

# Cold Fronts

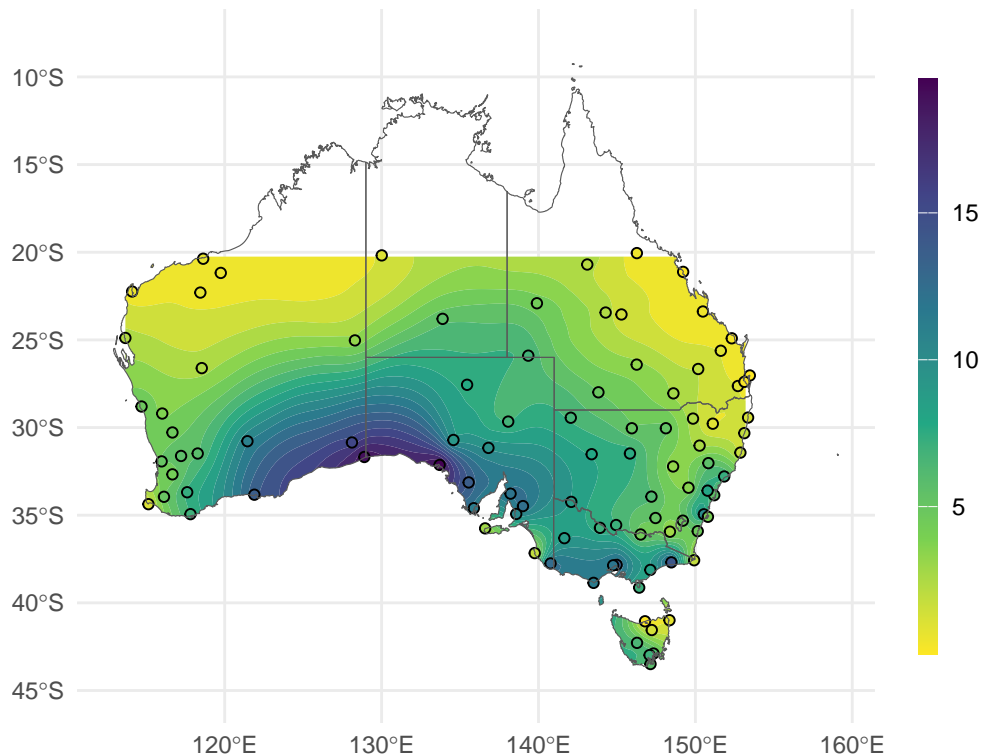
2024-10-31

## Temperature fall

T-fall is defined as the difference between a day maximum temperature and it previous day.

```
obs |>
  _[, .(n_front = sum(t_fall, na.rm = TRUE)), by = .(year(date), site_number)] |>
  _[, .(mean_front = mean(n_front)), by = site_number] |>
  metadata[i = _, on = "site_number"] |>
  _[latitude < -20] |>
  ggplot(aes(longitude, latitude)) +
  geom_contour_fill(aes(z = mean_front), kriging = 150, clip = aus, breaks = seq(-1, 20, 1)) +
  geom_point(aes(fill = mean_front), shape = 21) +
  scale_color_viridis_c(guide = guide_colorbar(barwidth = 0.5,
                                                barheigh = 15), direction = -1) +
  scale_fill_viridis_c(guide = guide_colorbar(barwidth = 0.5,
                                              barheigh = 15), direction = -1) +
  geom_sf(data = aus, inherit.aes = FALSE, fill = NA) +
  coord_sf(ylim = c(-45, -8)) +
  labs(x = NULL, y = NULL, title = "Mean annual occurrence of falls in daily maximum \ntemperature of a",
       fill = NULL) +
  theme_minimal()
```

