The \texttt{metsymb} package\footnote{This document corresponds to \texttt{metsymb} v1.2, dated 2022/09/10.}

Frédéric P.A. Vogt
\texttt{frederic.vogt@meteoswiss.ch}

August 30, 2023

\begin{abstract}
This package introduces commands to generate professional meteorological symbols with vectorial quality. As of August 30, 2023, these include: oktas (\texttt{0}, \texttt{1}, \texttt{2}, \ldots), cloud genera (\texttt{-}, \texttt{+}, \texttt{0}, \ldots), and C\textsubscript{L}–C\textsubscript{M}–C\textsubscript{H} cloud codes (\texttt{A}, \texttt{X}, \texttt{Z}, \ldots). This package essentially introduces a new font in which each symbol is assigned to a glyph, which can then be called individually from \LaTeX\ documents via dedicated commands.
\end{abstract}

\tableofcontents

\section{Why \texttt{metsymb} ?}

The creation of this package was motivated by the fact that in 2021, there were no dedicated Unicode elements for \texttt{okta} and \texttt{cloud genera} symbols. To the best of my knowledge, no \LaTeX\ package provides a uniform set of these symbols either\footnote{If you know of one, please let me know and I shall list it here!}.

This package is a direct attempt to remedy to this unfortunate state of affair. Individual symbols are designed using Ti\textsc{k}Z\footnote{\url{https://www.ctan.org/pkg/pgf}}. They are then bundled into a dedicated font with FontForge\footnote{\url{https://fontforge.org/en-US/}}. Individual glyphs of this metsymb font are then tied to dedicated \LaTeX\ commands via this package.
One key element of the metsymb symbols is that they are designed using explicit (mathematical) TikZ commands. This evidently helps to maintain a uniform look between the symbols, but also—and perhaps more importantly—it ensures that each symbol can be faithfully reproduced with different software in the future (should the need arise).

2 Usage

Using the metsymb package is straightforward. By importing it via a not-so-surprising \usepackage{metsymb} in the preamble of your documents, you will gain access to the commands listed in Tables 1 to 3.

Table 1: metsymb commands for the okta symbols.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>\zerookta</td>
</tr>
<tr>
<td>○</td>
<td>\oneokta</td>
</tr>
<tr>
<td>○</td>
<td>\twooktas</td>
</tr>
<tr>
<td>○</td>
<td>\threeoktas</td>
</tr>
<tr>
<td>○</td>
<td>\fouroktas</td>
</tr>
<tr>
<td>□</td>
<td>\fiveoktas</td>
</tr>
<tr>
<td>□</td>
<td>\sixoktas</td>
</tr>
<tr>
<td>□</td>
<td>\sevenoktas</td>
</tr>
<tr>
<td>□</td>
<td>\eightoktas</td>
</tr>
<tr>
<td>□</td>
<td>\nineoktas</td>
</tr>
</tbody>
</table>

Table 2: metsymb commands for the cloud genera symbols.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>\cirrus</td>
</tr>
<tr>
<td>+</td>
<td>\nimbostratus</td>
</tr>
<tr>
<td>+</td>
<td>\cirrostratus</td>
</tr>
<tr>
<td>+</td>
<td>\stratocumulus</td>
</tr>
<tr>
<td>+</td>
<td>\stratus</td>
</tr>
<tr>
<td>+</td>
<td>\altocumulus</td>
</tr>
<tr>
<td>+</td>
<td>\cumulus</td>
</tr>
<tr>
<td>+</td>
<td>\cumulonimbus</td>
</tr>
</tbody>
</table>

