# Prévision de consommation électrique à plusieurs niveaux

# Introduction

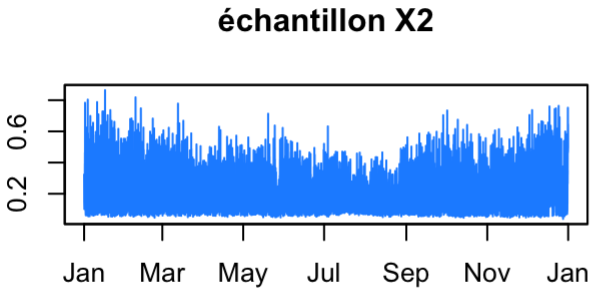
# Prédiction de consommation électrique

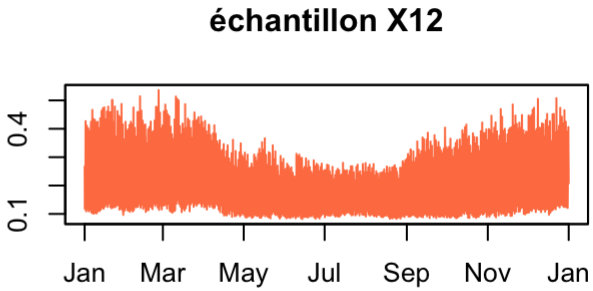
- `X1  X10` 10
- `X11  X20` 100
- `X21  X30` 1000

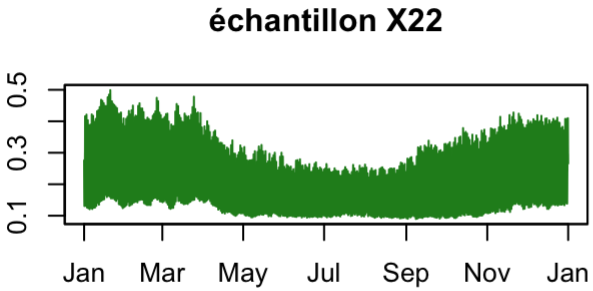
# Sommaire

# Analyse descriptive des données

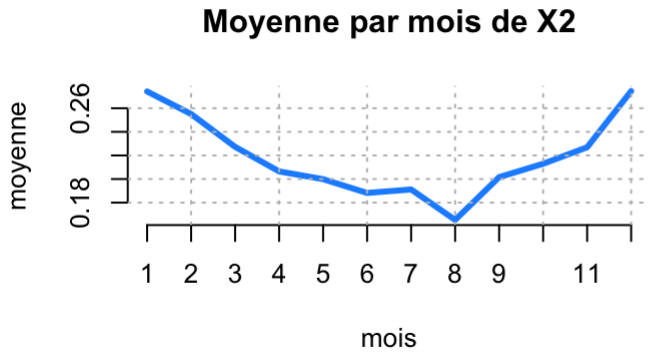
# Représentations graphiques de `X2`, `X12` et `X22`

