

# A comparison of open source solutions for storing large spatial-temporal geographic datasets

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## ABSTRACT

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Keywords: Spatial-temporal, GIS, database, raster analysis

## INTRODUCTION

Your introduction goes here! Some examples of commonly used commands and features are listed below, to help you get started.

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Those dynamics can be investigated using time-series of land-cover/land-use change obtained from remote sensing. This has been successfully employed to detect small-scale forest disturbances and degradation (Huang et al. 2010; DeVries et al. 2015), woody vegetation encroachment on pasture (Rufin et al. 2015), phenological mapping crop-land abandonment and fallow periods (Estel et al. 2015) or classifying land-use transitions (Zhu and Woodcock 2014). To assess the habitat stability of a site the occurrence, frequency and magnitude of natural and anthropogenic sources of disturbances could be investigated (Manning et al. 2009; Müller et al. 2014; Watson et al. 2014). This could be for instance fire, logging, selective and clear-cut harvests, flooding or drought events, plowing or grazing pressure on land. These disturbance events can be investigated in case-by-case studies or as defining properties of the stability of a habitat. They can help to reconstruct the (short-term) history of a landscape (Ewers et al. 2013),

## About PeerJ

Difficulties is that spatial-temporal data has 4 dimensions

make figure of different ways for storage (time-voxel, simple table)

Although proprietary solutions for storing spatial-temporal raster dataset exists such as ... - we will focus explicitly on solutions that are freely available, reproducible and might find application in small to medium size research settings.

We will also focus on comparably small settings such for small-medium scientific or business settings, recognizing that larger solutions for clusters might exist (Cary et al., 2009)

In this paper current methods and their individual shortcoming and merits of storing spatial-temporal raster images with open-source products is discussed. Furthermore we will test and evaluate the individual methods in the light of speed, storage efficiency and ease of management.

We identify four main purposes of establishing a database system - which are management, storage, query and subset modularity (as expansion of data and functions) and

## SOME L<sup>A</sup>T<sub>E</sub>X EXAMPLES

Use section and subsection commands to organize your document. L<sup>A</sup>T<sub>E</sub>X handles all the formatting and numbering automatically. Use ref and label commands for cross-references.

because hardware speed is relative and subject to computational power we will make the comparison as being relative to a simple on-disk storage of files. Obviously some RIO speeds might also change depending on improvements in code

Idea: Store only change of pixels in a temporal fashion. Baseline complete, then only change Likely only practicable for classified rasters Define temporal resolution in advance, then write association if change happened maybe store the change in a formula

comparison between database types

### Figures and Tables

Use the table and tabular commands for basic tables — see Table 1, for example. You can upload a figure (JPEG, PNG or PDF) using the project menu. To include it in your document, use the includegraphics command as in the code for Figure 1 below.

spatiallite only stores numbers, but not date types

**Figure 1.** An example image.

Item	Quantity
Widgets	42
Gadgets	13

**Table 1.** An example table.

### Citations

LaTeX formats citations and references automatically using the bibliography records in your .bib file, which you can edit via the project menu. Use the cite command for an inline citation, like Figueredo and Wolf (2009), and the citep command for a citation in parentheses (Figueredo and Wolf, 2009).

### Mathematics

L<sup>A</sup>T<sub>E</sub>X is great at typesetting mathematics. Let  $X_1, X_2, \dots, X_n$  be a sequence of independent and identically distributed random variables with  $E[X_i] = \mu$  and  $\text{Var}[X_i] = \sigma^2 < \infty$ , and let

$$S_n = \frac{X_1 + X_2 + \dots + X_n}{n} = \frac{1}{n} \sum_i^n X_i$$

denote their mean. Then as  $n$  approaches infinity, the random variables  $\sqrt{n}(S_n - \mu)$  converge in distribution to a normal  $\mathcal{N}(0, \sigma^2)$ .

### Lists

You can make lists with automatic numbering ...

1. Like this,
2. and like this.

... or bullet points ...

- Like this,
- and like this.

... or with words and descriptions ...

**Word** Definition

**Concept** Explanation

**Idea** Text

We hope you find write $\LaTeX$  useful for your PeerJ submission, and please let us know if you have any feedback. Further examples with dummy text are included in the following pages.

## METHODS

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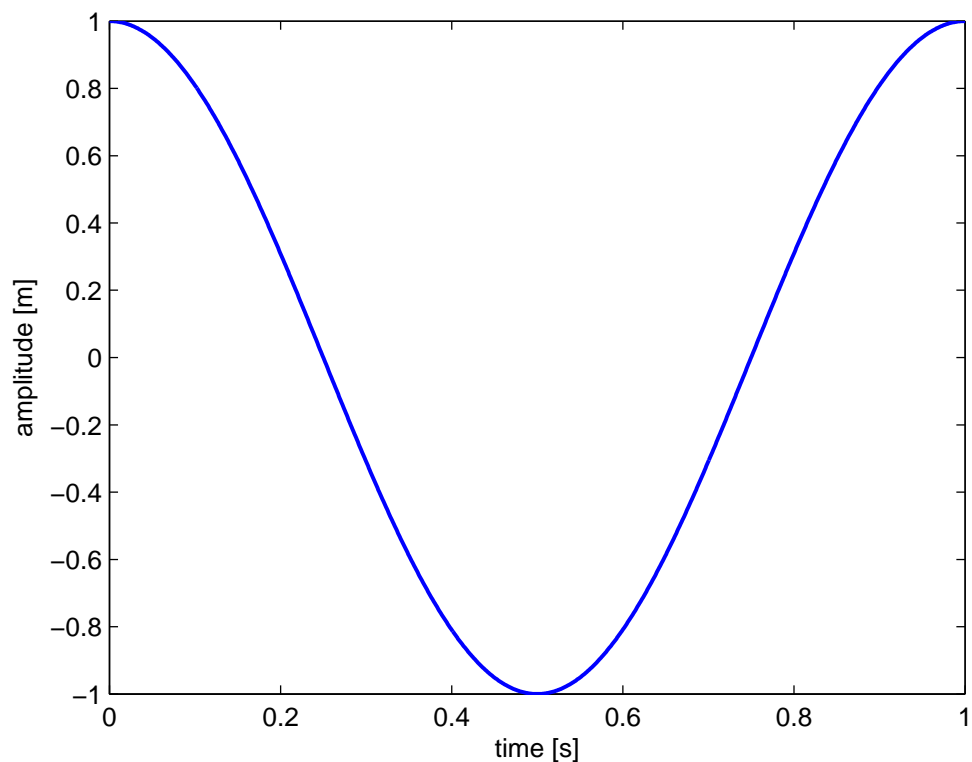
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**Figure 2.** In-text Picture

Reference to Figure 2.

## RESULTS AND DISCUSSION

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## **ACKNOWLEDGMENTS**

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