

# Package ‘cubble’

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**Title** A Vector Spatio-Temporal Data Structure for Data Analysis

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**Description** A spatiotemporal data object in a relational data structure to separate the recording of time variant/ invariant variables.

**License** MIT + file LICENSE

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**R topics documented:**

arrange.temporal_cubble_df	2
as_cubble	6
check_key	8
climate_aus	9
covid	10
cubble	11
face_temporal	12
fill_gaps.temporal_cubble_df	13
geom_glyph	14
is_cubble	17
key_vars.cubble_df	18
make_spatial_sf	19
make_temporal_tsibble	19
match_sites	20
print.cubble_df	22
river	22
stations	23
unfold	24
update_cubble	25
[.spatial_cubble_df	25
<b>Index</b>	<b>27</b>

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arrange.temporal\_cubble\_df  
*dplyr methods*

---

**Description**

Verbs supported for both nested and long cubble include: `dplyr::mutate()`, `dplyr::filter()`, `dplyr::arrange()`, `dplyr::select()`, `dplyr::group_by()`, `dplyr::ungroup()`, `dplyr::summarise()`, `dplyr::rename()`, `dplyr::bind_cols()`, `dplyr::rowwise()`, `dplyr::slice_*()`, `dplyr::*_join()`, `dplyr::relocate()`, `dplyr::pull()`

**Usage**

```
## S3 method for class 'temporal_cubble_df'
arrange(.data, ...)
```

```
## S3 method for class 'spatial_cubble_df'
select(.data, ...)
```

```
## S3 method for class 'temporal_cubble_df'
select(.data, ...)
```

```
## S3 method for class 'spatial_cubble_df'
```

```
group_by(.data, ..., .add, .drop)

## S3 method for class 'temporal_cubble_df'
group_by(.data, ..., .add, .drop)

## S3 method for class 'spatial_cubble_df'
ungroup(x, ...)

## S3 method for class 'temporal_cubble_df'
ungroup(x, ...)

## S3 method for class 'spatial_cubble_df'
summarise(.data, ..., .by = NULL, .groups = NULL)

## S3 method for class 'temporal_cubble_df'
summarise(.data, ..., .by = key_vars(.data), .groups = NULL)

## S3 method for class 'spatial_cubble_df'
rename(.data, ...)

## S3 method for class 'temporal_cubble_df'
rename(.data, ...)

bind_rows.temporal_cubble_df(..., .id = NULL)

bind_cols.spatial_cubble_df(..., .name_repair)

bind_cols.temporal_cubble_df(..., .name_repair)

## S3 method for class 'spatial_cubble_df'
rowwise(data, ...)

## S3 method for class 'temporal_cubble_df'
rowwise(data, ...)

## S3 method for class 'cubble_df'
dplyr_col_modify(data, cols)

## S3 method for class 'spatial_cubble_df'
dplyr_row_slice(data, i, ...)

## S3 method for class 'temporal_cubble_df'
dplyr_row_slice(data, i, ...)

## S3 method for class 'spatial_cubble_df'
dplyr_reconstruct(data, template)

## S3 method for class 'temporal_cubble_df'
```

```
dplyr_reconstruct(data, template)

## S3 method for class 'spatial_cubble_df'
mutate(.data, ...)

## S3 method for class 'spatial_cubble_df'
filter(.data, ...)

## S3 method for class 'spatial_cubble_df'
arrange(.data, ...)
```

## Arguments

...	In <code>group_by()</code> , variables or computations to group by. Computations are always done on the ungrouped data frame. To perform computations on the grouped data, you need to use a separate <code>mutate()</code> step before the <code>group_by()</code> . Computations are not allowed in <code>nest_by()</code> . In <code>ungroup()</code> , variables to remove from the grouping.
.add	When FALSE, the default, <code>group_by()</code> will override existing groups. To add to the existing groups, use <code>.add = TRUE</code> . This argument was previously called <code>add</code> , but that prevented creating a new grouping variable called <code>add</code> , and conflicts with our naming conventions.
.drop	Drop groups formed by factor levels that don't appear in the data? The default is TRUE except when <code>.data</code> has been previously grouped with <code>.drop = FALSE</code> . See <a href="#">group_by_drop_default()</a> for details.
x	A <code>tbl()</code>
.by	<b>[Experimental]</b> <tidy-select> Optionally, a selection of columns to group by for just this operation, functioning as an alternative to <code>group_by()</code> . For details and examples, see <a href="#">?dplyr_by</a> .
.groups	<b>[Experimental]</b> Grouping structure of the result. <ul style="list-style-type: none"> <li>"drop_last": dropping the last level of grouping. This was the only supported option before version 1.0.0.</li> <li>"drop": All levels of grouping are dropped.</li> <li>"keep": Same grouping structure as <code>.data</code>.</li> <li>"rowwise": Each row is its own group.</li> </ul>

When `.groups` is not specified, it is chosen based on the number of rows of the results:

- If all the results have 1 row, you get "drop\_last".
- If the number of rows varies, you get "keep" (note that returning a variable number of rows was deprecated in favor of `reframe()`, which also unconditionally drops all levels of grouping).

In addition, a message informs you of that choice, unless the result is ungrouped, the option `"dplyr.summarise.inform"` is set to FALSE, or when `summarise()` is called from a function in a package.

