ANÁLISE: SÉRIES TEMPORAIS DOS DADOS DO INMET

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TÓPICOS DE ABORDAGEM

- Banco de dados
- Tratamento de Dados
- EDA
- Comparação de Métodos
- Análises Residuais

INMET: INSTITUTO NACIONAL DE METEOROLOGIA (2024)

Manipulação dos dados

```r
arquivos <- sprintf(
  "INMET_S_RS_A801_PORTO ALEGRE_01-01-%d_A_31-12-%d.csv",
  2015:2024, 2015:2024
)
ler_arquivo <- function(caminho) {
  tryCatch(
    {   df <- read.delim(
        file = caminho, header = FALSE, skip = 9, sep = ";",
        fileEncoding = "latin1")
      return(df)},
    error = function(e) {
      message(sprintf("Erro no arquivo %s: %s", caminho, e$message))
      return(NULL)})}
# Ler todos os arquivos
lista_dados <- lapply(arquivos, ler_arquivo)
problemas <- sapply(lista_dados, is.null)
INMET <- bind_rows(lista_dados[!problemas])

caminhodadocabecalho <- "INMET_S_RS_A801_PORTO ALEGRE_01-01-2024_A_31-12-2024.csv"
dadocabecalho <- read.delim(
  caminhodadocabecalho, header = FALSE, skip = 8, sep = ";", fileEncoding = "latin1")[1, ]
colnames(INMET) <- as.character(dadocabecalho[1, ])

INMET$`TEMPERATURA MÁXIMA NA HORA ANT. (AUT) (°C)`[INMET$`TEMPERATURA MÁXIMA NA HORA ANT. (AUT) (°C)` < -2] <- NA
INMET$`TEMPERATURA MÍNIMA NA HORA ANT. (AUT) (°C)`[INMET$`TEMPERATURA MÍNIMA NA HORA ANT. (AUT) (°C)` < -2] <- NA
```

Manipulação dos dados

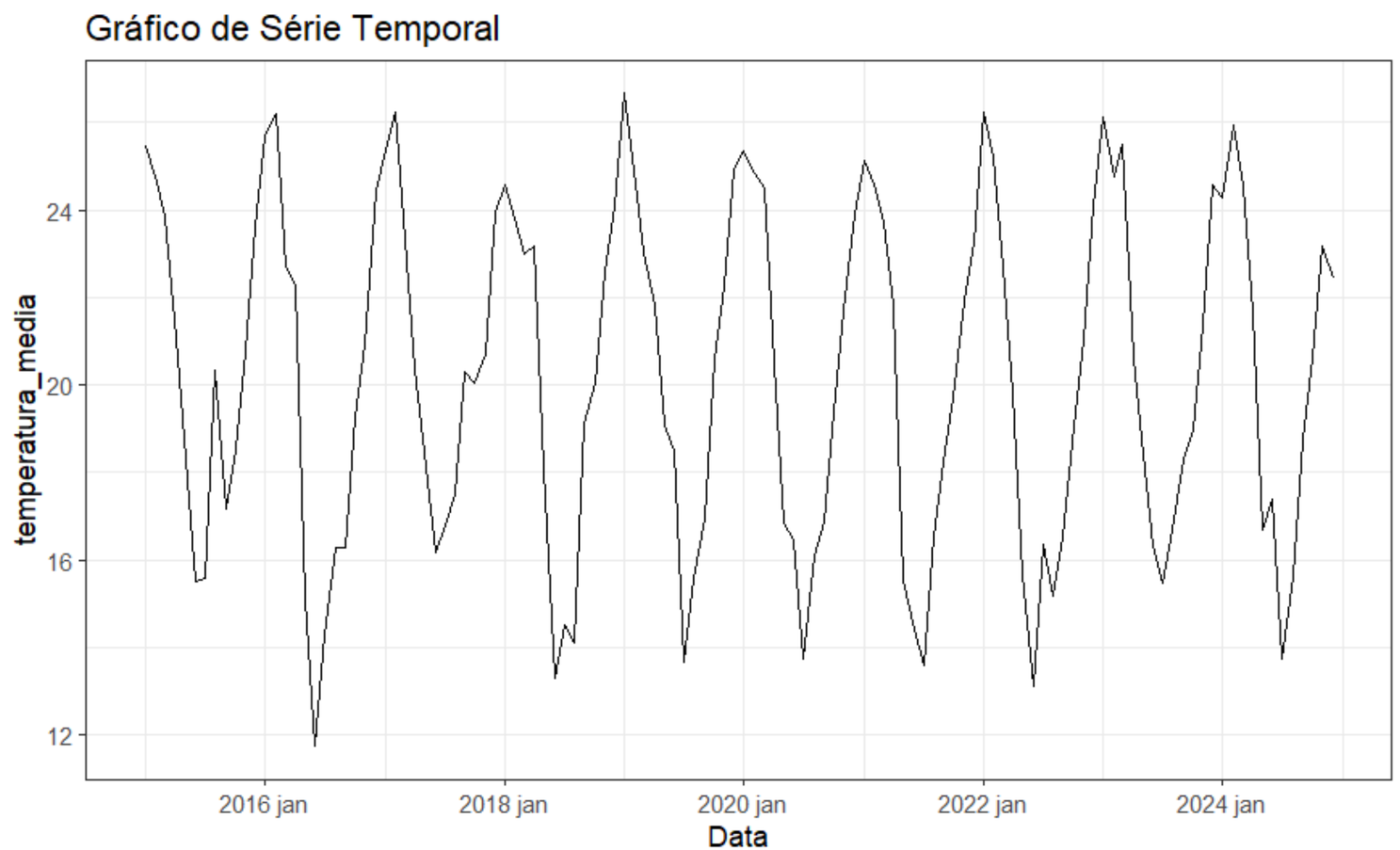
```
ARQUIVOS <- SPRINTF(
  "INMET_S_RS_A801_PORTO ALEGRE_01-01-%D_A_31-12-%D.CSV",
  2015:2024, 2015:2024
)
LER_ARQUIVO <- FUNCTION(CAMINHO) {
  TRYCATCH(
    {   DF <- READ.DELIM(
        FILE = CAMINHO, HEADER = FALSE, SKIP = 9, SEP = ";",
        FILEENCODING = "LATIN1")
      RETURN(DF)},
    ERROR = FUNCTION(E) {
      MESSAGE(SPRINTF("ERRO NO ARQUIVO %S: %S", CAMINHO, E$MESSAGE))
      RETURN(NULL)})}
# LER TODOS OS ARQUIVOS
LISTA_DADOS <- LAPPLY(ARQUIVOS, LER_ARQUIVO)
PROBLEMAS <- SAPPLY(LISTA_DADOS, IS.NULL)
INMET <- BIND_ROWS(LISTA_DADOS[!PROBLEMAS])

CAMINHODADOCABECALHO <- "INMET_S_RS_A801_PORTO ALEGRE_01-01-2024_A_31-12-2024.CSV"
DADOCABECALHO <- READ.DELIM(
  CAMINHODADOCABECALHO, HEADER = FALSE, SKIP = 8, SEP = ";", FILEENCODING = "LATIN1")[1, ]
COLNAMES(INMET) <- AS.CHARACTER(DADOCABECALHO[1, ])

INMET$`TEMPERATURA MÁXIMA NA HORA ANT. (AUT) (°C)`[INMET$`TEMPERATURA MÁXIMA NA HORA ANT. (AUT) (°C)` < -2] <- NA
INMET$`TEMPERATURA MÍNIMA NA HORA ANT. (AUT) (°C)`[INMET$`TEMPERATURA MÍNIMA NA HORA ANT. (AUT) (°C)` < -2] <- NA
```