Table 3: metsymb commands for the $C_L$, $C_M$, and $C_H$ cloud symbols.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>\clI</td>
</tr>
<tr>
<td>○</td>
<td>\cmI</td>
</tr>
<tr>
<td>○</td>
<td>\chI</td>
</tr>
<tr>
<td>□</td>
<td>\clIII</td>
</tr>
<tr>
<td>□</td>
<td>\cmIII</td>
</tr>
<tr>
<td>□</td>
<td>\chIII</td>
</tr>
<tr>
<td>□</td>
<td>\clIV</td>
</tr>
<tr>
<td>□</td>
<td>\cmIV</td>
</tr>
<tr>
<td>□</td>
<td>\chIV</td>
</tr>
<tr>
<td>□</td>
<td>\clV</td>
</tr>
<tr>
<td>□</td>
<td>\cmV</td>
</tr>
<tr>
<td>□</td>
<td>\chV</td>
</tr>
<tr>
<td>□</td>
<td>\clVI</td>
</tr>
<tr>
<td>□</td>
<td>\cmVI</td>
</tr>
<tr>
<td>□</td>
<td>\chVI</td>
</tr>
<tr>
<td>□</td>
<td>\clVII</td>
</tr>
<tr>
<td>□</td>
<td>\cmVII</td>
</tr>
<tr>
<td>□</td>
<td>\chVII</td>
</tr>
<tr>
<td>□</td>
<td>\clVIII</td>
</tr>
<tr>
<td>□</td>
<td>\cmVIII</td>
</tr>
<tr>
<td>□</td>
<td>\chVIII</td>
</tr>
<tr>
<td>□</td>
<td>\clIX</td>
</tr>
<tr>
<td>□</td>
<td>\cmIX</td>
</tr>
<tr>
<td>□</td>
<td>\chIX</td>
</tr>
</tbody>
</table>
2.1 Using metsymb with matplotlib

metsymb can be used to include meteorological symbols inside Python plots, provided that the use of a system-wide \LaTeX installation is enabled via the setting `text.usetex` in your `rcParams`\(^4\). In fact, the assembly of a dedicated vectorial font to store the metsymb symbols\(^5\) is directly motivated by the fact that matplotlib requires proper font metrics to include symbols in Python plots.

The following minimal working example, stored in `metsymb.mwe.py` inside the metsymb Github repository, illustrates how one can couple metsymb and matplotlib (see Fig. 1 for the result):

```python
# Import matplotlib
from matplotlib import pyplot as plt

# Set the proper rcparams elements
plt.style.use('/metsymb_mwe.mplstyle')

# Create a basic figure with some demo text in the center.
plt.figure(1, figsize=(4, 0.5))
plt.text(0.5, 0.5,
'\texttt{LARGE} Hello World: \texttt{threeoktas\nimbostratus\chIX}',
ha='center')
plt.axis('off')

# Export to different format and display on-screen.
plt.savefig('metsymb_mwe.pdf')
plt.savefig('metsymb_mwe.png')
# plt.show()
```

where `metsymb_mwe.mplstyle` contains:

```
#coding: utf-8

Copyright (C) 2021 MeteoSwiss, originally written by F.P.A. Vogt; frederic.vogt@meteoswiss.ch

This file may be distributed and/or modified under the conditions of the BSD-3-Clause License.
The terms of this license are available at:
https://opensource.org/licenses/BSD-3-Clause

SPDX-License-Identifier: BSD-3-Clause

Module content: minimal working example of the metsymb La\TeX package with matplotlib figures.
```

Figure 1: Result of the `metsymb_mwe.py` demonstration script, illustrating how the metsymb package can be used with matplotlib.

\(^{5}\text{instead of a simpler \TeX approach, for example}\\)
3 Code development and bug reports

The metsymb package is being developed inside a dedicated Github repository under the MeteoSwiss organization, located at: https://github.com/MeteoSwiss/metsymb. User contributions are welcome and will be examined in details. So are bug reports and suggestions for new symbols, which are best submitted as Github Issues directly on the code’s repo at: https://github.com/MeteoSwiss/metsymb/issues

4 License and copyright

The copyright (2021-2023) of metsymb is owned by MeteoSwiss. The code, originally written by Frédéric P.A. Vogt, is released under the terms of the BSD-3-Clause License, available at https://opensource.org/licenses/BSD-3-Clause.

5 Acknowledgments

The following resources proved immensely useful to assemble the first version of this package:

- The FontForge documentation, and in particular the FontForge and TeX article: https://fontforge.org/docs/techref/PfaEdit-TeX.html
- The \TeX font errors: Cheatsheet: https://texdoc.org/serve/tex-font-errors-cheatsheet/

Several StackOverflow users also proved extremely helpful when building metsymb, in particular:

- those that provided clarifications and help in this post, in that post, and in that other post.

Thank you also to jklymak and amentzer.lee from the matplotlib discourse community for their clarifications in this post.

6 Font table

The complete font table for metsymb, generated via the command pdftex testfont with the \sample call, is visible in Fig. 2.

7 Implementation

The metsymb package very simply defines new commands to fetch individual glyphs from the metsymb font. As such, its \LaTeX side is rather simple.