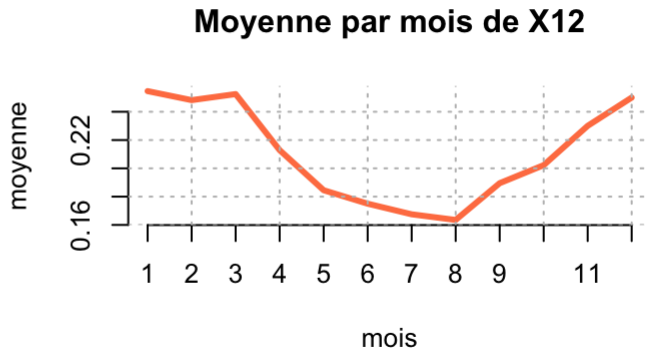


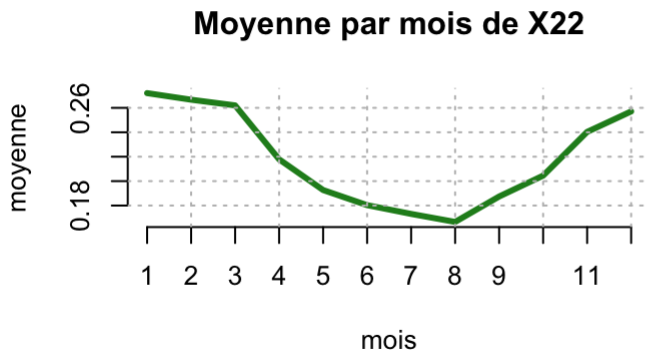



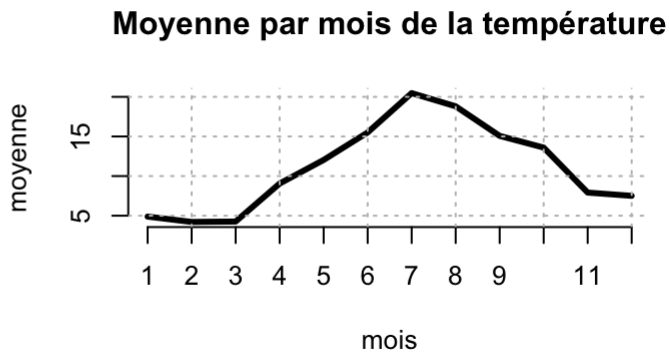



# Représentation graphique des moyennes par mois



# Estimation de l'erreur

# Création de la base de test :

```
smp_size <- floor(0.75*nrow(consom.csv))
train_ind <- sample(seq_len(nrow(consom.csv)), size = smp_size)

Train <- consom.csv[train_ind, ]
Test <- consom.csv[-train_ind, ]
```

**Train** 75% **data0** 13140

**Test** 25% **data0** 4380

# Création de la fonction de test :

$$RMSE(Y, \widehat{Y}) = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2}$$

```
rmse <- function (actual, predicted) {
  sqrt(mean((actual - predicted)^2))
}
```

# Prédiction par régression linéaire

# Première fonction de prédiction

```
reglin <- function(k) {
  # modèle
  Xk <- data0[, k + 1]
  model <- lm(Xk ~ mois + heure + Temperature, data = consom.csv)

  # prédiction
  Xk.pred <- data.frame(mois.pred, heure.pred, temp.Xk)
  pred <- unname(predict(model, newdata = Xk.pred))
}
```

