int != Integer; How choosing the right data type could improve your system's performance

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ABSTRACT.

A fast and highly responsive system doesn't only come from scaling the system horizontally or vertically, but the underlying implementation plays a huge role which is mostly underestimated. int is never the same as Integer, and applying the wrong data type comes with a hidden cost which will impact your system's performance negatively, and the goal of this paper is to show you how choosing the right data type could improve your system's performance.

INT AND INTEGER HISTORY

If you intend to store or read a number, int or Integer data type will be considered. Both might serve the same results for end users, they are meant to be used correctly. int is a primitive data type which has a 32-bit size, meaning you can store or maintain a number not more or lesser than -$2^{32} to 2^{31}$

Inetger is a reference data type that also maintains the same bit size as int, but has an object reference in its memory with the reference pointing to another reference.

Properties^a%	int	Integer
Size	$32 bits$	32 bits
Subclass of Object	No	Yes
Require memory	$<= 32 bits$	64 bits+
Autoboxing	No	Yes
Requires pointer	No	Yes
Comparison operation	==	equals

^{a}Please do not use more than one '´between columns, and note that if a table includes table footnotes, it must be inside a `minipage` environment.

Why Integer requires more memory:

Short answer:

It has additional properties that need to be maintained which requires more memory

Long answer:

1. It's a class

2. All class in Java are a subclass of Object

3. All subclass in Java automatically extends the Object methods and properties

4. For an object to exist,

i. It must be created

ii. For it to be created, it must be store

iii. For it to be stored, it must acquire a memory

iv. For it be be used and referenced elsewhere, it must maintain a properties to determine its uniqueness

v. For it to be unique, its properties must be store into a memory which requires additional memory

HashCode of that object

Header of the objects

```
\title[Short Title]{The Full Title of Your Paper}
\author[Short Authors]{Author 1, Author 2 and Author 3}
```

Lists

The IGS class file provides for numbered (`enumerate`) and unnumbered (`itemize`) lists. Nested lists are not encouraged. The default numbering system is 1., 2., 3., etc.; please do not change this unless there is a good reason. The IGS design removes bullet points from unnumbered lists.

User-defined macros

If possible, please do not define any new macros.

Tables

Tables may be typeset in either one- or two-column format. To typeset two-column format, add asterisks

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Table 1. One-column table captions will extend beyond the rules in two-column format. Do not try to adjust! Table captions do not have full points at the end

Period[a]	Surface elevation change	Emergence velocity
1975−85	−0.50	0.43
1986−2002	−1.03	0.32
Difference	−0.53	−0.11

[a]Please do not use more than one '&' between columns, and note that if a table includes table footnotes, it must be inside a `minipage` environment.

(`\begin{table*}`...`\end{table*}`) as shown in Table 2. We may change the format in-house if necessary. Please avoid the use of colour or shading. Note that if you choose to refer to tables using labels, `\caption` must precede `\label`, as in standard LATEX. Vertical rules are not house-style and will be removed. Note the use of the minipage environment in Table 1 which enables table footnotes to be output. If the table is two-column, use {178mm} instead of {86mm} on line 6. The source code for Tables 1 and 2 is shown immediately below the tables.

FIGURES

Figures may be typeset in either one- or two-column format. One-column format allows up to 86 mm (e.g. Fig. 1); two-column format up to 178 mm (e.g. Fig. 2). Please do not provide original graphics files in which the figure is a great deal larger or smaller than what you envisage will be the final printed size. To typeset two-column format, add asterisks (`\begin{figure*}`...`\end{figure*}`) as shown in Fig. 2. We may change the format in-house if necessary. Please note that if you choose to refer to figures using labels, `\caption` must precede `\label`, as in standard LATEX.

Please send one file for each figure (in other words do not use subfigures) and use a name that clearly identifies it (e.g. '72A712Fig03.eps').

