Leg 3

The final ascent

(Fev 2026)

Manque pour plot définitifs!!! :

- scatter plot : Ajouter les obs partout! avec une droite!
    - scow pour tau (récupérer scow thetao sur pcf025?)
    - soda3 pour hfdsO
    - glorys * 3 pour wo

- Traiter glorys natif 1/12e pour thetao, so, uo, vo, **wo, hfdsO & tau**!

- pech12 (shflux) aller le récupérer dans le fichier sigma correspondant au fichier z
    - shflux:long_name = "averaged surface net heat flux" ;
    - swrad:long_name = "averaged Short-wave surface radiation" ;
    - Pas le Downward Heat Flux at Sea Water Surface

- Reprendre OA pour tau=f(dxdydz atmosphere)

A faire pour discussion :

- Ecrire sur les plots la liste des exclusion r2 et plot

Profiles

sst=f(wo)

wo=f(tau)

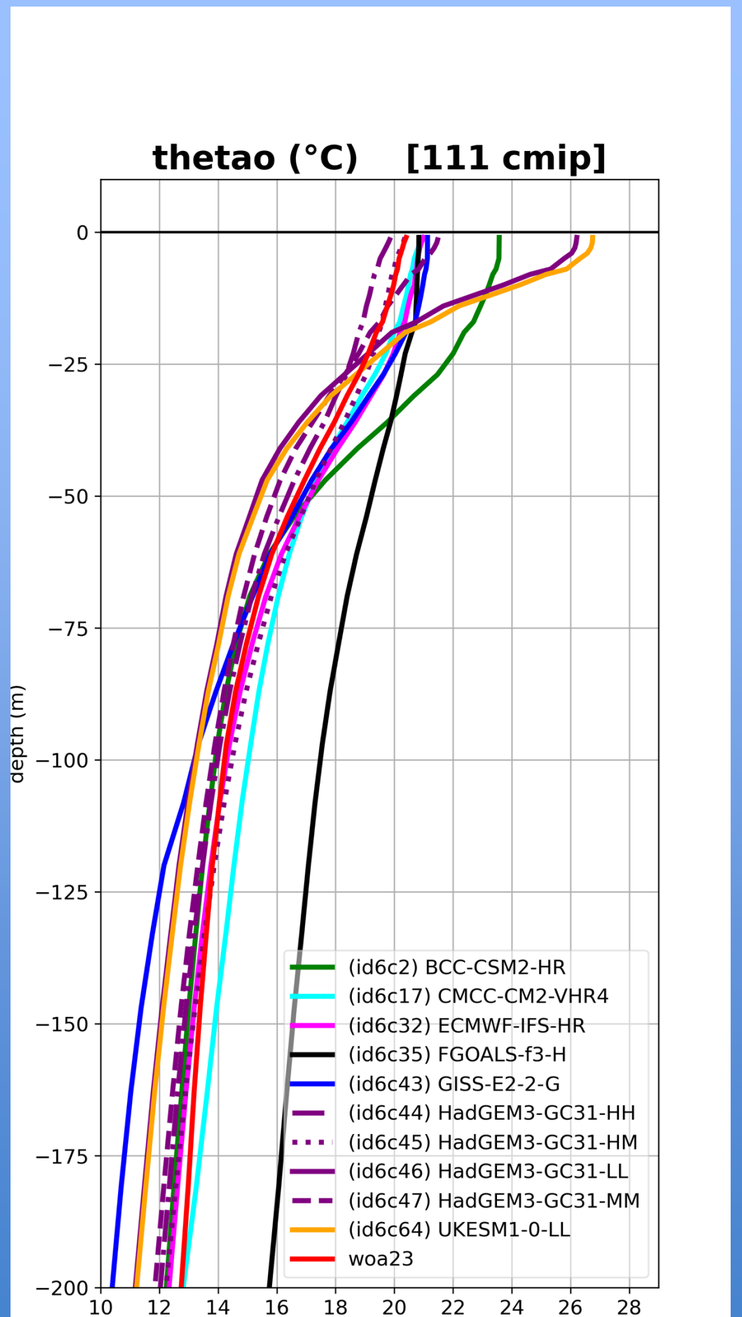
wo=f(dx,dy,dz) ocean

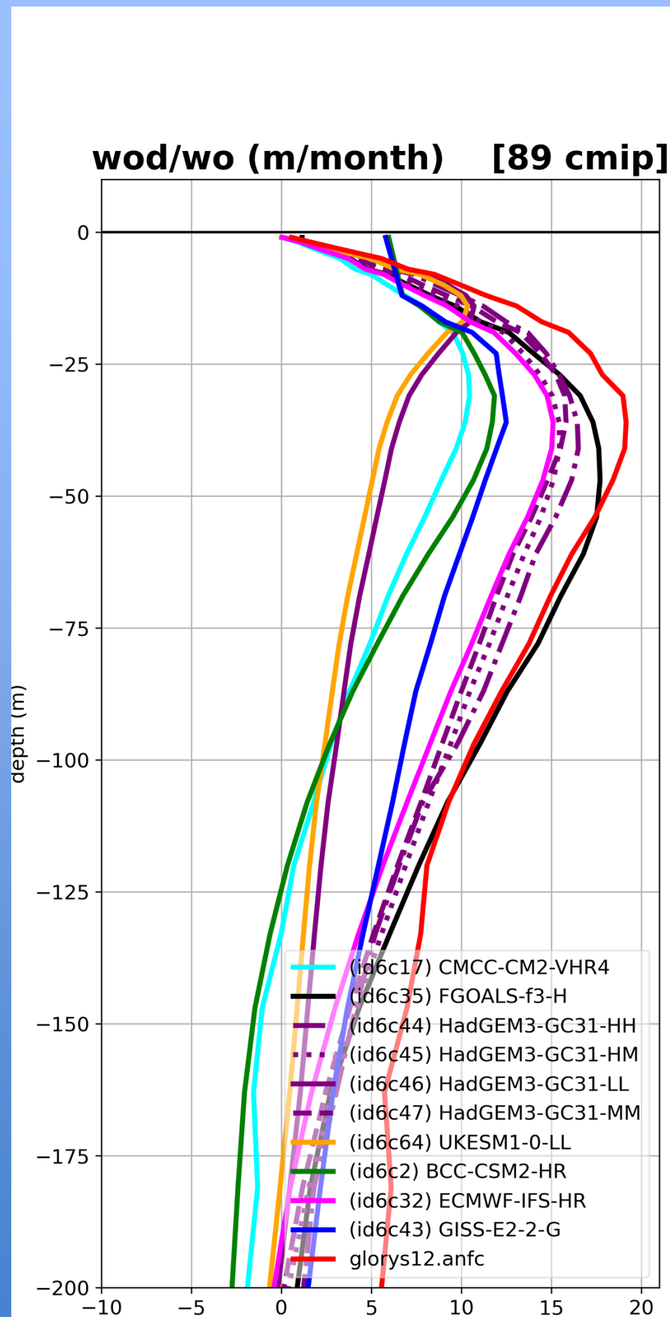
wo=f(dx,dy,dz) atmosphere

deltaT=f(Q,H,wo)

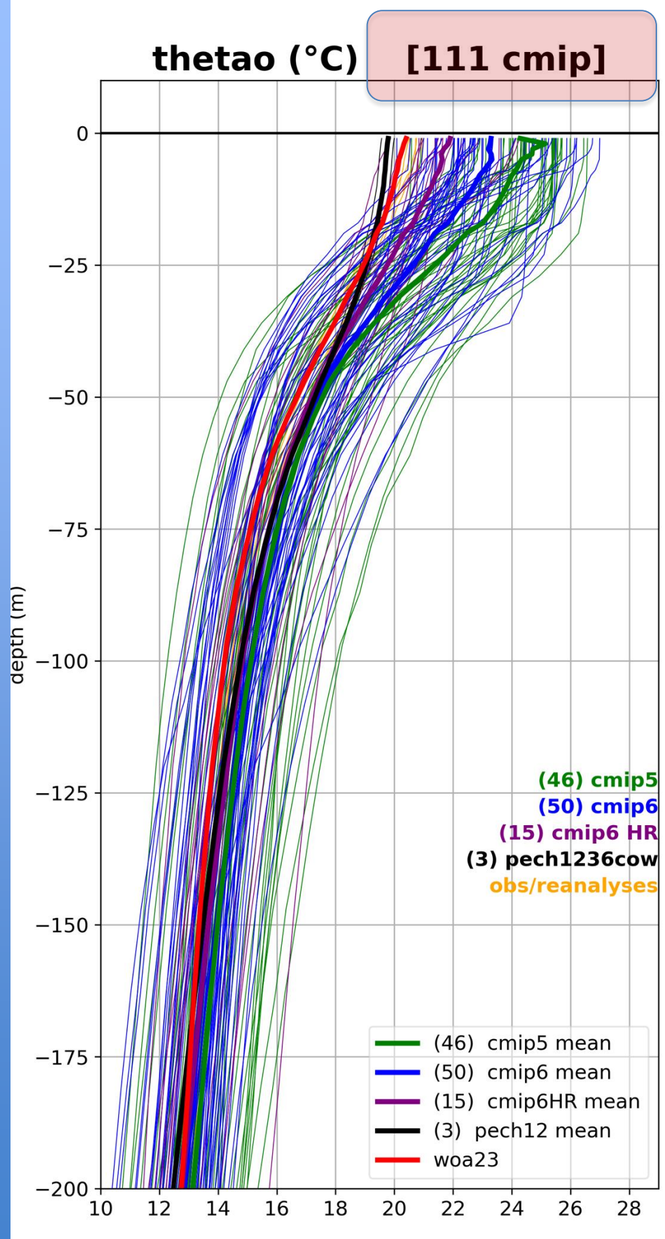
hfdsO=f(dT*wod)