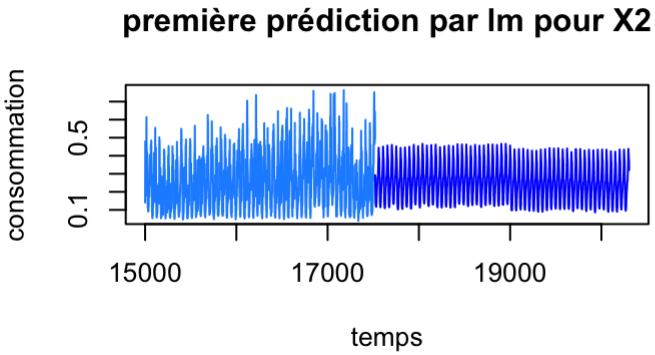
# Deuxième fonction de prédiction

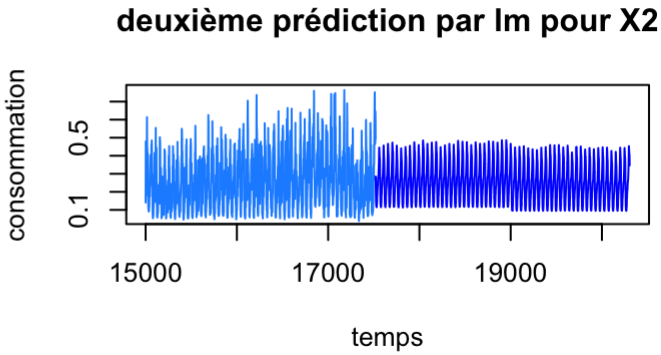
```
reglin <- function(k) {
  # modèle
  Xk <- data0[, k + 1]
  model <- lm(Xk ~ mois + heure + weekend + Temperature
              + temp.heure + temp.weekend + temp.mois
              + mois.heure + weekend.heure, data = consom.csv)
  # prédiction
  Xk.pred <- data.frame(mois.pred, heure.pred, weekend.pred,
                        temp.Xk, temp.heure.pred, temp.mois.pred,
                        temp.weekend.pred, mois.heure.pred,
                        weekend.heure.pred)
  pred <- unname(predict(model, newdata = Xk.pred))
}
```

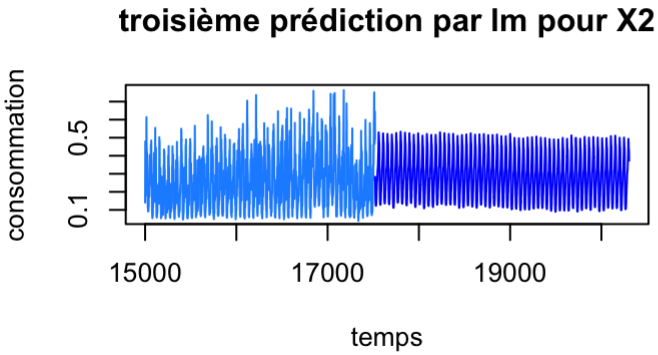
# Troisième fonction de prédiction

```
reglin <- function(k) {
  # modèle
  Xk <- data0[, k + 1]
  model <- lm(Xk ~ mois + heure + weekend + Temperature
              + I(Temperature^2) + Temperature.lag
              + temp.heure + temp.weekend + temp.mois
              + mois.heure + weekend.heure, data = consom.csv)
  # prédiction
  Xk.pred <- data.frame(mois.pred, heure.pred, weekend.pred,
                        temp.Xk, temp.Xk^2, temp.Xk.lag,
                        temp.heure.pred, temp.mois.pred,
                        temp.weekend.pred, mois.heure.pred,
                        weekend.heure.pred)
  pred <- unname(predict(model, newdata = Xk.pred))
}
```