In addition, figures should be eps, ai (illustrator), ps, tif, psd or pdf. Use strong black lines with a width of at least 0.75pt at final printed size (avoid tinting if possible) and SI units in labels. Lettering should ideally be Optima to match the final typeface; Arial or a similar sans serif font for a second choice. Aim to have the final-size lettering at 9pt, if possible. Figures should not be in boxes. The source code for Figs 1 and 2 is shown immediately below the figures.

Equations

We are including some complex equations as examples. Equations should be checked for width by removing the [`review`]

option. Note the use of `cases*` in the following equation:

$$\alpha_{t_2} = \begin{cases} \alpha_{t_1} - a_1[\ln(T+1)]e^{(a_2\sqrt{n})} & n_d > 0 \;\; \text{and} \;\; T > 0 \\ \alpha_{t_1} - a_3 e^{(a_2\sqrt{n})} & n_d > 0 \;\; \text{and} \;\; T < 0 \\ \alpha_{t_1} + a_4 P_s & n_d = 0 \end{cases} \tag{1}$$

Equations should be aligned on the equals signs where possible. Equations that extend beyond the one-column measure should be turned over before an operator.

$$I_c = I_0 \left(\frac{\bar{R}_m}{R}\right)^2 \psi^{\frac{P}{P_0 \cos Z}} \\ \times [\cos\beta \, \cos Z + \sin\beta \, \sin Z \, \cos(\psi_{\text{sun}} - \psi_{\text{slope}})] \tag{2}$$

Typesetting upright Greek characters

Normal greek: `$\alpha\beta\gamma\delta$` $\alpha\beta\gamma\delta$
     Upright greek: `$\upalpha\upbeta\upgamma\updelta$` αβγδ
     Usual partial: `$\partial$` ∂
     Upright partial: `$\uppartial$` ∂

Marginal notes

The IGS class file redefines the LATEX command `\marginpar`. If you wish to add a marginal note such as the one alongside this text, you would key `\marginpar{Editor! Help!}`. Marginal notes will be removed before printing.

References

All citations in text should include the author name(s) and the year of publication (e.g. 'Smith, 2014'; 'Smith and Jones, 2014'; 'Smith and others, 2015') and have an entry in the reference list.

References should:

be short;

be complete and accurate;

be arranged in alphabetical order by first author's surname;

include too much rather than too little information;

include doi numbers where available (note that older bib databases often included doi's in the page field – in which case they may appear after a comma and without braces);

Table 2. Two-column table. Seasonal and annual SAT trends (°C decade^{-1}) in the Arctic

| Area	1951–2005					1976–2005				
	Dec–Feb	Mar–May	Jun–Aug	Sep–Nov	Annual	Dec–Feb	Mar–May	Jun–Aug	Sep–Nov	Annual
Atlantic region	0.09	0.29	0.10	0.09	0.15	0.470	0.60	0.45	0.53	0.59
Siberian region	0.12	0.29	0.04	0.17	0.16	0.08	0.69	0.29	0.59	0.48
Pacific region	0.45	0.46	0.25	0.26	0.35	0.712	1.08	0.27	0.66	0.52
Canadian region	0.16	0.12	0.14	0.30	0.18	0.20	0.52	0.48	0.94	0.53
Baffin Bay region	−0.02	0.10	0.00	0.15	0.02	0.33	0.62	0.51	0.80	0.57
Arctic 1	0.16	0.21	0.12	0.20	0.18	0.36	200.65	0.42	0.74	0.54
Arctic 2	0.22	0.29	0.14	0.14	0.19	0.38	0.60	0.40	0.51	0.45
Arctic 3	0.28	0.31	0.14	0.13	0.21	0.42	40.53	0.41	0.42	0.43
NH (land + ocean)	0.13	0.13	0.10	0.10	0.12	0.27	0.24	0.25	0.25	0.25
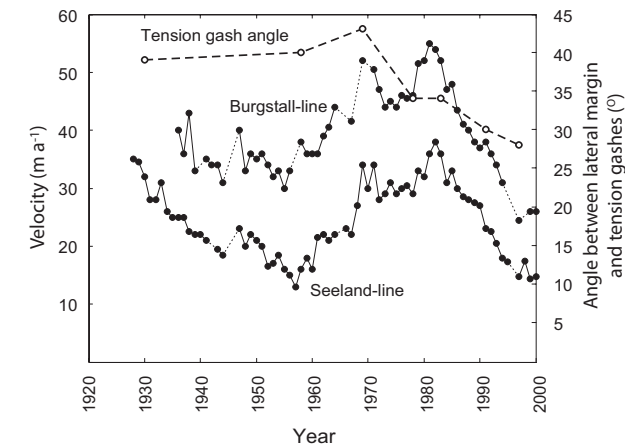
Fig. 1. One-column figures should be ⩽86 mm. Good artwork can make or break a paper. Capitalize the first word of a label and use round not square brackets for units.