\zeroookta The 0 okta symbol:
1 \newcommand{\zeroookta}{\usefont{U}{metsymb}{m}{n} \char33 }\%

\oneokta The 1 okta symbol:
2 \newcommand{\oneokta}{\usefont{U}{metsymb}{m}{n} \char34 }\%

\twooktas The 2 oktas symbol:
3 \newcommand{\twooktas}{\usefont{U}{metsymb}{m}{n} \char35 }\%
\threeoktas The 3 oktas symbol:
4 \newcommand{\threeoktas}{\usefont{U}{metsymb}{m}{n} \char36}

\fouroktas The 4 oktas symbol:
5 \newcommand{\fouroktas}{\usefont{U}{metsymb}{m}{n} \char37}

\fiveoktas The 5 oktas symbol:
6 \newcommand{\fiveoktas}{\usefont{U}{metsymb}{m}{n} \char38}

\sixoktas The 6 oktas symbol:
7 \newcommand{\sixoktas}{\usefont{U}{metsymb}{m}{n} \char39}

\sevenoktas The 7 oktas symbol:
8 \newcommand{\sevenoktas}{\usefont{U}{metsymb}{m}{n} \char40}

\eightoktas The 8 oktas symbol:
9 \newcommand{\eightoktas}{\usefont{U}{metsymb}{m}{n} \char41}

\nineoktas The 9 oktas symbol:
10 \newcommand{\nineoktas}{\usefont{U}{metsymb}{m}{n} \char42}

\cirrus The cirrus symbol:
11 \newcommand{\cirrus}{\usefont{U}{metsymb}{m}{n} \char43}

\cirrocumulus The cirrocumulus symbol:
12 \newcommand{\cirrocumulus}{\usefont{U}{metsymb}{m}{n} \char44}

\cirrostratus The cirrostratus symbol:
13 \newcommand{\cirrostratus}{\usefont{U}{metsymb}{m}{n} \char45}

\altocumulus The altocumulus symbol:
14 \newcommand{\altocumulus}{\usefont{U}{metsymb}{m}{n} \char46}

\altostratus The altostratus symbol:
15 \newcommand{\altostratus}{\usefont{U}{metsymb}{m}{n} \char47}

\nimbostratus The nimbostratus symbol:
16 \newcommand{\nimbostratus}{\usefont{U}{metsymb}{m}{n} \char48}

\stratocumulus The stratocumulus symbol:
17 \newcommand{\stratocumulus}{\usefont{U}{metsymb}{m}{n} \char49}

\stratus The stratus symbol:
18 \newcommand{\stratus}{\usefont{U}{metsymb}{m}{n} \char50}

\cumulus The cumulus symbol:
19 \newcommand{\cumulus}{\usefont{U}{metsymb}{m}{n} \char51}

\cumulonimbus The cumulonimbus symbol:
20 \newcommand{\cumulonimbus}{\usefont{U}{metsymb}{m}{n} \char52}

\clI The CL = 1 cloud symbol:
21 \newcommand{\clI}{\usefont{U}{metsymb}{m}{n} \char53}
\text{\textbackslash chII} The $C_H = 2$ cloud symbol:
40 \newcommand{\textbackslash chII}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char72 \}}%

\text{\textbackslash chIII} The $C_H = 3$ cloud symbol:
41 \newcommand{\textbackslash chIII}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char73 \}}%

\text{\textbackslash chIV} The $C_H = 4$ cloud symbol:
42 \newcommand{\textbackslash chIV}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char74 \}}%

\text{\textbackslash chV} The $C_H = 5$ cloud symbol:
43 \newcommand{\textbackslash chV}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char75 \}}%

\text{\textbackslash chVI} The $C_H = 6$ cloud symbol:
44 \newcommand{\textbackslash chVI}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char76 \}}%

\text{\textbackslash chVII} The $C_H = 7$ cloud symbol:
45 \newcommand{\textbackslash chVII}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char77 \}}%

\text{\textbackslash chVIII} The $C_H = 8$ cloud symbol:
46 \newcommand{\textbackslash chVIII}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char78 \}}%

\text{\textbackslash chIX} The $C_H = 9$ cloud symbol:
47 \newcommand{\textbackslash chIX}{\{\usefont{U}{metsymb}{m}{n} \textbackslash char79 \}}%
Figure 2: Complete font table for metsymb.