TAMANHO (DIAS): 3653

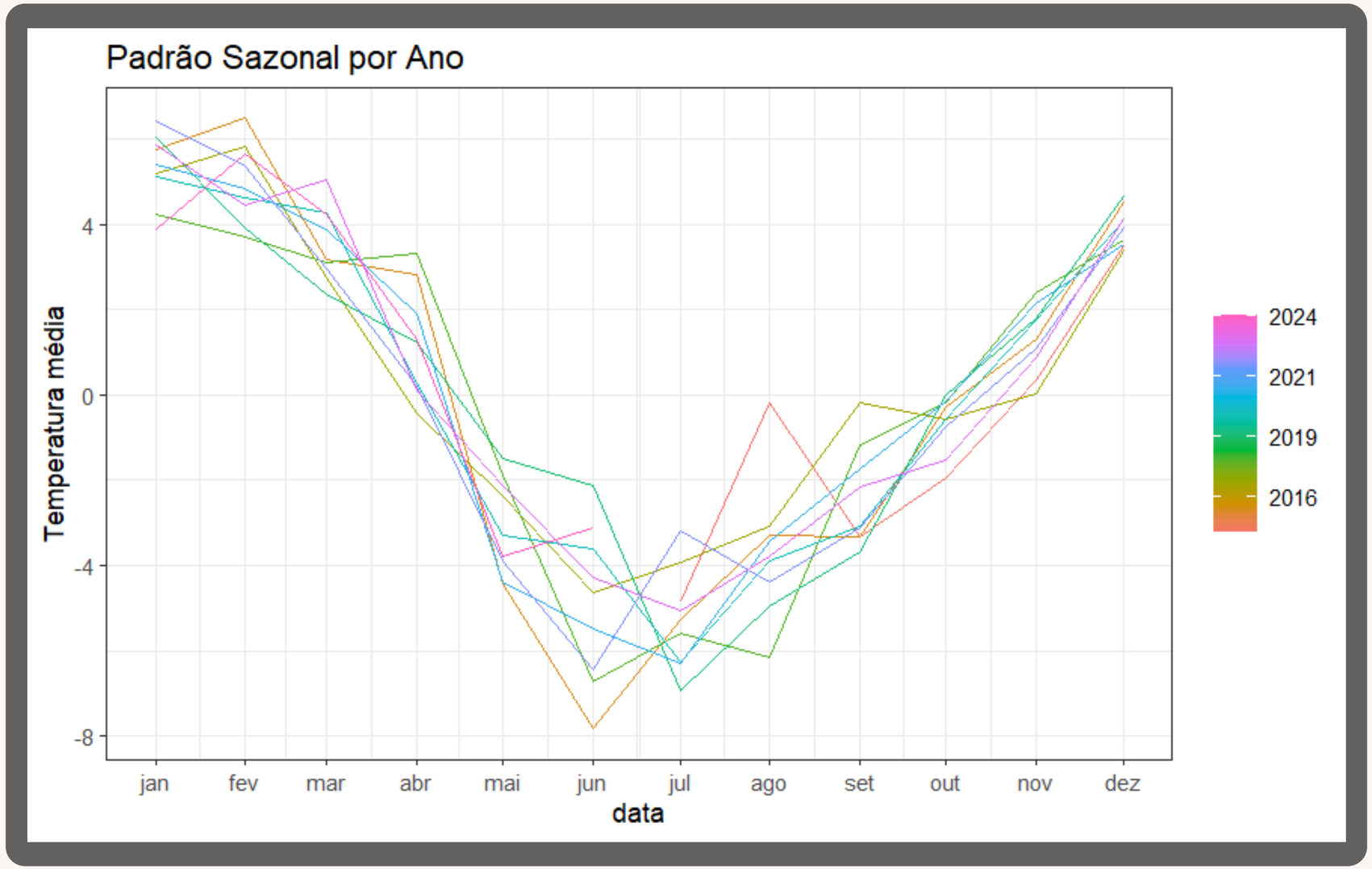
MIN.	MEDIANA
6.623	20.655
MAX.	**NA'S**
31.490	2