include works accepted but not published as 'in press';

not include personal communications, unpublished data or manuscript in preparation or submitted for publication, data published on the web (these should be included in the text).

Automatic references using BibTeX

To generate automatic references from a bib database, you must first specify the database (we are using `igsrefs.bib`) and then the IGS bibliography style by placing the following two commands where you would like the references to appear (normally at the end of your paper, before `\end{document}`:

```
\bibliography{igsrefs}
```

```
\bibliographystyle{igs}
```

Then run through the following steps:

1. Run your paper through LaTeX.

2. Run BibTeX on your paper.

3. Open the newly-created bbl file containing the cited references and copy the entire contents to just below the `bibliography`/`bibliographystyle` commands.

4. Then comment them out:

```
%\bibliography{igsrefs}
%\bibliographystyle{igs}
```

5. Run your paper through LaTeX *twice* more.

The IGS do not need your bib or bbl files. Note that BibTeX will lose the second initial in the entry 'Box JE', for example, if it has been typed as '{J.E.} Box' in the bib file. This is because any text in an entry enclosed in {} will be treated as a single unit, and will not be further parsed. Prof. Box's name will typeset correctly if entered as 'J. E. Box' in the bib file.

If you have cited 16 references from the bib database, e.g. (Rignot and Steffen, 2008), (Rignot and others, 2008), (Motyka and others, 2011), (Morlighem and others, 2010), (Morlighem and others, 2011), (Seroussi and others, 2011), (Yan and others, 2013), (Rogozhina and others, 2012), (Hanna and others, 2013), (Goelzer and others, 2013), (Lucas-Picher and others, 2012), (Edwards and others, 2014), (Gladstone and others, 2010), (Morlighem and others, 2013), (Goldberg and Sergienko, 2011) and (Paterson, 1994), the output will be just those 16 references and they will appear at the end of the article.

Citations using natbib commands   Note that the standard natbib style file has been modified to fall into line with IGS style. The modified style file is called igsnatbib.sty (included in this distribution), and works exactly the same as natbib.sty. The default IGS house style is (Yan and others, 2013). The following combinations are also available – refer to the natbib documentation if you require any further explanation:

(Yan and others, 2013)   \citep{Yan13}
(see Yan and others, 2013, p. 34)
                    \citep[see][p.$\,$34]{Yan13}
(e.g. Yan and others, 2013)\citep[e.g.][]{Yan13}
(Yan and others, 2013, Section 2.3)
                    \citep[Section~2.3]{Yan13}
(Yan and others, 2013; Edwards and others, 2014)
                    \citep{Yan13, Edwards14}
Yan and others (2013); Edwards and others (2014)
                    \cite{Yan13, Edwards14}
Yan and others 2013   \citealt{Yan13}
Yan and others (2013)   \cite{Yan13}
Yan and others, 2013   \citealp{Yan13}
Yan and others   \citeauthor{Yan13}
(2013)   \citeyearpar{Yan13}
2013   \citeyear{Yan13}