.id	The name of an optional identifier column. Provide a string to create an output column that identifies each input. The column will use names if available, otherwise it will use positions.
.name_repair	One of "unique", "universal", or "check_unique". See <code>vctrs::vec_as_names()</code> for the meaning of these options.
data, .data	a cubble object of class <code>spatial_cubble_df</code> or <code>temporal_cubble_df</code>
cols	A named list used to modify columns. A NULL value should remove an existing column.
i	A numeric or logical vector that indexes the rows of data.
template	Template data frame to use for restoring attributes.

### Details

You may find not all the verbs have a `verb.spatial_cubble_df` or `verb.temporal_cubble_df` implemented. These verbs call the dplyr extending trios: `dplyr_row_slice`, `dplyr_col_modify`, and `dplyr_reconstruct` under the hood. See [https://dplyr.tidyverse.org/reference/dplyr\\_extending.html](https://dplyr.tidyverse.org/reference/dplyr_extending.html)

### Examples

```
library(dplyr)
cb_nested <- climate_mel
cb_long <- face_temporal(climate_mel)

# filter - currently filter.spatial_cubble_df, dply_row_slice
cb_nested %>% filter(elev > 40)
cb_long %>% filter(prcp > 0)

# mutate - currently mutate.spatial_cubble_df, dply_col_modify
cb_nested %>% mutate(elev2 = elev + 10)
cb_long %>% mutate(prcp2 = prcp + 10)

# arrange - currently arrange.spatial_cubble_df, arrange.temporal_cubble_df
cb_nested %>% arrange(wmo_id)
cb_long %>% arrange(prcp)

# summarise - summarise.spatial_cubble_df, summarise.temporal_cubble_df
cb_long %>%
  group_by(first_5 = ifelse(lubridate::day(date) <=5, 1, 2 )) %>%
  summarise(tmax = mean(tmax))
cb_long %>%
  mutate(first_5 = ifelse(lubridate::day(date) <=5, 1, 2)) %>%
  summarise(t = mean(tmax), .by = first_5)

# select - select.spatial_cubble_df, select.temporal_cubble_df
cb_nested %>% select(name)
cb_nested %>% select(-id, -name)
cb_long %>% select(prcp)
cb_long %>% select(-prcp, -date)

# rename - rename.spatial_cubble_df, rename.temporal_cubble_df
```

```

cb_nested %>% rename(elev2 = elev)
cb_long %>% rename(prcp2 = prcp)
# rename on key attributes
cb_nested %>% rename(id2 = id)
cb_long %>% rename(date2 = date)

# join - mutate_join - dplyr_reconstruct()
# join - filter_join - dplyr_row_slice()
df1 <- cb_nested %>% as_tibble() %>% select(id, name) %>% head(2)
nested <- cb_nested %>% select(-name)
nested %>% left_join(df1, by = "id")
nested %>% right_join(df1, by = "id")
nested %>% inner_join(df1, by = "id")
nested %>% full_join(df1, by = "id")
nested %>% anti_join(df1, by = "id")

# bind_rows - dplyr_reconstruct, bind_rows.temporal_cubble_df
df1 <- cb_nested %>% head(1)
df2 <- cb_nested %>% tail(2)
bind_rows(df1, df2)
df1 <- cb_long %>% head(10)
df2 <- cb_long %>% tail(20)
bind_rows(df1, df2)

# relocate - dplyr_col_select, dplyr_col_select
cb_nested %>% relocate(ts, .before = name)
cb_nested %>% face_temporal() %>% relocate(tmin)

# slice - all the slice_* uses dplyr::slice(), which uses dplyr_row_slice()
cb_nested %>% slice_head(n = 2)
cb_nested %>% slice_tail(n = 2)
cb_nested %>% slice_max(elev)
cb_nested %>% slice_min(elev)
cb_nested %>% slice_sample(n = 2)

# rowwise - rowwise.spatial_cubble_df, rowwise.temporal_cubble_df
cb_nested %>% rowwise()
cb_long %>% rowwise()

# group_by & ungroup -
(res <- cb_nested %>% mutate(group1 = c(1, 1, 2)) %>% group_by(group1))
res %>% ungroup()
(res2 <- res %>% face_temporal() %>% unfold(group1) %>% group_by(group1))
res2 %>% ungroup()
res2 %>% mutate(first_5 = ifelse(lubridate::day(date) <= 5, 1, 6)) %>%
  group_by(first_5) %>%
  ungroup(group1)

```

**Description**

Coerce foreign objects into a cubble object

**Usage**

```
as_cubble(data, key, index, coords, ...)

## S3 method for class 'tbl_df'
as_cubble(data, key, index, coords, ...)

## S3 method for class 'sf'
as_cubble(data, key, index, ...)

## S3 method for class 'ncdf4'
as_cubble(
  data,
  key,
  index,
  coords,
  vars,
  lat_range = NULL,
  long_range = NULL,
  ...
)

## S3 method for class 'stars'
as_cubble(data, key, index, coords, ...)

## S3 method for class 'sftime'
as_cubble(data, key, index, coords, ...)
```

**Arguments**

data	an object to be converted into an cubble object. Currently support objects of classes <code>tibble</code> , <code>ncdf4</code> , <code>stars</code> , and <code>sftime</code> .
key	a character (symbol), the spatial identifier, see <a href="#">make_cubble()</a>
index	a character (symbol), the temporal identifier, see <a href="#">make_cubble()</a> .
coords	a vector of character (symbol) of length 2, see <a href="#">make_cubble()</a> .
...	other arguments.
vars	a vector of variables to read in (with quote), used in <code>as_cubble.netcdf()</code> to select the variable to read in.
lat_range, long_range	in the syntax of <code>seq(FROM, TO, BY)</code> to downsample the data to read in <code>as_cubble.netcdf()</code> .