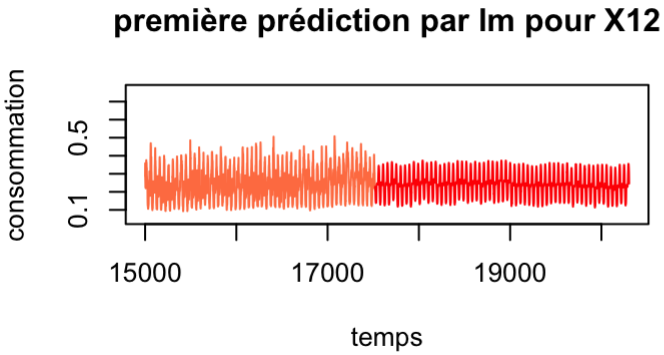
# Résultats pour `x2`

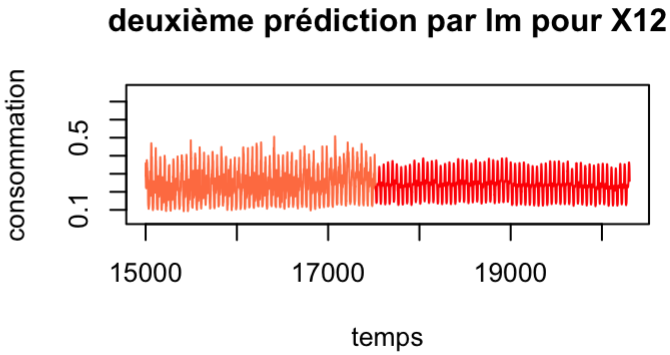


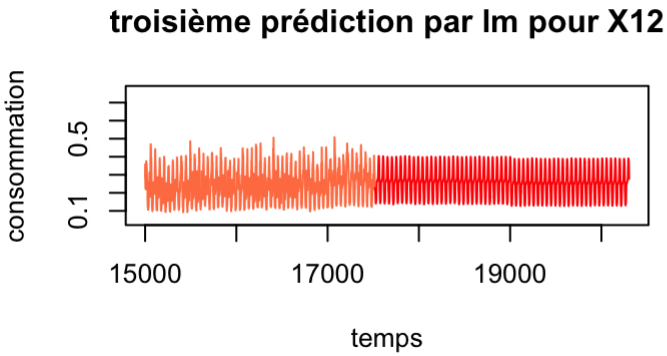



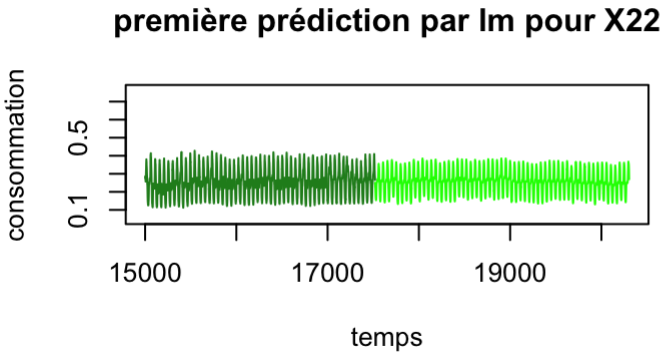
# Résultats pour `X12`

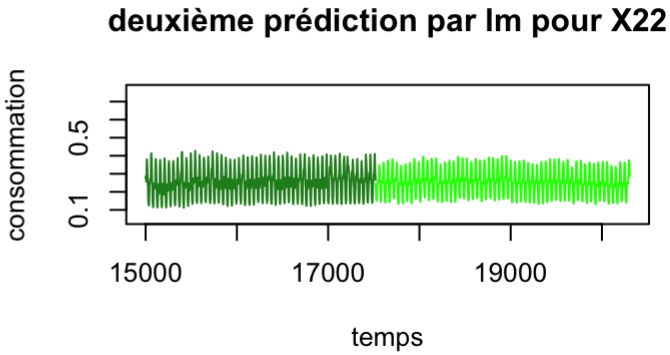


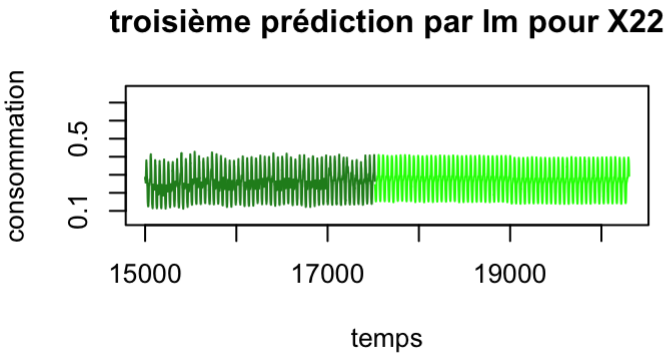



# Résultats pour `x22`



# Prédiction par modèle additif généralisé

# Choix des paramètres

- 
- 
- `rmse`

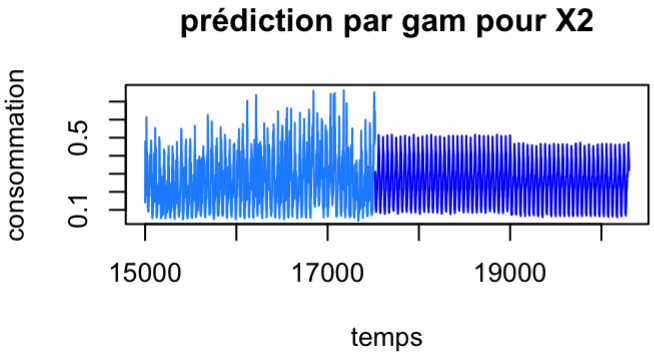
$$\texttt{Temperature}: k = 54 \qquad \texttt{heure}: k = 48$$
$$\texttt{mois}: k = 12 \qquad \texttt{Temperature.lag}: k = 10$$
$$\texttt{weekend.heure}: k = 10 \qquad \texttt{temp.weekend}: k = 40$$
$$\texttt{temp.mois}: k = 20 \qquad \texttt{temp.heure}: k = 18$$
$$\texttt{mois.heure}: k = 191$$

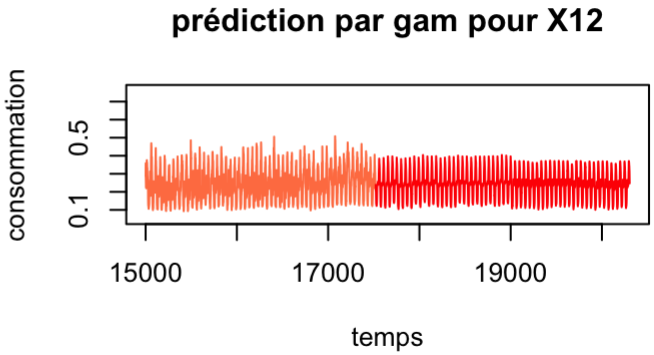