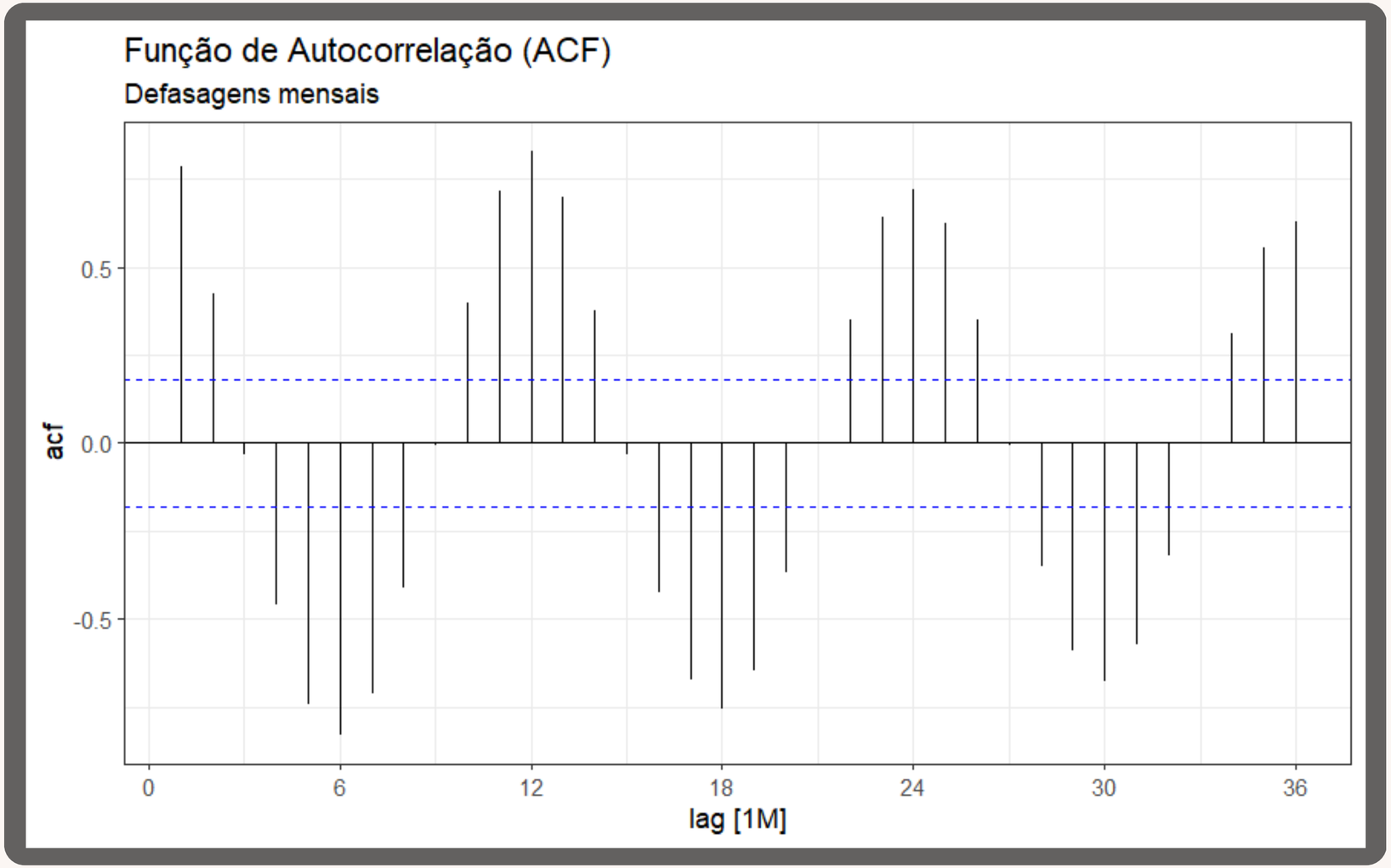
TAMANHO (MÊS): 120

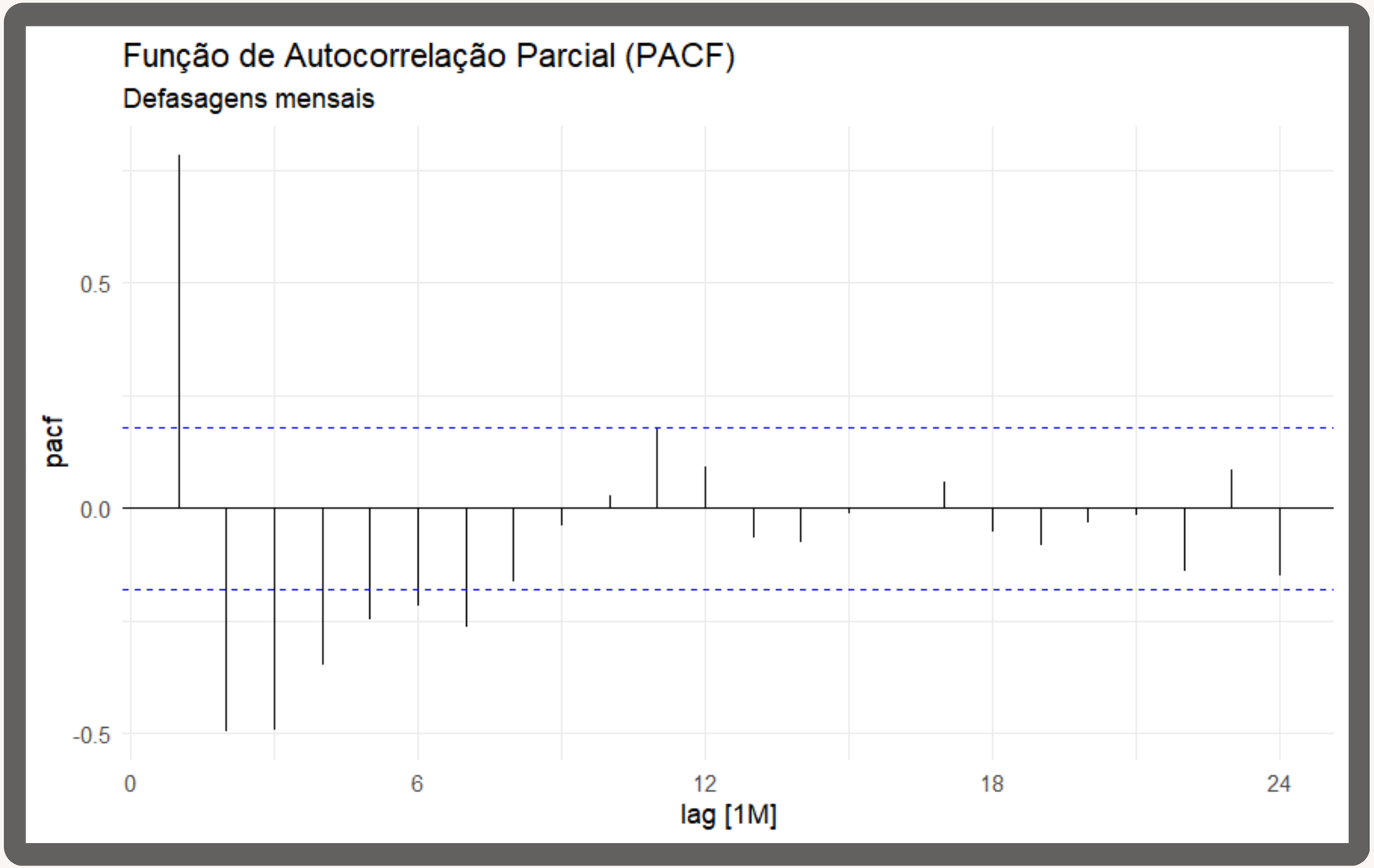
MIN.	MEDIANA
11.74	20.43
MAX.	**NA'S**
26.68	0



DADOS MENSAIS

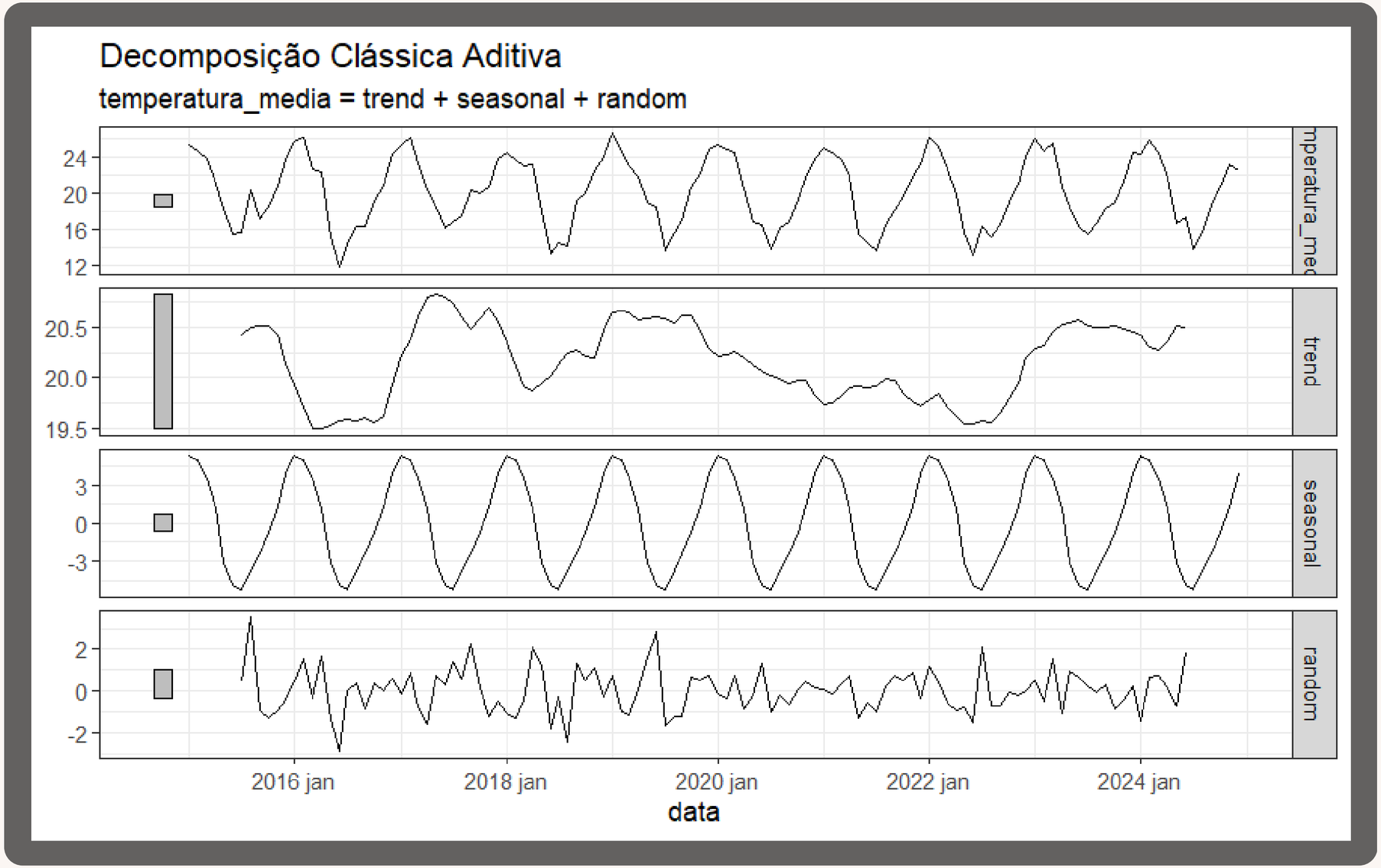

Padrão Sazonal por Ano
Temperatura média
4
0
-4
-8
jan
fev
mar
abr
mai
jun
jul
ago
set
out
nov
dez
data
2024
2021
2019
2016