**Value**

a cubble object

## Examples

```

climate_flat %>% as_cubble(key = id, index = date, coords = c(long, lat))

# only need `coords` if create from a tsibble
dt <- climate_flat %>% tsibble::as_tsibble(key = id, index = date)
dt %>% as_cubble(coords = c(long, lat))

# netcdf
path <- system.file("ncdf/era5-pressure.nc", package = "cubble")
raw <- ncdf4::nc_open(path)
dt <- as_cubble(raw)
# subset degree
dt <- as_cubble(raw, vars = c("q", "z"),
               long_range = seq(113, 153, 3),
               lat_range = seq(-53, -12, 3))

## Not run:
# stars - take a few seconds to run
tif <- system.file("tif/L7_ETMs.tif", package = "stars")
x <- stars::read_stars(tif)
x %>% as_cubble()

## End(Not run)

# don't have to supply coords if create from a sftime
dt <- climate_flat %>%
  sf::st_as_sf(coords = c("long", "lat"), crs = sf::st_crs("OGC:CRS84")) %>%
  sftime::st_as_sftime()
dt %>% as_cubble(key = id, index = date)

```

---

check_key	<i>Check on key when create cubble from two components (spatial/temporal)</i>
-----------	---

---

## Description

When creating a cubble from separate spatial and temporal component, `make_cubble()` will informed users about potential disagreement of the key values in the two datasets (some sites appear in one table but not the other). This function summarises the key values into those match, potentially can be matched, and can't be matched.

## Usage

```
check_key(spatial, temporal, by = NULL)
```

## Arguments

spatial	a tibble object or an sf object, the spatial component containing the key and coords variable (coords can be automatically created from an sf object if not supplied).
---------	--



temporal	a tibble object or a tsibble object, the temporal component containing the key and index variable.
by	in the syntax of the by argument in <code>dplyr::left_join()</code> , used in <code>make_cubble()</code> when the key variable has different names in the spatial and temporal data.

### Value

a list with three elements: 1) `paired`: a tibble of paired ID from spatial and temporal data, 2) `potential_pairs`: a tibble of pairs that could potentially match from both datasets, 3) `others`: other key values that can't be matched in a list: `others$temporal` and `others$spatial`

### Examples

```
check_key(stations, meteo)

# make_cubble() will prompt to use check_key if there are key mis-match:
make_cubble(spatial = lga, temporal = covid, by = c("lga_name_2018" = "lga"))
check_key(lga, covid, by = c("lga_name_2018" = "lga"))
```

---

climate_aus	<i>Australia climate data</i>
-------------	-------------------------------

---

### Description

`climate_aus`: daily measure on precipitation (`prcp`), maximum temperature (`tmax`), and minimum temperature (`tmin`) in 2020 for 639 stations. `historical_tmax`: daily maximum temperature (`tmax`) for 75 stations in Victoria and New South Wales for two periods: 1971-1975 and 2016-2020.

### Usage

```
climate_aus

historical_tmax
```

### Format

An object of class `spatial_cubble_df` (inherits from `cubble_df`, `tbl_df`, `tbl`, `data.frame`) with 639 rows and 7 columns.

An object of class `spatial_cubble_df` (inherits from `cubble_df`, `tbl_df`, `tbl`, `data.frame`) with 75 rows and 7 columns.

### Details

**id** station ID, "ASN000" are international paddings, the next two digits (digit 8-9) indicates the states the station is in: Western Australia: 01-13, Northern Territory: 14-15, South Australia: 16-26, Queensland: 27-45, New South Wales: 46-75, Victoria: 76-90, Tasmania: 91-99. See <http://www.bom.gov.au/climate/cdo/about/site-num.shtml>

**lat** latitude of the stations, in degree  
**long** longitude of the stations, in degree  
**elev** elevation of the stations  
**name** station name  
**wmo\_id** the world meteorological organisation (WMO) station number  
**ts** For `climate_aus`: date, prcp, tmax, and tmin, for `historical_tmax`: date and tmax

### Examples

```
climate_aus %>% face_temporal() %>% face_spatial()
```

---

covid	<i>Daily COVID count data (in tsibble) and Victoria LGA (in sf)</i>
-------	---

---

### Description

Daily COVID count data (`covid`) from 2022-01-01 to 2020-03-23 in a `tsibble` object (`date`, `lga`, `n`, and `avg_7day`). Victoria Local Government Area (LGA) spatial geometry in an `sf` object (`lga_name_2018` and `geometry`)

### Usage

```
covid
lga
```

### Format

An object of class `tbl_ts` (inherits from `tbl_df`, `tbl`, `data.frame`) with 6806 rows and 4 columns.  
 An object of class `sf` (inherits from `data.frame`) with 80 rows and 2 columns.