# Fonction de prédiction

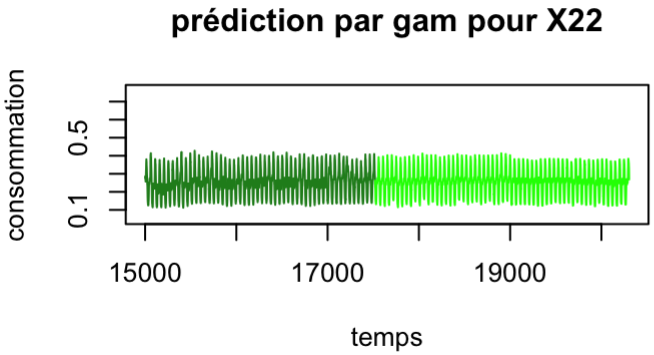
```
gam.pred <- function (k) {
  # modèle
  Xk <- data0[, k + 1]
  model <- gam(Xk ~ s(Temperature, k = 54) + s(heure.num, k = 48)
               + s(as.numeric(mois), k = 12) + s(mois.heure, k = 191)
               + s(weekend.heure, k = 10) + s(temp.weekend, k = 40)
               + s(temp.mois, k = 20) + s(Temperature.lag, k = 10)
               + s(temp.heure, k = 18), data = consom.csv)

  # prédiction
  Xk.pred <- data.frame(temp.Xk, heure.num.pred, mois.pred,
                        mois.heure.pred, weekend.heure.pred,
                        temp.Xk*weekend.pred,
                        temp.Xk*as.numeric(mois.pred),
                        temp.Xk.lag, temp.Xk*heure.num.pred)
  pred <- predict(model, newdata = Xk.pred)
}
```