Função de Autocorrelação (ACF)
Defasagens mensais
acf
0.5
0.0
-0.5
0
6
12
18
24
30
36
lag [1M]


Função de Autocorrelação Parcial (PACF)
Defasagens mensais
pacf
0.5
0.0
-0.5
0
6
12
18
24
lag [1M]

MODELOS ESPERADOS QUE SEJAM BONS:

- MODELO DE HOLT-WINTERS (CONSEGUE INCLUIR SAZONALIDADE)
- MODELO DE REGRESSÃO COM SAZONALIDADE EM DUMMIES
- PROCESSOS AUTOREGRESSIVOS (AR(4))
- SEASONAL NAIVE (SNAIVE)
- PROPHET


Decomposição Clássica Aditiva
temperatura_media = trend + seasonal + random
24
20
16
12
temperatura_med
20.5
20.0
19.5
trend
3
0
-3
seasonal
2
0
-2
random
2016 jan
2018 jan
2020 jan
2022 jan
2024 jan
data

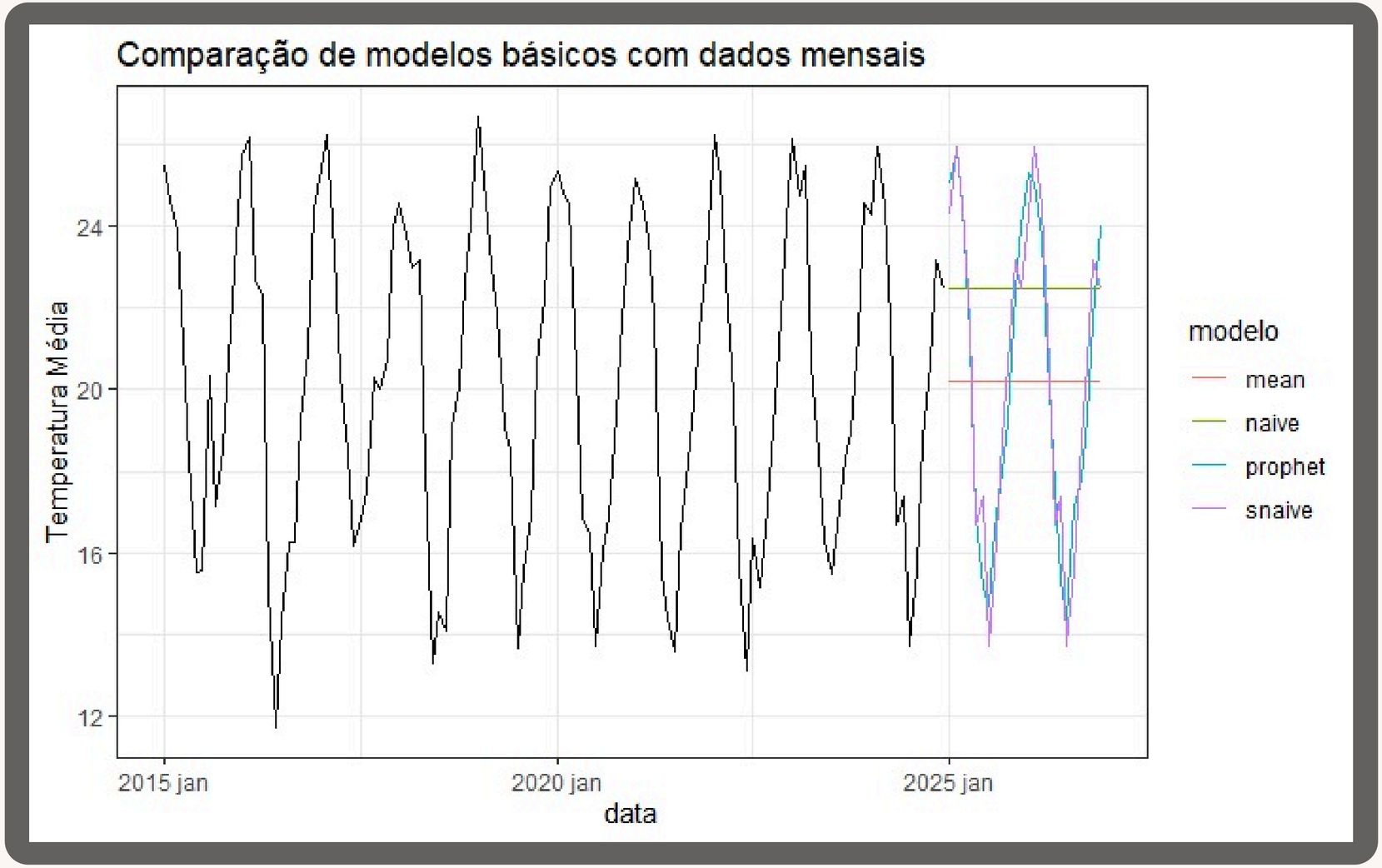
MÉTODOS DE PREVISÃO

PREVISÃO:

NAIVE

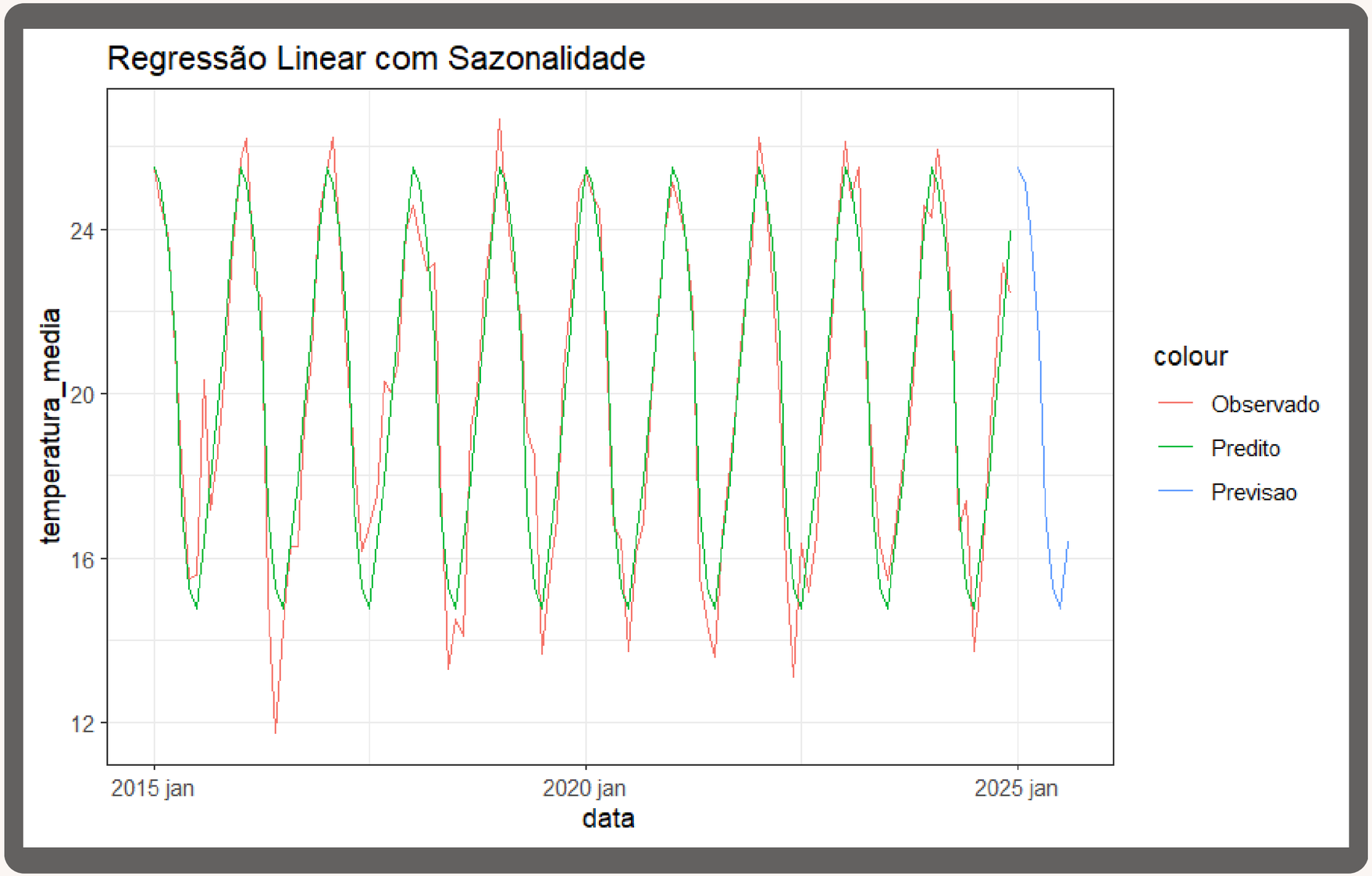
SNAIVE

PROPHET



DADOS MENSAIS

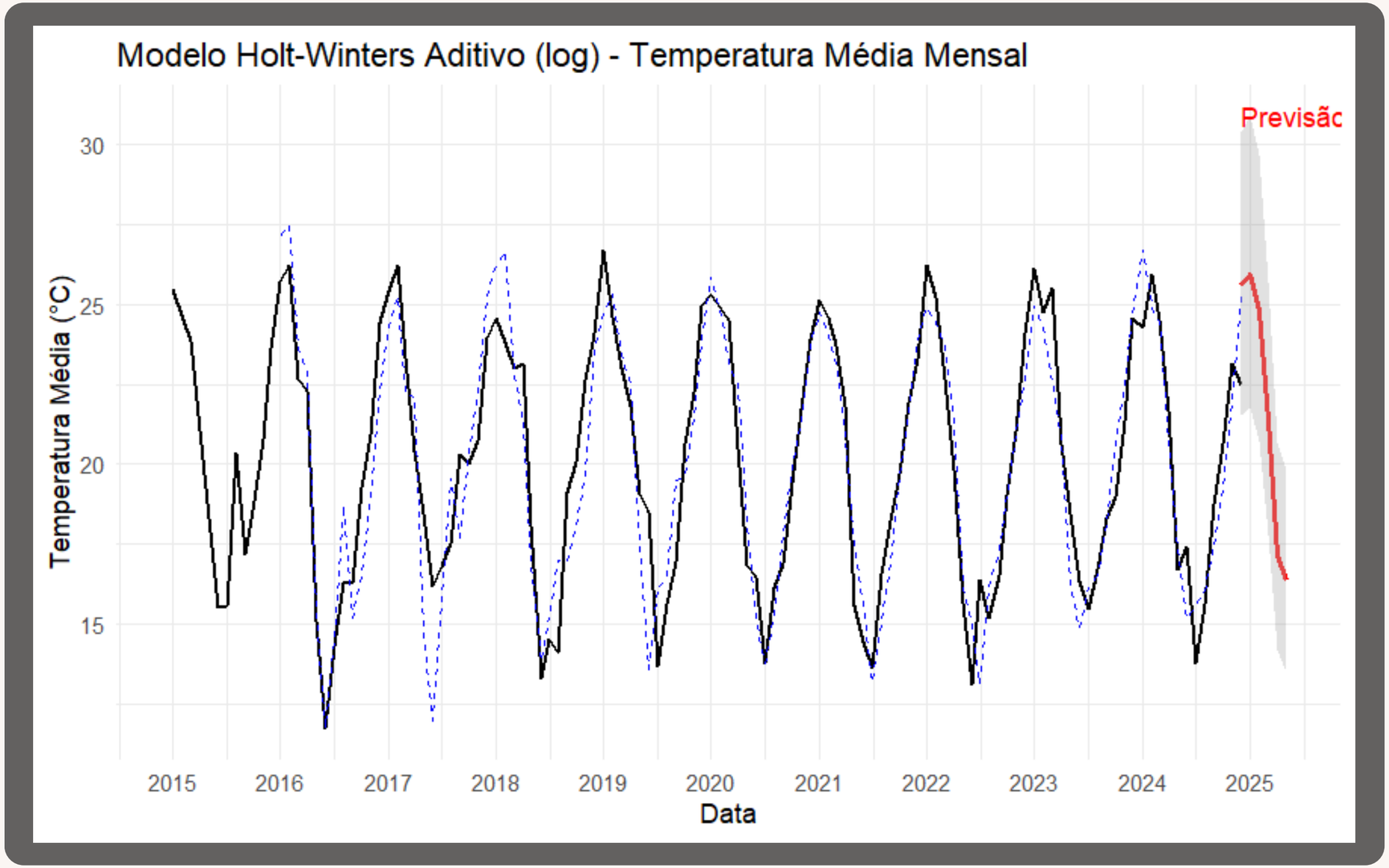
REGRESSÃO

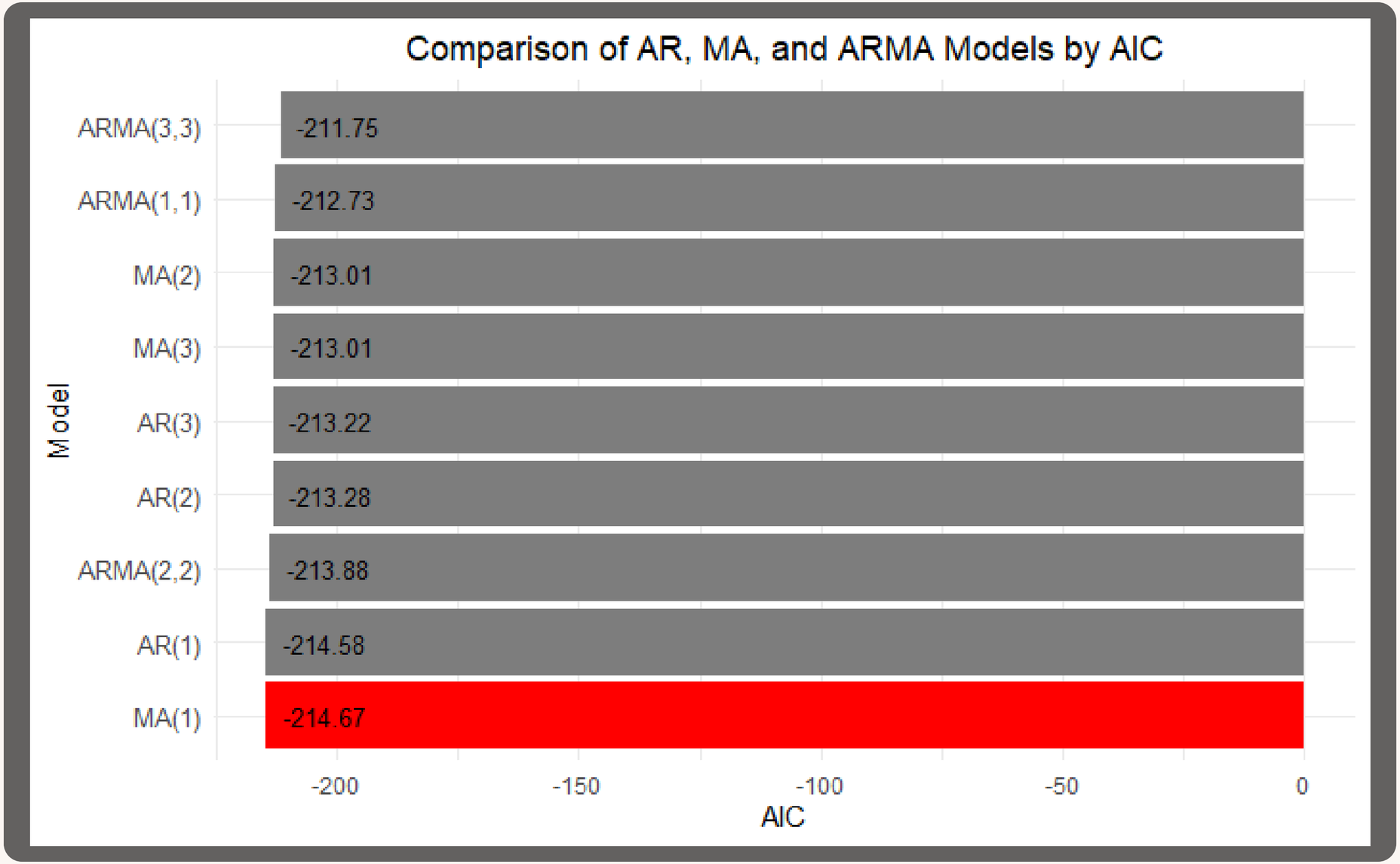


DADOS MENSAIS

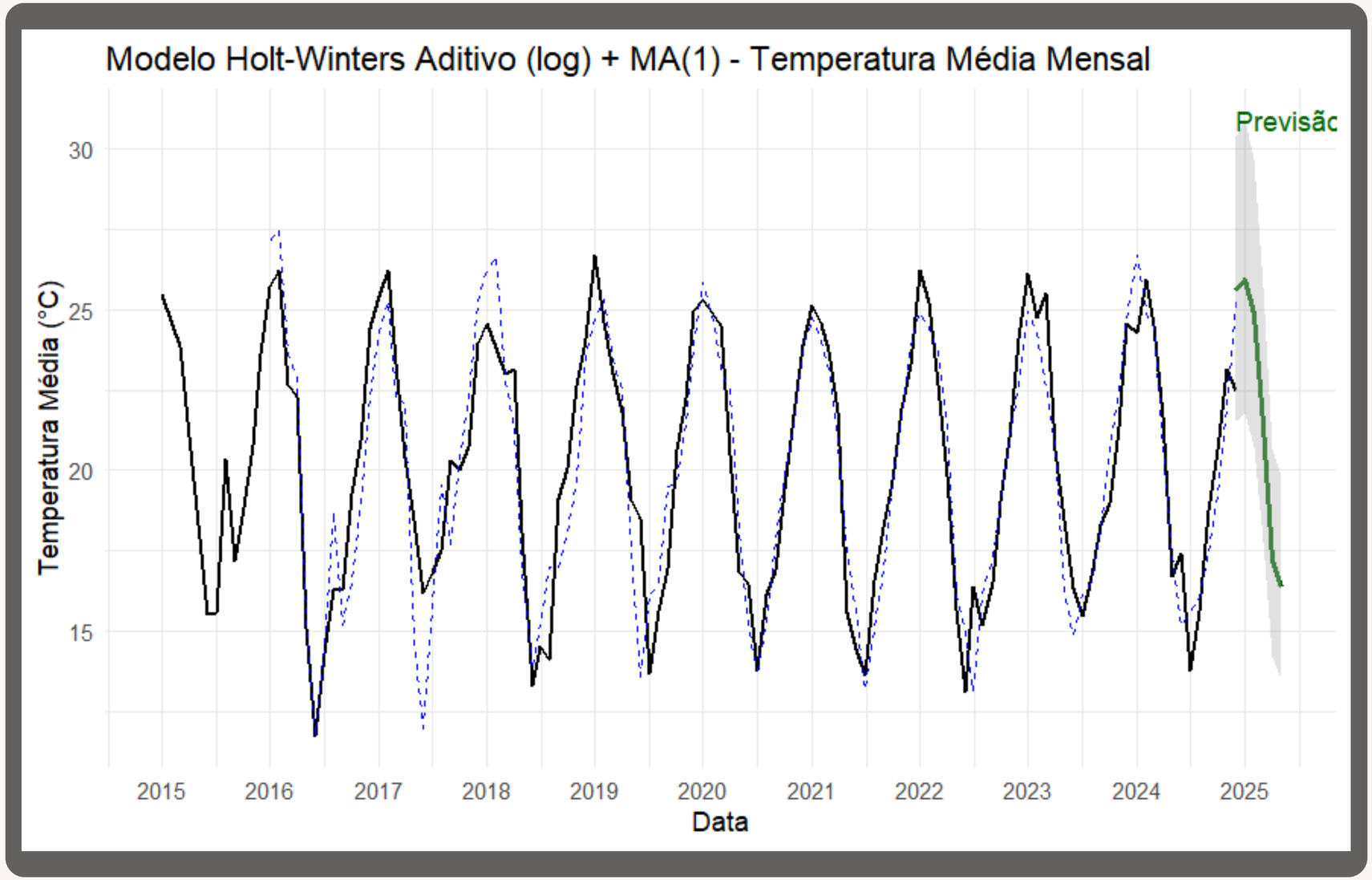
SUAVIZAÇÃO EXPONENCIAL

DADOS MENSAIS



