conducted in Southwest Sulawesi, Indonesia. A raster-based GIS is combined with a system dynamics model to allow local decision makers to examine the consequences of different management strategies under various scenarios. For each process a choice had to be made for the spatial and temporal resolution. A cell size or time step based on a disciplinary point of view is not necessarily appropriate if the function of the submodel for the integrated system is taken into account. For example, variations produced by an accurate model do not affect the system output if connected models have a strong damping effect. Such a system model shows a lack of *internal consistency*. In practice the spatio-temporal resolution is based on intuition and the availability of models and data, rather than a sound scientific methodology. As a consequence the design of the system becomes an art rather than a science. The suggestion made here is to use internal consistency as a design principle for integrated systems. This means that the appropriate time step and spatial resolution for each process are estimated prior to the selection of definitive models that are to be incorporated in the system.

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One of the processes described by the RaMCo model is the influence of catchment sediment runoff on nearcoast coral reefs (Figure 1). Coral reefs are affected by excessive levels of suspended sediment in the water column (*Rogers, 1990*). Different time scales can be used for the rainfall-runoff model ranging from hours to months or years. In general peak

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3. Spatio-temporal scaling

A choice must be made for the scaling of the time step and spatial resolution in order to assess the influence on the behaviour of the coupled system. If the source discharge $Q(t)$ is given for N consecutive time intervals $\Delta t = \Delta T / N$ the dose-response function can be written in the form:

$$F = f(S_y(t_1)) \cdots f(S_y(t_N)) \quad (4)$$

because of the linearity of (1). In (4) the dose-response function $f(S)$ corresponds to a time step $\Delta t \ll \Delta T$. As spatial scaling rule we assume that

$$f(S_y(t)) = F(S_y(t))^{1/N} \quad (5)$$

where $S_y(t)$ depends on $Q(t)$. The source discharge for time step Δt is obtained from the hourly source discharge by taking the time average

$$Q_{\Delta t}(t) = \frac{1}{\Delta t} \sum_{t-\Delta t/2}^{t+\Delta t/2} Q_0(t) \quad (6)$$

To account for changes in the spatial resolution Δx we use the average over the reference cells of size Δx_0 :

$$S_y(\Delta x) = K^{-2} \sum_{i,j}^K S_{i,j}(\Delta x_0) \quad K = \Delta x / \Delta x_0 \quad (7)$$

4. Results

Six values of the spatial resolution in the range 10-500 m and the time step in the range of 1-500 hours were used to calculate the average fraction of living coral cover after one month (Figure 2).

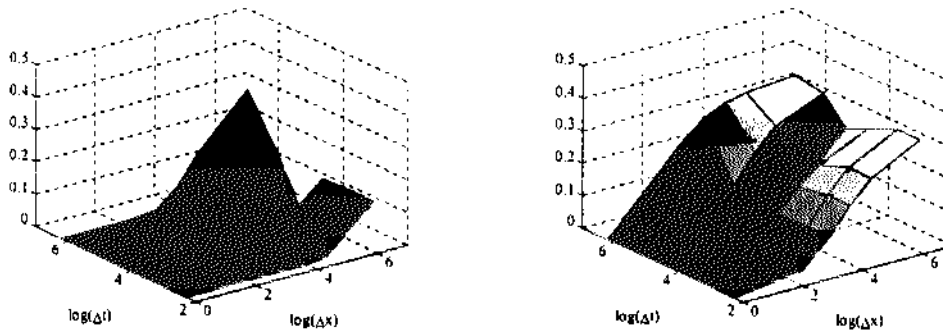


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Figure 2. Sensitivity analysis. Influence of spatial resolution and time step on average coral cover of the reef for $S_0 = 300 \text{ mg l}^{-1}$ (left) and $S_0 = 500 \text{ mg l}^{-1}$ (right).

Figure 2 clearly shows the sensitivity of the reef condition for changes in the dose-response function. A region in the spatio-temporal resolution can be identified, where further reductions of time step and cell size do not affect the model outcome, and refinements of the runoff and sediment discharge models become obsolete. Figure 3 shows the uncertainty in the model outcomes if the shape parameters α and S_0 are drawn from a normal distribution.

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is rather liberal, therefore it is assumed that $P(Conv) = 0.75$. The user accuracy and probability of commission error of interpreted December 1991 imagery (ploughing) are assumed $P(Plough | Evd) = 0.88$ and $P(Plough | \overline{Evd}) = 0.08$, respectively.

Table 1. Abbreviations and notations for case 1.

Notation	Meaning
<i>Ara</i>	An agricultural parcel is deemed to be 'eligible arable land' for subsidy purposes because of its land use on December 31, 1991
<i>Conv</i>	Permanent grassland was actually converted to arable land around winter 1991/92
<i>Evd</i>	Unconfirmed evidence is found for ploughing before 31 December 1991
<i>Plough</i>	Grassland was actually ploughed before 31 December 1991
<i>b</i>	Expected benefit for the National Administration (NA) in the case where an application for subsidy for a non-eligible parcel is sanctioned
<i>d</i>	Expected damage to the NA in the case where a truly eligible parcel is sanctioned

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3.3 Results Case 1

The results listed in Table 2 and visualised in Figure 2 were obtained from Eqs. (1-3) after some elementary calculation of probability. The labels 'never sanction' and 'always sanction' indicate zones where a decision can be made irrespective of the results from the December 1991 imagery. Obviously, the NA should decide not to use additional imagery if the $b : d$ ratio falls within either zone ($EVOI = 0$). Otherwise, the NA should use December 1991 imagery only if the costs of additional analysis (including imagery) per parcel are less than the $EVOI$ indicated by the contour lines of Figure 2.

Table 2. Decision boundaries, and the NA's decisions and expectations.

Condition	December 1991 image used		December 1991 image not used		EVOI
	Decision	$E(V)_{yes}$	Decision	$E(V)_{no}$	
$b > 0.043d$	no sanction	$-0.63b$	no sanction	$-0.63b$	0
$0.043d < b < 0.30d$	$\left\{ \begin{array}{l} \text{sanction if } \overline{Evd} \\ \text{no sanction else} \end{array} \right.$	$\left\{ \begin{array}{l} 0.54b - \\ 0.051d \end{array} \right.$	no sanction	$-0.63b$	$\left\{ \begin{array}{l} 1.16b - \\ 0.051d \end{array} \right.$
$0.30d < b < 3.67d$	$\left\{ \begin{array}{l} \text{sanction if } \overline{Evd} \\ \text{no sanction else} \end{array} \right.$	$\left\{ \begin{array}{l} 0.54b - \\ 0.051d \end{array} \right.$	sanction	$\left\{ \begin{array}{l} 0.63b - \\ 0.38d \end{array} \right.$	$\left\{ \begin{array}{l} 0.32d - \\ 0.09b \end{array} \right.$
$b > 3.67d$	sanction	$\left\{ \begin{array}{l} 0.63b - \\ 0.38d \end{array} \right.$	sanction	$\left\{ \begin{array}{l} 0.63b - \\ 0.38d \end{array} \right.$	0

ACKNOWLEDGEMENTS

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