# Résultats pour `X2`, `X12` et `X22`



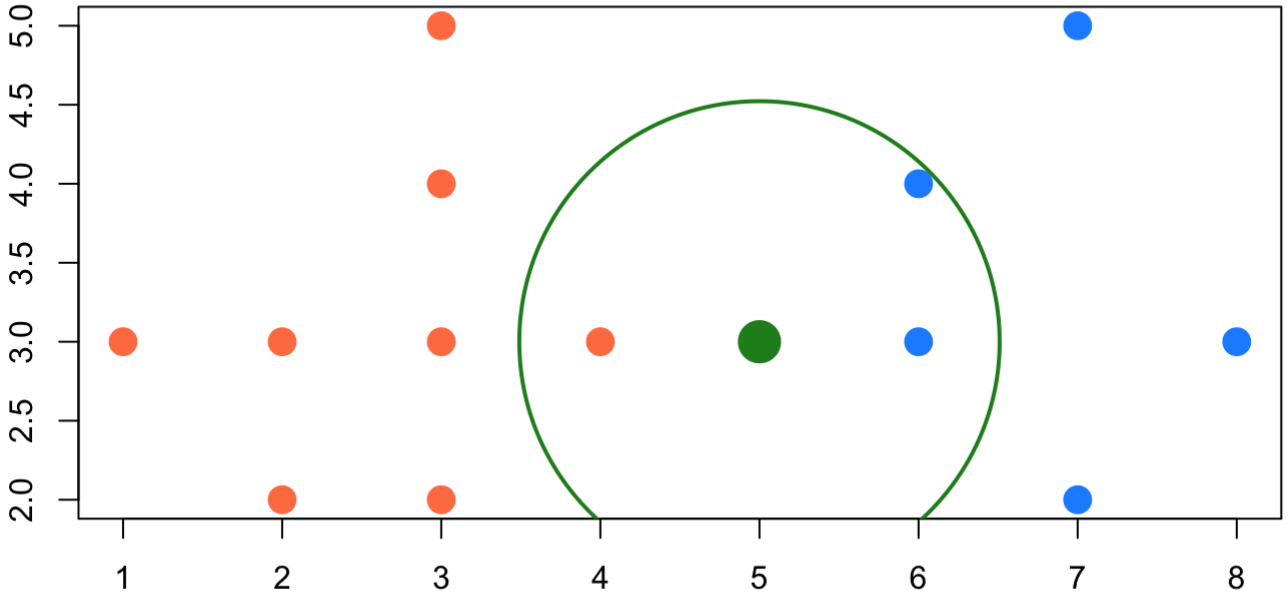
# Prédiction par les plus proches voisins