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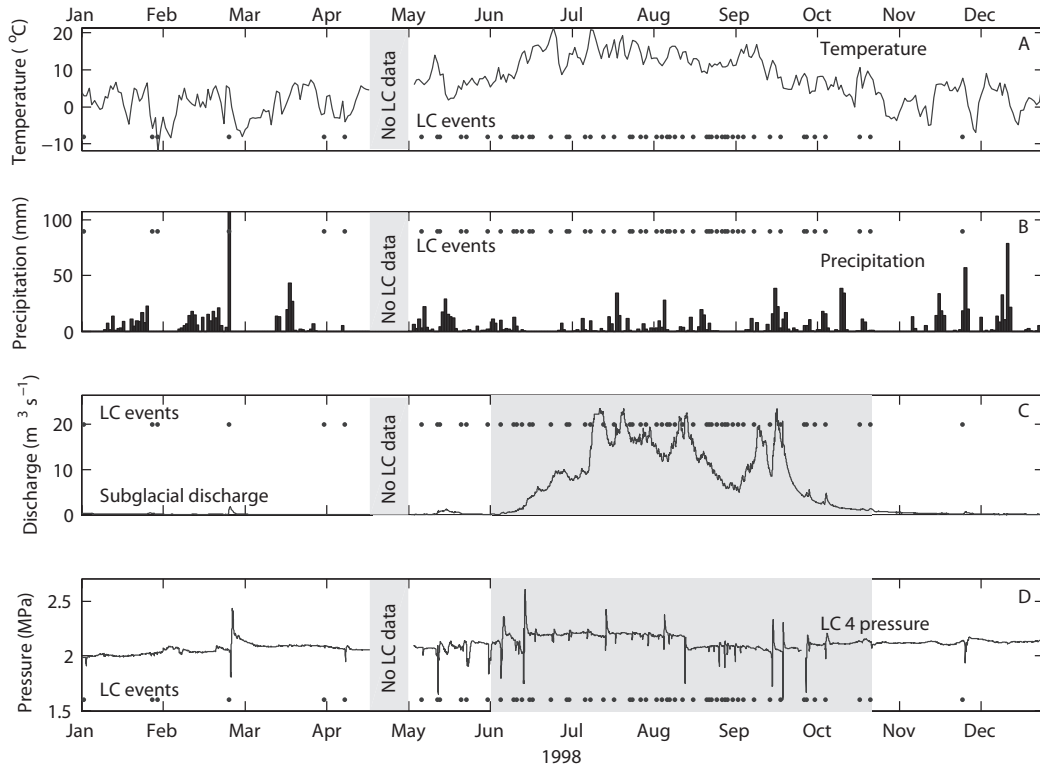
Fig. 2. Two-column figures should be ⩽178 mm. SSA reconstructed components found by projecting the SSA filters found using the whole 2000 traces in Fig. 4, on trace number 1, ordered by magnitude of variance accounted for in the radar trace.

```
\begin{figure*}%fig2, two column
\centering{\includegraphics{72A712Fig02.eps}}
\caption{Two-column figures should be $\leq$178$\,$mm. SSA reconstructed components found by
  projecting the SSA filters found using the whole 2000 traces in Fig.~4, on trace number 1,
  ordered by magnitude of variance accounted for in the radar trace.}
\label{filters}
\end{figure*}
```

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APPENDIX

Start an appendix by typing \appendix\section{Appendix}. Appendices appear after the references. Equation numbers automatically start again with (3).

$$2\eta\kappa\frac{\partial\bar{u}}{\partial t} + \rho_r g\bar{u} + D\kappa^4\bar{u} = \bar{\sigma}_{zz}. \tag{3}$$

HANDLING MORE THAN ONE APPENDIX

Use the following code to achieve heading APPENDIX A followed by APPENDIX B and APPENDIX C, with appropriate equation numbers:

```
\appendix
\section{Appendix A}

\setcounter{equation}{0}
\renewcommand\theequation{B\arabic{equation}}
\section{Appendix B}

\setcounter{equation}{0}
\renewcommand\theequation{C\arabic{equation}}
\section{Appendix C}
```