### Details

**date** date object, from 2022-01-01 to 2020-03-23  
**lga** Victoria Local Government Area (LGA) in Australia  
**n** COVID-19 case count  
**avg\_7day** rolling mean of `n` in a 7 day window. Calculate with `mutate(avg_7day = slider::slide_dbl(n, mean, .before = 6))`  
**lga\_name\_2018** LGA encoding by Australia Bureau of Statistics, slightly differ from the encoding used by the Department of Health in the `covid` data  
**geometry** multipolygon geometry of each LGA

**Examples**

```

library(sf)
library(dplyr)
# prompt msg on the key mismatch between the two datasets
make_cubble(lga, covid, by = c("lga_name_2018" = "lga"))
check_res <- check_key(lga, covid, by = c("lga_name_2018" = "lga"))

# fix mismatch
lga2 <- lga |>
  rename(lga = lga_name_2018) |>
  mutate(lga = ifelse(lga == "Kingston (C) (Vic.)", "Kingston (C)", lga),
         lga = ifelse(lga == "Latrobe (C) (Vic.)", "Latrobe (C)", lga)) |>
  filter(!lga %in% check_res$others$spatial)
covid2 <- covid |> filter(!lga %in% check_res$others$temporal)

make_cubble(spatial = lga2, temporal = covid2)

```

---

cubble	<i>Create a cubble object</i>
--------	-------------------------------

---

**Description**

Create a cubble object

**Usage**

```
cubble(..., key, index, coords)
```

```
make_cubble(spatial, temporal, by = NULL, key, index, coords)
```

**Arguments**

...	a set of name-value pairs to create a cubble, need to include the key, index, and coords variables.
key	a character (or symbol), the spatial identifier. See the Key section in <a href="#">tsibble::as_tsibble()</a>
index	a character (or symbol), the temporal identifier. Currently support base R classes Date, POSIXlt, POSIXct and tsibble's <a href="#">tsibble::yearmonth()</a> , <a href="#">tsibble::yearweek()</a> , and <a href="#">tsibble::yearquarter()</a> class. See the Index section in <a href="#">tsibble::as_tsibble()</a>
coords	a vector of character (or symbol) of length two, in the order of longitude first and then latitude, the argument can be omitted if created from an sf and its subclasses. In case the sf geometry column is not POINT, coords will be the centroid coordinates.
spatial	a tibble object or an sf object, the spatial component containing the key and coords variable (coords can be automatically created from an sf object if not supplied).
temporal	a tibble object or a tsibble object, the temporal component containing the key and index variable.

by in the syntax of the by argument in `dplyr::left_join()`, used in `make_cubble()` when the key variable has different names in the spatial and temporal data.

### Value

a cubble object

### Examples

```
cubble(
  id = rep(c("perth", "melbourne", "sydney"), each = 3),
  date = rep(as.Date("2020-01-01") + 0:2, times = 3),
  long = rep(c(115.86, 144.96, 151.21), each = 3),
  lat = rep(c(-31.95, -37.81, -33.87), each = 3),
  value = rnorm(n = 9),
  key = id, index = date, coords = c(long, lat)
)

# stations and climate are in-built data in cubble
make_cubble(spatial = stations, temporal = meteo,
            key = id, index = date, coords = c(long, lat))
```

---

face_temporal	<i>Pivot a cubble object between the nested/long (spatial/temporal) form</i>
---------------	--

---

### Description

While `face_temporal()` switches a cubble object into a long cubble, suitable for temporal operations, `face_spatial()` turns a long cubble back into a nest cubble for spatial operations. The two operations are exact inverse.

### Usage

```
face_temporal(data, col)

## S3 method for class 'temporal_cubble_df'
face_temporal(data, col)

## S3 method for class 'spatial_cubble_df'
face_temporal(data, col)

face_spatial(data)

## S3 method for class 'spatial_cubble_df'
face_spatial(data)

## S3 method for class 'temporal_cubble_df'
face_spatial(data)
```

**Arguments**

`data` a cubble object

`col` a character (or a symbol), the list column to be expanded, `col` is required to be specified if there are more than one list column and the list column name is not `ts`.

**Value**

a cubble object

**Examples**

```
cb_long <- climate_mel %>% face_temporal()
cb_back <- cb_long %>% face_spatial()
identical(climate_mel, cb_back)
```

---

```
fill_gaps.temporal_cubble_df
```

*Gap-filling on the temporal component of a cubble object*

---

**Description**

Gap-filling on the temporal component of a cubble object

**Usage**

```
## S3 method for class 'temporal_cubble_df'
fill_gaps(.data, ..., .full = FALSE, .start = NULL, .end = NULL)
```

```
## S3 method for class 'temporal_cubble_df'
scan_gaps(.data, ...)
```

**Arguments**

`.data` A tibble.

`...` A set of name-value pairs. The values provided will only replace missing values that were marked as "implicit", and will leave previously existing NA untouched.

- empty: filled with default NA.
- filled by values or functions.

`.full`

- FALSE inserts NA for each keyed unit within its own period.
- TRUE fills NA over the entire time span of the data (a.k.a. fully balanced panel).
- `start()` pad NA to the same starting point (i.e. `min(<index>)`) across units.
- `end()` pad NA to the same ending point (i.e. `max(<index>)`) across units.

`.start, .end` Set custom starting/ending time that allows to expand the existing time spans.