## Mean annual occurrence of falls in daily maximum temperature of at least 10 K



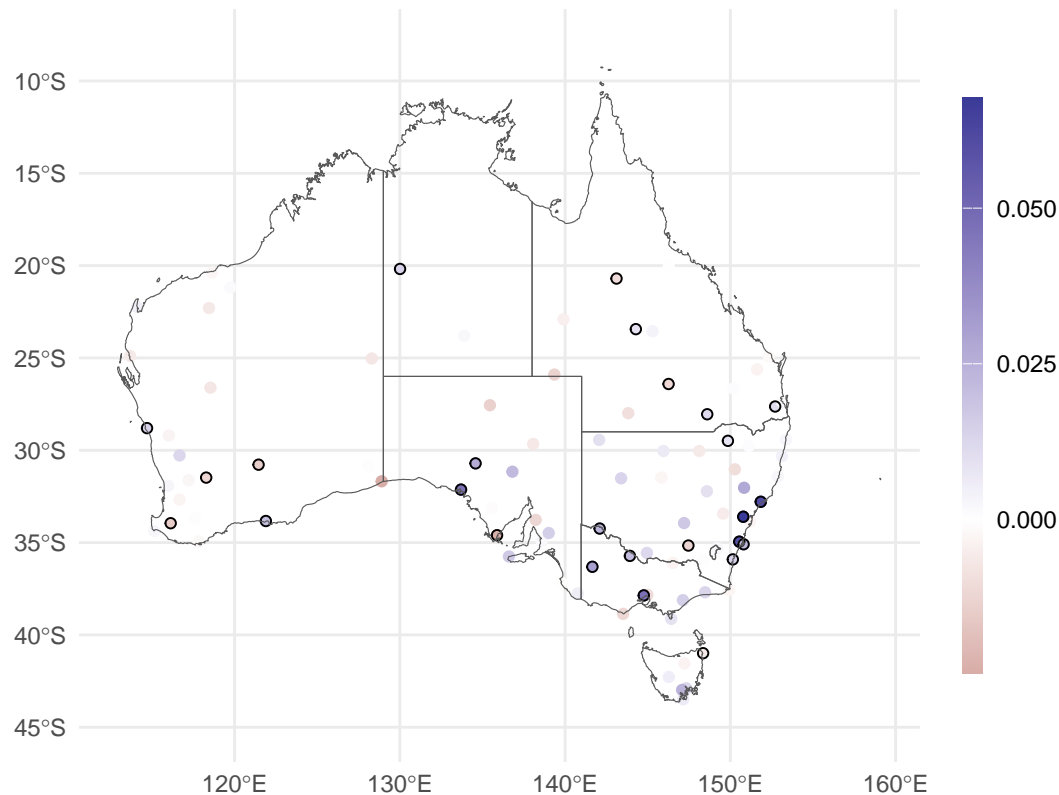
Is the temperature falls increasing overtime?

```
Pvaluate <- function(estimate, std.error, df, adjustment = "none") {
  stats::p.adjust(2*stats::pt(abs(estimate)/std.error, df, lower.tail = FALSE), method = adjustment)
}

obs[month(date) %in% c(10, 11, 12, 1, 2, 3)] |>
  _[, .(n_front = sum(t_fall, na.rm = TRUE)), by = .(year(date), site_number)] |>
  _[, metR::FitLm(n_front, year, se = TRUE), by = site_number] |>
  _[term != "(Intercept)"] |>
  _[, let(p.value = Pvaluate(estimate, std.error, df)), by = site_number] |>
  _[] |>
  metadata[i = _, on = "site_number"] |>
  _[latitude < -20] |>
  ggplot(aes(longitude, latitude)) +
  # geom_contour_fill(aes(z = mean_front), kriging = 150, clip = aus, breaks = seq(-1, 20, 1)) +
  geom_point(aes(color = estimate)) +
  geom_point(data = ~.x[p.value < 0.05], shape = 21) +
  # scale_color_viridis_c(guide = guide_colorbar(barwidth = 0.5,
  #                                             barheigh = 15), direction = -1) +
  scale_color_divergent(low = scales::muted("red"),
                        mid = "white",
                        high = scales::muted("blue"),
                        guide = guide_colorbar(barwidth = 0.5,
                                              barheigh = 15)) +
  geom_sf(data = aus, inherit.aes = FALSE, fill = NA) +
```

```
coord_sf(ylim = c(-45, -8)) +
labs(x = NULL, y = NULL, title = "Trend on ONDJFM of temperature falls",
color = NULL) +
theme_minimal()
```

### Trend on ONDJFM of temperature falls



### Case study

```
stations <- metadata[station_name %in% c("Mount Gambier", "Wagga Wagga", "Sydney", "Melbourne"), site_number]

obs[site_number %in% stations] |>
  _[, .(n_front = sum(t_fall, na.rm = TRUE)), by = .(year(date), site_number)] |>
  metadata[i = _, on = "site_number"] |>
  _[, let(n_front_mean = frollmean(n_front, 5, align = "center"))] |>
  _[, station_name := forcats::fct_relevel(station_name, c("Mount Gambier", "Wagga Wagga", "Sydney", "Melbourne"))] |>
  ggplot(aes(year, n_front)) +
  geom_line(color = "steelblue") +
  geom_line(aes(y = n_front_mean)) +
  geom_smooth(method = "lm", se = FALSE, color = "red", linewidth = 0.5) +
  facet_wrap(~station_name) +
  labs(x = NULL, y = "Number of temperature falls") +
  theme_minimal()
```

```
## `geom_smooth()` using formula = 'y ~ x'
```

```
## Warning: Removed 4 rows containing missing values or values outside the scale range
```

```
## (`geom_line()`).
```