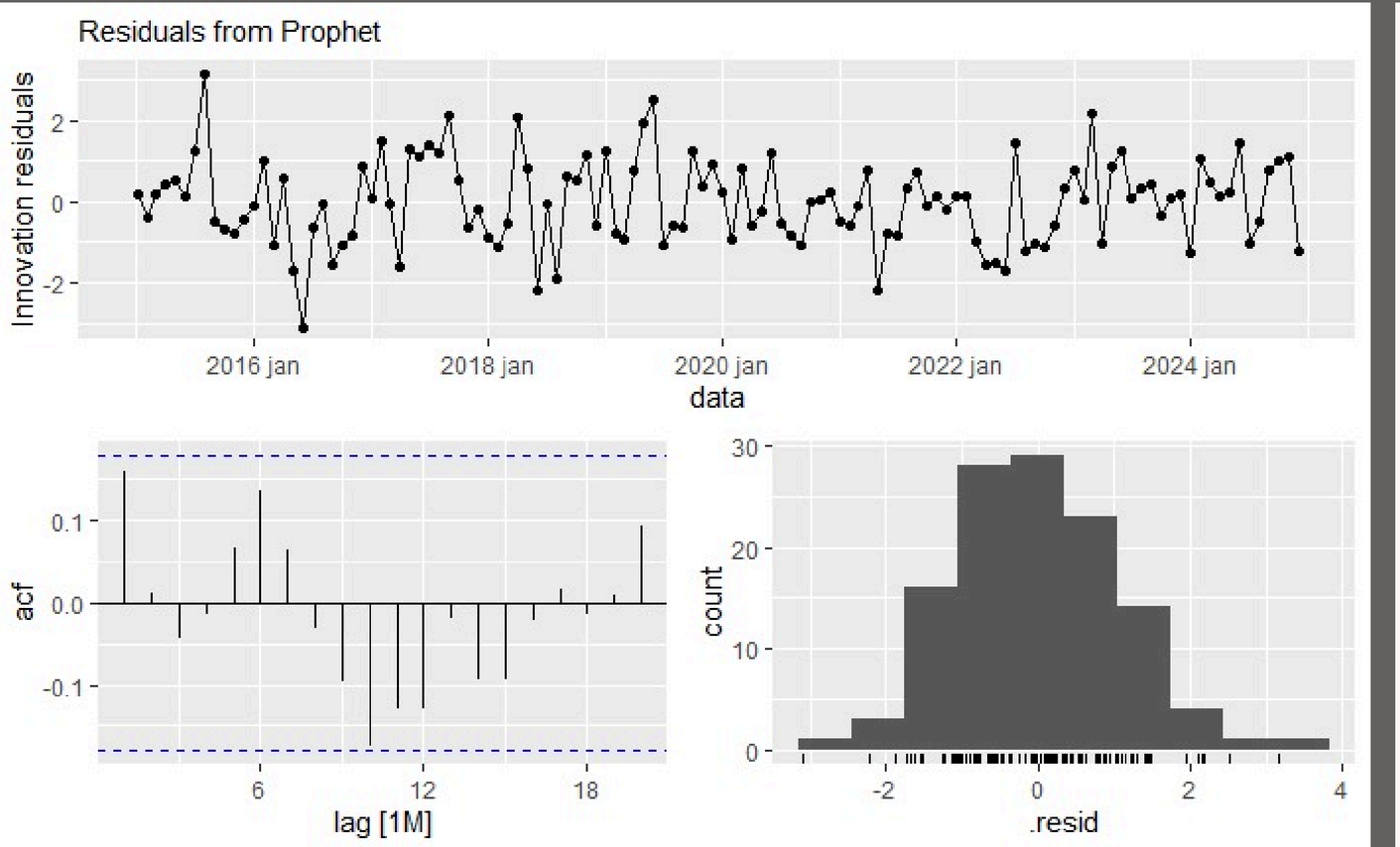

Comparison of AR, MA, and ARMA Models by AIC
Model
ARMA(3,3)
ARMA(1,1)
MA(2)
MA(3)
AR(3)
AR(2)
ARMA(2,2)
AR(1)
MA(1)
-211.75
-212.73
-213.01
-213.01
-213.22
-213.28
-213.88
-214.58
-214.67
-200
-150
-100
-50
0
AIC

DADOS MENSAIS



Modelos	QME
Prophet Mensal	1,13917
Regressão	1,288134
HW Aditivo Mensal	2,311686
HW Aditivo log + MA(1)	2,484792
HW Aditivo log	2,491048
...	...
HWA Mensal Ajustado	2,701019
Snaive Mensal	2,864862
HW Mult. Ajustado	3,257941
Naive Mensal	6,236472
Media Mensal	14,960413