**Value**

a cubble object

**Examples**

```
library(tsibble)
climate_aus %>% face_temporal() %>% fill_gaps()
climate_aus %>% face_temporal() %>% scan_gaps()
```

---

geom\_glyph

*Create glyph map with ggplot2*

---

**Description**

Create glyph map with ggplot2

**Usage**

```
geom_glyph(  
  mapping = NULL,  
  data = NULL,  
  stat = "identity",  
  position = "identity",  
  ...,  
  x_major = NULL,  
  x_minor = NULL,  
  y_major = NULL,  
  y_minor = NULL,  
  x_scale = identity,  
  y_scale = identity,  
  polar = FALSE,  
  width = ggplot2::rel(2.1),  
  height = ggplot2::rel(1.8),  
  global_rescale = TRUE,  
  show.legend = NA,  
  inherit.aes = TRUE  
)
```

```
geom_glyph_line(  
  mapping = NULL,  
  data = NULL,  
  stat = "identity",  
  position = "identity",  
  ...,  
  x_major = NULL,  
  x_minor = NULL,  
  y_major = NULL,
```

```

    y_minor = NULL,
    polar = FALSE,
    width = ggplot2::rel(2.1),
    height = ggplot2::rel(2.1),
    show.legend = NA,
    inherit.aes = TRUE
  )

  geom_glyph_box(
    mapping = NULL,
    data = NULL,
    stat = "identity",
    position = "identity",
    ...,
    x_major = NULL,
    x_minor = NULL,
    y_major = NULL,
    y_minor = NULL,
    polar = FALSE,
    width = ggplot2::rel(2.1),
    height = ggplot2::rel(2.1),
    show.legend = NA,
    inherit.aes = TRUE
  )

```

### Arguments

mapping	Set of aesthetic mappings created by <a href="#">aes()</a> . If specified and <code>inherit.aes = TRUE</code> (the default), it is combined with the default mapping at the top level of the plot. You must supply mapping if there is no plot mapping.
data	<p>The data to be displayed in this layer. There are three options:</p> <p>If <code>NULL</code>, the default, the data is inherited from the plot data as specified in the call to <a href="#">ggplot()</a>.</p> <p>A <code>data.frame</code>, or other object, will override the plot data. All objects will be fortified to produce a data frame. See <a href="#">fortify()</a> for which variables will be created.</p> <p>A function will be called with a single argument, the plot data. The return value must be a <code>data.frame</code>, and will be used as the layer data. A function can be created from a formula (e.g. <code>~ head(.x, 10)</code>).</p>
stat	The statistical transformation to use on the data for this layer, either as a ggproto <code>Geom</code> subclass or as a string naming the stat stripped of the <code>stat_</code> prefix (e.g. "count" rather than "stat_count")
position	Position adjustment, either as a string naming the adjustment (e.g. "jitter" to use <code>position_jitter</code> ), or the result of a call to a position adjustment function. Use the latter if you need to change the settings of the adjustment.
...	Other arguments passed on to <a href="#">layer()</a> . These are often aesthetics, used to set an aesthetic to a fixed value, like <code>colour = "red"</code> or <code>size = 3</code> . They may also be parameters to the paired geom/stat.

x_major, x_minor, y_major, y_minor	The name of the variable (as a string) for the major and minor x and y axes. Together, each unique combination of x_major and y_major specifies a grid cell.
y_scale, x_scale	The scaling function to be applied to each set of minor values within a grid cell. Defaults to <code>identity</code> so that no scaling is performed.
polar	A logical of length 1, specifying whether the glyphs should be drawn in polar coordinates. Defaults to FALSE.
height, width	The height and width of each glyph. Defaults to 95% of the <code>resolution</code> of the data. Specify the width absolutely by supplying a numeric vector of length 1, or relative to the resolution of the data by using <code>rel</code> .
global_rescale	Whether rescale is performed globally or on each individual glyph.
show.legend	logical. Should this layer be included in the legends? NA, the default, includes if any aesthetics are mapped. FALSE never includes, and TRUE always includes. It can also be a named logical vector to finely select the aesthetics to display.
inherit.aes	If FALSE, overrides the default aesthetics, rather than combining with them. This is most useful for helper functions that define both data and aesthetics and shouldn't inherit behaviour from the default plot specification, e.g. <code>borders()</code> .

**Value**

a ggplot object

**Examples**

```
print_p <- GGally::print_if_interactive

library(ggplot2)
# basic glyph map with reference line and box-----
p <- ggplot(data = GGally::nasa,
            aes(x_major = long, x_minor = day,
                y_major = lat, y_minor = surftemp)) +
  geom_glyph_box() +
  geom_glyph_line() +
  geom_glyph() +
  theme_bw()
print_p(p)

# rescale on each individual glyph -----
p <- ggplot(data = GGally::nasa,
            aes(x_major = long, x_minor = day,
                y_major = lat, y_minor = surftemp)) +
  geom_glyph(global_rescale = FALSE)
print_p(p)

# adjust width and height with relative & absolute value -----
p <- ggplot() +
  geom_glyph(data = GGally::nasa,
            aes(x_major = long, x_minor = day,
```



```
      y_major = lat, y_minor = surftemp),
      width = rel(0.8), height = 1) +
  theme_bw()
print_p(p)

# apply a re-scaling on Y and use polar coordinate
p <-
  GGally::nasa %>%
  ggplot(aes(x_major = long, x_minor = day,
             y_major = lat, y_minor = ozone)) +
  geom_glyph_box(fill=NA) +
  geom_glyph_line() +
  geom_glyph(y_scale = GGally::range01, polar = TRUE)
print_p(p)
```