# Explications

- $\{x_i \text{ pour } i \in 1, \cdots, N\}$
- $x_i$ $c(x_i)$
- $k$ $x_i$

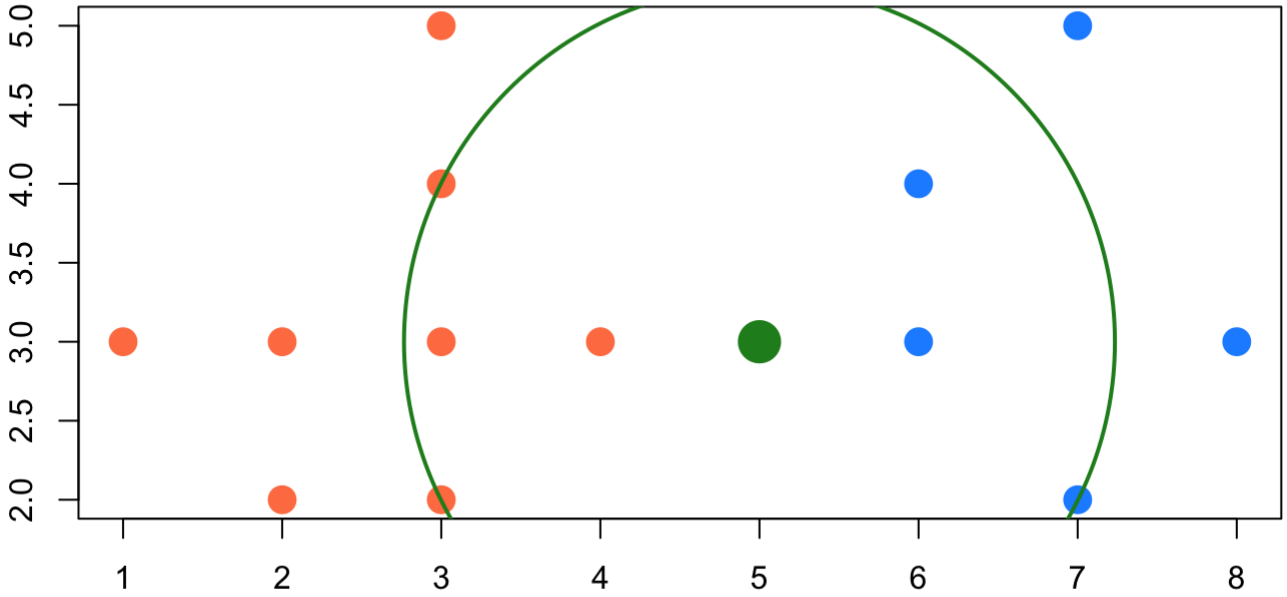
# Exemple

3



# Exemple

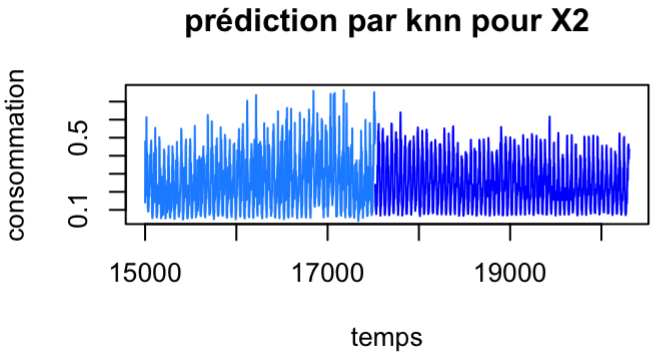
7

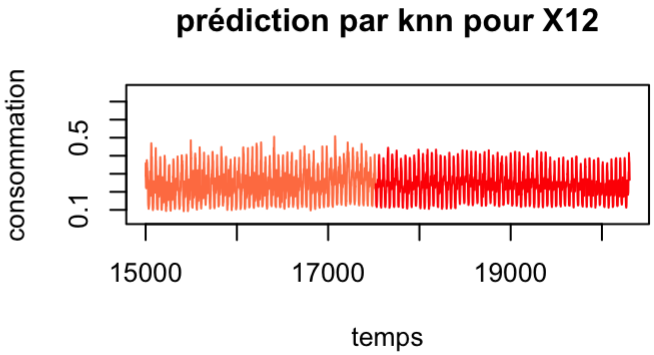


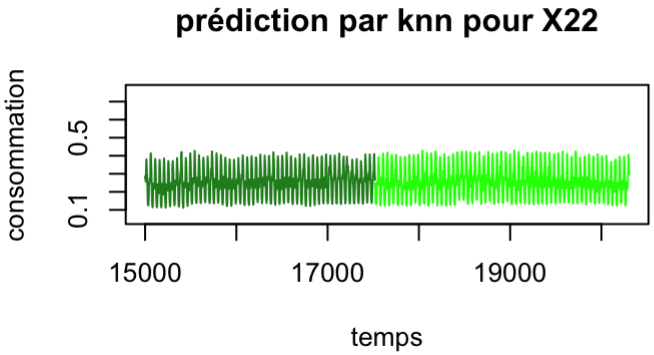
# Fonction de prédiction

```
PPVoisins <- function (i) {
  tra <- data.frame(mois, heure.num, weekend, week.num,
                    Temperature, Temperature.lag)
  tes <- data.frame(mois.pred, heure.num.pred, weekend.pred,
                      week.num.pred, Temperature.pred,
                      Temperature.lag.pred)
  tes <- tes[c((2784*(i - 1) + 1):(2784*i)), ]
  conso <- consom.csv[, i + 5]
  pred <- knn.reg(train = tra, test = tes, y = conso,
                  k = best_k[i])$pred
}
```

# Résultats pour `x2`, `x12` et `x22`



# Conclusion

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- lm
- knn

ARIMA

Merci pour votre attention !