PROPHET



BOX-PIERCE TEST

X-SQUARED = 21.229

DF = 24

P-VALUE = 0.6252

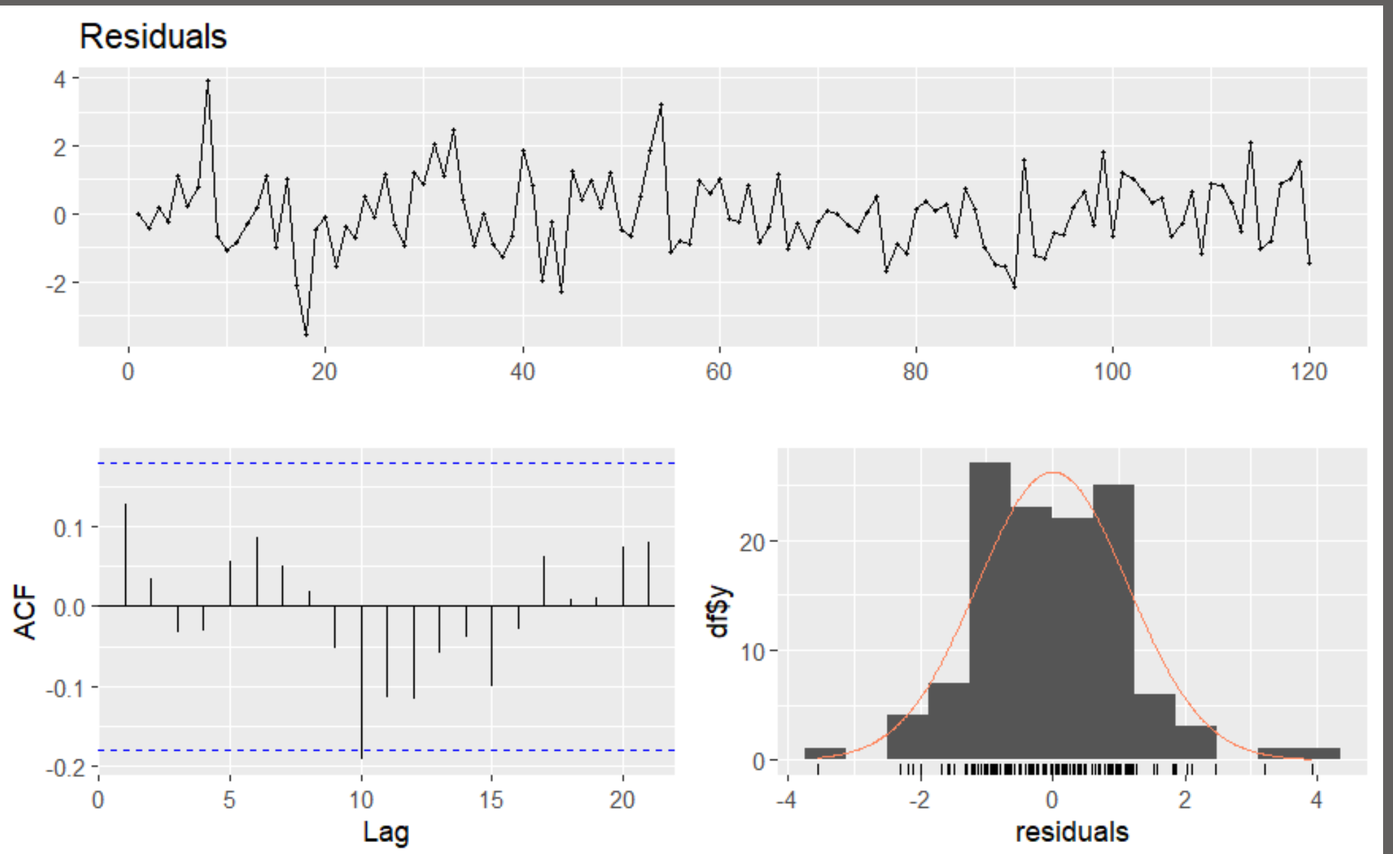
BOX-LJUNG TEST

X-SQUARED = 23.755

DF = 24

P-VALUE = 0.4757

REGRESSÃO



BOX-PIERCE TEST

X-SQUARED = 8.608

DF = 10

P-VALUE = 0.5696

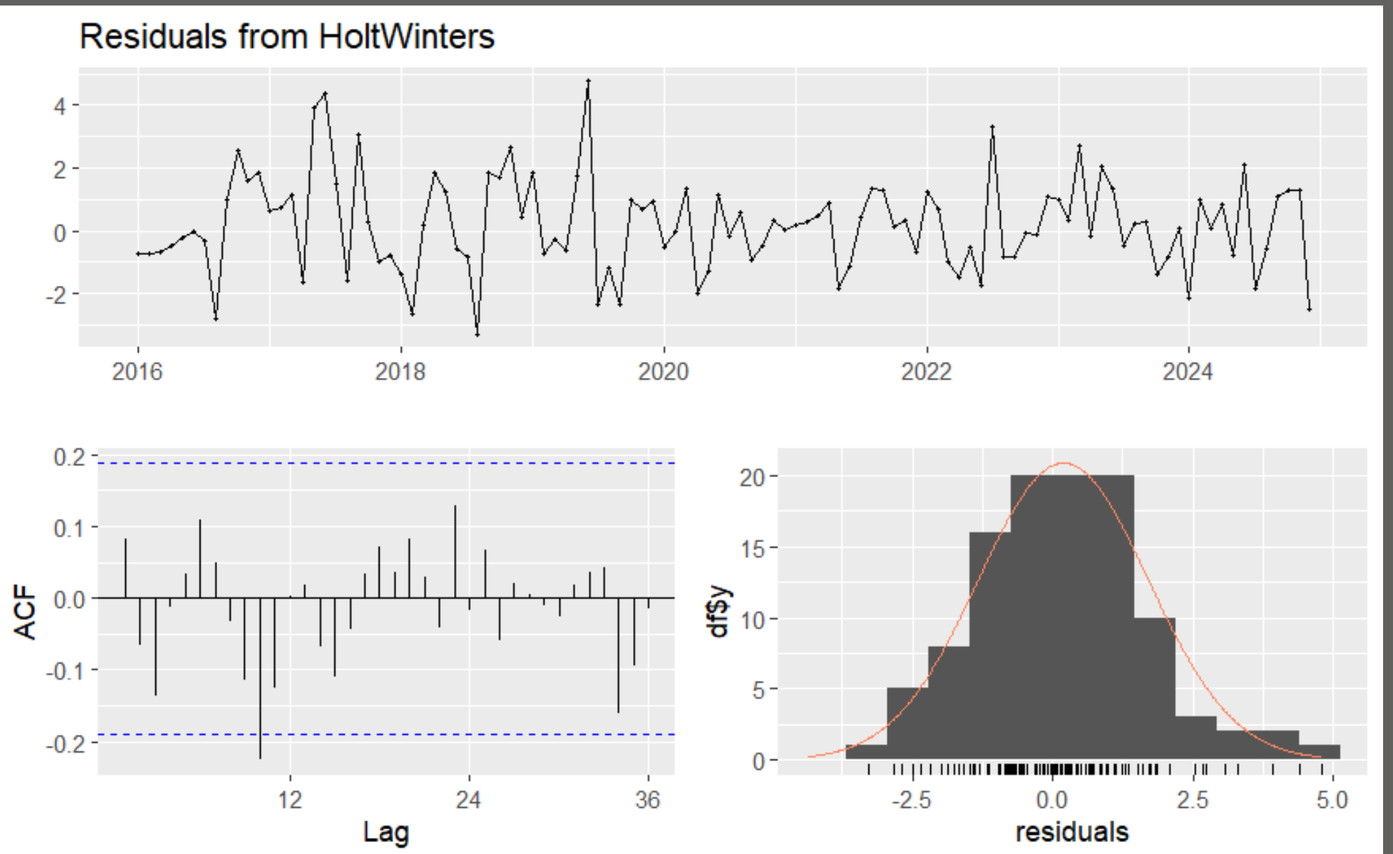
BOX-LJUNG TEST

X-SQUARED = 9.297

DF = 10

P-VALUE = 0.5042

HOLT WINTERS ADITIVO



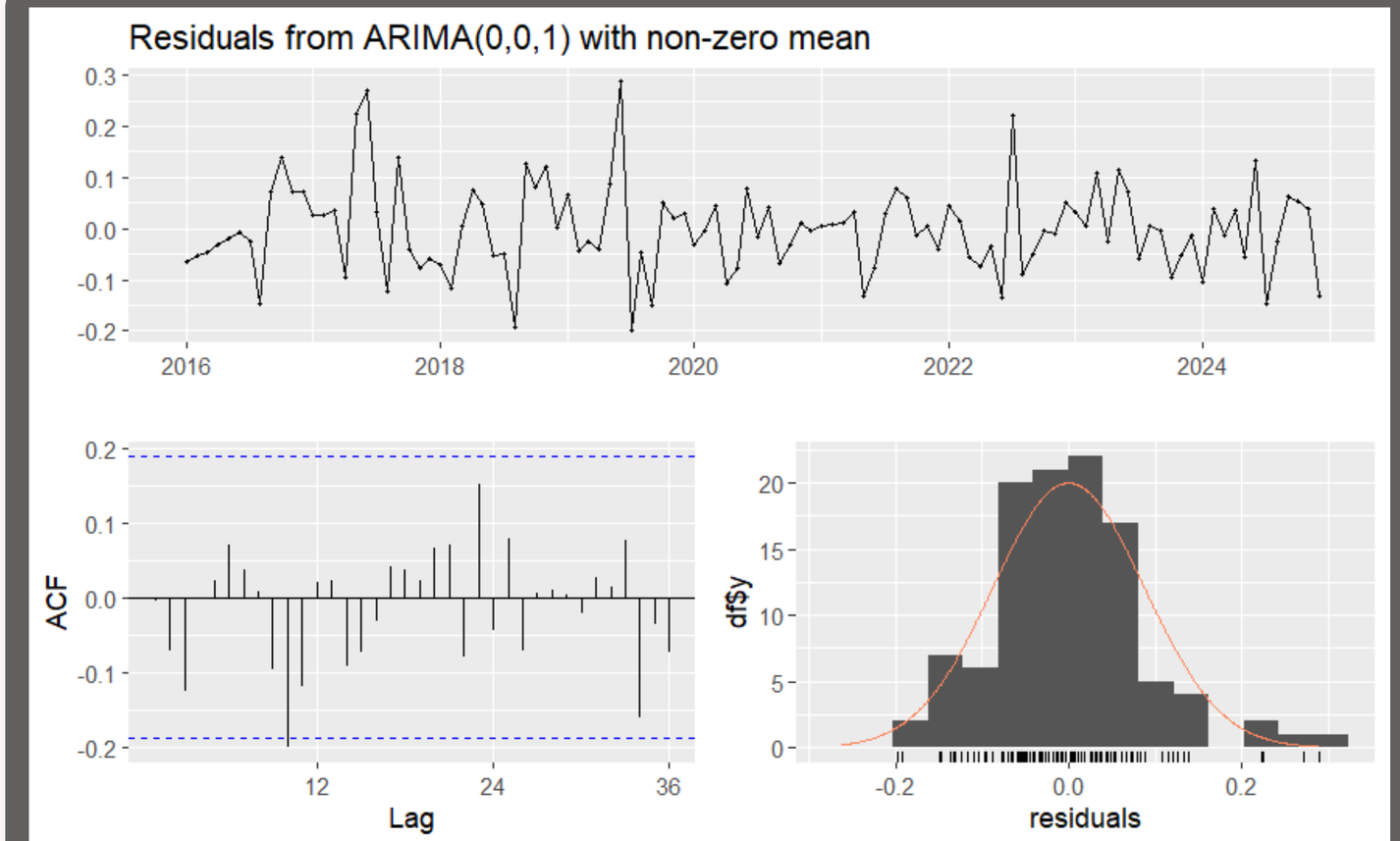
LJUNG-BOX TEST

X-SQUARED = 19.542

DF = 22

P-VALUE = 0.6117

HOLT WINTERS ADITIVO (LOG) + MA(1)



BOX-LJUNG TEST

X-SQUARED = 20.642

DF = 24

P-VALUE = 0.6598

BOX-PIERCE TEST

X-SQUARED = 17.599

DF = 24

P-VALUE = 0.822

AGRADECEMOS A TODOS QUE ASSISTIRAM