---

is\_cubble

*Predicate functions on the object class*

---

## Description

Predicate functions on the object class

## Usage

```
is_cubble(data)
```

```
is_cubble_spatial(data)
```

```
is_cubble_temporal(data)
```

```
is_sf(data)
```

```
is_tsibble(data)
```

## Arguments

data            an object to test for the class

## Value

a logical value of TRUE/FALSE

## Examples

```
is_cubble(stations)
is_cubble(meteo)
is_cubble(climate_flat)
is_cubble(climate_mel)
is_cubble(climate_australia)
```

```
is_cubble_spatial(climate_aus)
is_cubble_temporal(climate_aus)
```

---

key\_vars.cubble\_df      *Extract cubble attributes*

---

## Description

Extract cubble attributes

## Usage

```
## S3 method for class 'cubble_df'
key_vars(x)

## S3 method for class 'cubble_df'
key(x)

## S3 method for class 'cubble_df'
key_data(.data)

coords(data)

spatial(data)

## S3 method for class 'spatial_cubble_df'
spatial(data)

## S3 method for class 'temporal_cubble_df'
spatial(data)

index(data)

index_var(data)
```

## Arguments

x, .data, data    a cubble object

## Examples

```
library(tsibble)
key(climate_mel)
key_vars(climate_mel)
key_data(climate_mel)
cubble::index(climate_mel)
cubble::index_var(climate_mel)
coords(climate_mel)
spatial(climate_mel)
```

---

make\_spatial\_sf      *Update the spatial cubble to include the sf class*

---

**Description**

add geometry list column to cubble\_df object

**Usage**

```
make_spatial_sf(x, sfc = NULL, crs, silent = FALSE)
```

**Arguments**

x	object of class spatial_cubble_df
sfc	object of class sfc (see package sf)
crs	object of class crs (see package sf); if missing 'OGC:CRS84' is assumed (WGS84) and a message is emitted
silent	logical; suppress message?

**See Also**

[make\\_temporal\\_tsibble](#)

**Examples**

```
climate_mel %>% make_spatial_sf()
```

---

make\_temporal\_tsibble      *Update the temporal cubble to include the tsibble class (tbl\_ts)*

---

**Description**

Update the temporal cubble to include the tsibble class (tbl\_ts)

**Usage**

```
make_temporal_tsibble(x)
```

**Arguments**

x	object of class temporal_cubble_df
---	------------------------------------

**Examples**

```
climate_mel %>% face_temporal() %>% make_temporal_tsibble()
```

---

match_sites	<i>Match stations in two cubbles by spatial distance/ temporal similarity</i>
-------------	---

---

### Description

The spatial matching is calculated using `sf::st_distance()` with different distance (in meter or degree) available depending on the coordinate reference system and parameter (which and par). The temporal matching is based on a temporal matching function (`temporal_match_fn`) that can be customised.

### Usage

```
match_sites(  
  df1,  
  df2,  
  crs = sf::st_crs("OGC:CRS84"),  
  which = NULL,  
  par = 0,  
  spatial_n_each = 1,  
  spatial_n_group = 4,  
  data_id,  
  match_id,  
  temporal_matching = TRUE,  
  temporal_by,  
  temporal_match_fn = match_peak,  
  temporal_n_highest = 20,  
  temporal_window = 5,  
  ...  
)  
  
match_spatial(  
  df1,  
  df2,  
  crs = sf::st_crs("OGC:CRS84"),  
  which = NULL,  
  par = 0,  
  spatial_n_each = 1,  
  spatial_n_group = 4,  
  return_cubble = FALSE  
)  
  
match_temporal(  
  data,  
  data_id,  
  match_id = NULL,  
  temporal_by,  
  return_cubble = FALSE,
```

```

    temporal_match_fn = match_peak,
    temporal_n_highest = 30,
    temporal_window = 5,
    ...
  )

```

### Arguments

df1, df2	the two cubble objects to match
crs	a crs object from <code>sf::st_crs()</code>
which	character; for Cartesian coordinates only: one of Euclidean, Hausdorff or Frechet; for geodetic coordinates, great circle distances are computed; see details
par	for which equal to Hausdorff or Frechet, optionally use a value between 0 and 1 to densify the geometry
spatial_n_each	integer, the number of matched "station" in df2 for each df1 record
spatial_n_group	integer, the number of matched group (pair) return
data_id	a character (or symbol), the variable differentiates df1 and df2
match_id	a character (or symbol), the variable differentiate each group of match
temporal_matching	logical, whether to match temporally
temporal_by	in the by syntax in <code>dplyr::*_join()</code> , the variables to match temporally in df1 and df2.
temporal_match_fn	character, the function name on how two time series should be matched
temporal_n_highest	numeric, the number of highest peak used for temporal matching in <code>match_peak</code>
temporal_window	The temporal window allowed in <code>match_peak</code>
...	parameters passing to temporal match
return_cubble	logical (default to false), whether to return the cubble object or a matching summary table
data	the resulting cubble object from spatial matching (with <code>return_cubble = TRUE</code> in spatial matching)

### Examples

```

library(dplyr)
climate_au <- mutate(climate_au, type = "climate")
match_spatial(climate_au, river)
# turn with different distance calculation:
match_spatial(climate_au, river, which = "Hausdorff")
# tune the number of matches in each group
match_spatial(climate_au, river, spatial_n_each = 5, spatial_n_group = 2)

```

```
a1 <- match_spatial(climate_au, river, return_cubble = TRUE) %>% bind_rows()
match_temporal(a1, data_id = type, match_id = group,
               temporal_by = c("prcp" = "Water_course_level"))
```

---

```
print.cubble_df      Print methods
```

---

## Description

Print methods

## Usage

```
## S3 method for class 'cubble_df'
print(x, width = NULL, ...)

## S3 method for class 'spatial_cubble_df'
tbl_sum(x)

## S3 method for class 'temporal_cubble_df'
tbl_sum(x)
```

## Arguments

`x` any R object (conceptually); typically numeric.

`width` default method: the *minimum* field width or NULL or 0 for no restriction. AsIs method: the *maximum* field width for non-character objects. NULL corresponds to the default 12.

... further arguments passed to or from other methods.

## Examples

```
climate_mel # a nested/spatial cubble
face_temporal(climate_mel) # a long/temporal cubble
```

---

```
river      Australia river data
```

---

## Description

Australia river data

## Usage

```
river
```

**Format**

An object of class `spatial_cubble_df` (inherits from `cubble_df`, `tbl_df`, `tbl`, `data.frame`) with 71 rows and 6 columns.

**Examples**

```
river
```

---

stations	<i>Toy climate data</i>
----------	-------------------------

---

**Description**

Daily measure (2020-01-01 to 2020-01-10) on precipitation (`prcp`), maximum temperature (`tmax`), and minimum temperature (`tmin`) for 3 melbourne airport stations. `stations` is the spatial component, (`stations_sf` as an `sf` object), `meteo` has the temporal component (`meteo_ts` as a `tsibble` object), `climate_flat` has both in a single joined table, and `climate_mel` is the `cubble` object. See `climate_au` on the full dataset.

**Usage**

```
stations
```

```
stations_sf
```

```
meteo
```

```
meteo_ts
```

```
climate_flat
```

```
climate_mel
```

**Format**

An object of class `tbl_df` (inherits from `tbl`, `data.frame`) with 3 rows and 6 columns.

An object of class `sf` (inherits from `tbl_df`, `tbl`, `data.frame`) with 3 rows and 5 columns.

An object of class `tbl_df` (inherits from `tbl`, `data.frame`) with 30 rows and 5 columns.

An object of class `tbl_ts` (inherits from `tbl_df`, `tbl`, `data.frame`) with 30 rows and 5 columns.

An object of class `tbl_df` (inherits from `tbl`, `data.frame`) with 30 rows and 10 columns.

An object of class `spatial_cubble_df` (inherits from `cubble_df`, `tbl_df`, `tbl`, `data.frame`) with 3 rows and 7 columns.

**See Also**

```
climate_au
```

**Examples**

```
cb <- make_cubble(
  spatial = stations, temporal = meteo,
  key = id, index = date, coords = c(long, lat)
)
identical(cb, climate_mel)
cb2 <- climate_flat %>%
  as_cubble(key = id, index = date, coords = c(long, lat))
identical(cb, climate_mel)
```

---

 unfold

---

*Augment spatial component into the long (temporal) form*


---

**Description**

Some spatio-temporal transformation, i.e. glyph maps, uses both spatial and temporal variables. `unfold()` allows you to temporarily moves spatial variables into the long form for these transformations.

**Usage**

```
unfold(data, ...)

## S3 method for class 'spatial_cubble_df'
unfold(data, ...)

## S3 method for class 'temporal_cubble_df'
unfold(data, ...)
```

**Arguments**

<code>data</code>	a long cubble object
<code>...</code>	spatial variables to move into the long form, support tidyselect syntax

**Value**

a cubble object in the long form

**Examples**

```
climate_mel %>% face_temporal() %>% unfold(long, lat)
climate_mel %>% face_temporal() %>% unfold(dplyr::starts_with("l"))
```



---

update_cubble	<i>Temporary update cubble if the sf class take precedent of cubble classes</i>
---------------	---

---

**Description**

When the data is already a cubble object but need update on attributes

**Usage**

```
update_cubble(data, key, index, coords, ...)

## S3 method for class 'spatial_cubble_df'
update_cubble(data, key = NULL, index = NULL, coords = NULL, ...)

## S3 method for class 'temporal_cubble_df'
update_cubble(
  data,
  key = NULL,
  index = NULL,
  coords = NULL,
  spatial = NULL,
  ...
)
```

**Arguments**

data, key, index, coords, spatial, ...  
skdfjskd

---

[.spatial\_cubble\_df *Accessors to a cubble object*

---

**Description**

Accessors to a cubble object

**Usage**

```
## S3 method for class 'spatial_cubble_df'
data[i, j, drop = FALSE]

## S3 method for class 'temporal_cubble_df'
data[i, j, drop = FALSE]

## S3 replacement method for class 'spatial_cubble_df'
```

```

names(x) <- value

## S3 replacement method for class 'temporal_cubble_df'
names(x) <- value

## S3 replacement method for class 'cubble_df'
x[[i]] <- value

```

### Arguments

data	an object of class <code>spatial_cubble_df</code> or <code>temporal_cubble_df</code>
i, j	row and column selector
drop	logical. If TRUE the result is coerced to the lowest possible dimension. The default is to drop if only one column is left, but <b>not</b> to drop if only one row is left.
x	data frame.
value	A suitable replacement value: it will be repeated a whole number of times if necessary and it may be coerced: see the Coercion section. If NULL, deletes the column if a single column is selected.

### Details

For nested cubbles, `[` will return a cubble object if the key variable, the coords variables, and the `ts` column all present. If the cubble object is also an `sf` object, the sticky select behavior on the `sf` column will preserve. For long cubbles, `[` will return a cubble object if the key and index variable both present. When a cubble can't be created and the data is not an `sf` class, `[` will always return a tibble, even with single index selection.

### Examples

```

climate_mel[c(1:3, 7)] # a nested cubble
make_spatial_sf(climate_mel)[1:3] # an sf

long <- climate_mel %>% face_temporal()
long[1:3] # a long cubble

climate_mel[1:3] # tibble
long[2:5] # tibble
climate_mel[1] # still tibble
long[1] # and still tibble

```

# Index

- \* **datasets**
  - climate\_au, 9
  - covid, 10
  - river, 22
  - stations, 23
- ?dplyr\_by, 4
- [.spatial\_cubble\_df, 25
- [.temporal\_cubble\_df
  - ([.spatial\_cubble\_df), 25
- [[<- .cubble\_df ([.spatial\_cubble\_df), 25
  
- aes(), 15
- arrange.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- arrange.temporal\_cubble\_df, 2
- as\_cubble, 6
  
- bind\_cols.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- bind\_cols.temporal\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- bind\_rows.temporal\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- borders(), 16
  
- check\_key, 8
- climate\_au, 9
- climate\_flat(stations), 23
- climate\_mel(stations), 23
- coords(key\_vars.cubble\_df), 18
- covid, 10
- cubble, 11
  
- dplyr::arrange(), 2
- dplyr::bind\_cols(), 2
- dplyr::filter(), 2
- dplyr::group\_by(), 2
- dplyr::left\_join(), 9, 12
- dplyr::mutate(), 2
- dplyr::pull(), 2
  
- dplyr::relocate(), 2
- dplyr::rename(), 2
- dplyr::rowwise(), 2
- dplyr::select(), 2
- dplyr::summarise(), 2
- dplyr::ungroup(), 2
- dplyr\_col\_modify.cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- dplyr\_reconstruct.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- dplyr\_reconstruct.temporal\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- dplyr\_row\_slice.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- dplyr\_row\_slice.temporal\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
  
- face\_spatial(face\_temporal), 12
- face\_temporal, 12
- fill\_gaps.temporal\_cubble\_df, 13
- filter.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- fortify(), 15
  
- geom\_glyph, 14
- geom\_glyph\_box(geom\_glyph), 14
- geom\_glyph\_line(geom\_glyph), 14
- ggplot(), 15
- group\_by(), 4
- group\_by.spatial\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- group\_by.temporal\_cubble\_df
  - (arrange.temporal\_cubble\_df), 2
- group\_by\_drop\_default(), 4
  
- historical\_tmax(climate\_au), 9
  
- identity, 16
- index(key\_vars.cubble\_df), 18
- index\_var(key\_vars.cubble\_df), 18

is\_cubble, 17  
 is\_cubble\_spatial(is\_cubble), 17  
 is\_cubble\_temporal(is\_cubble), 17  
 is\_sf(is\_cubble), 17  
 is\_tsibble(is\_cubble), 17  
  
 key.cubble\_df(key\_vars.cubble\_df), 18  
 key\_data.cubble\_df  
     (key\_vars.cubble\_df), 18  
 key\_vars.cubble\_df, 18  
  
 layer(), 15  
 lga(covid), 10  
  
 make\_cubble(cubble), 11  
 make\_cubble(), 7, 8  
 make\_spatial\_sf, 19  
 make\_temporal\_tsibble, 19, 19  
 match\_sites, 20  
 match\_spatial(match\_sites), 20  
 match\_temporal(match\_sites), 20  
 meteo(stations), 23  
 meteo\_ts(stations), 23  
 mutate.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
  
 names<- .spatial\_cubble\_df  
     ([.spatial\_cubble\_df), 25  
 names<- .temporal\_cubble\_df  
     ([.spatial\_cubble\_df), 25  
  
 print.cubble\_df, 22  
  
 reframe(), 4  
 rel, 16  
 rename.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 rename.temporal\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 resolution, 16  
 river, 22  
 rowwise.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 rowwise.temporal\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
  
 scan\_gaps.temporal\_cubble\_df  
     (fill\_gaps.temporal\_cubble\_df),  
     13  
  
 select.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 select.temporal\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 sf::st\_crs(), 21  
 sf::st\_distance(), 20  
 spatial(key\_vars.cubble\_df), 18  
 stations, 23  
 stations\_sf(stations), 23  
 summarise.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 summarise.temporal\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
  
 tbl(), 4  
 tbl\_sum.spatial\_cubble\_df  
     (print.cubble\_df), 22  
 tbl\_sum.temporal\_cubble\_df  
     (print.cubble\_df), 22  
 tsibble::as\_tsibble(), 11  
 tsibble::yearmonth(), 11  
 tsibble::yearquarter(), 11  
 tsibble::yearweek(), 11  
  
 unfold, 24  
 ungroup.spatial\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 ungroup.temporal\_cubble\_df  
     (arrange.temporal\_cubble\_df), 2  
 update\_cubble, 25  
  
 vctrs::vec\_as\_names(), 5