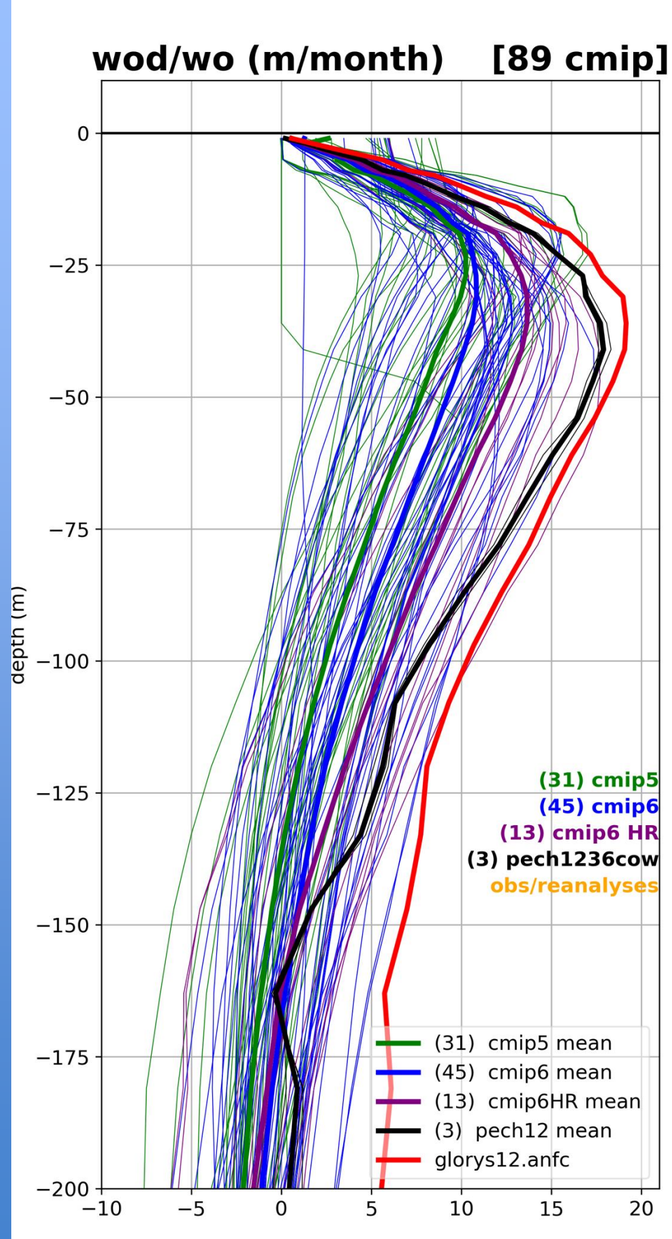
Profiles


thetao (°C) [111 cmip]
depth (m)
0
−25
−50
−75
−100
−125
−150
−175
−200
10
12
14
16
18
20
22
24
26
28
(id6c2) BCC-CSM2-HR
(id6c17) CMCC-CM2-VHR4
(id6c32) ECMWF-IFS-HR
(id6c35) FGOALS-f3-H
(id6c43) GISS-E2-2-G
(id6c44) HadGEM3-GC31-HH
(id6c45) HadGEM3-GC31-HM
(id6c46) HadGEM3-GC31-LL
(id6c47) HadGEM3-GC31-MM
(id6c64) UKESM1-0-LL
woa23


wod/wo (m/month) [89 cmip]
depth (m)
0
−25
−50
−75
−100
−125
−150
−175
−200
−10
−5
0
5
10
15
20
(id6c17) CMCC-CM2-VHR4
(id6c35) FGOALS-f3-H
(id6c44) HadGEM3-GC31-HH
(id6c45) HadGEM3-GC31-HM
(id6c46) HadGEM3-GC31-LL
(id6c47) HadGEM3-GC31-MM
(id6c64) UKESM1-0-LL
(id6c2) BCC-CSM2-HR
(id6c32) ECMWF-IFS-HR
(id6c43) GISS-E2-2-G
glorys12.anfc

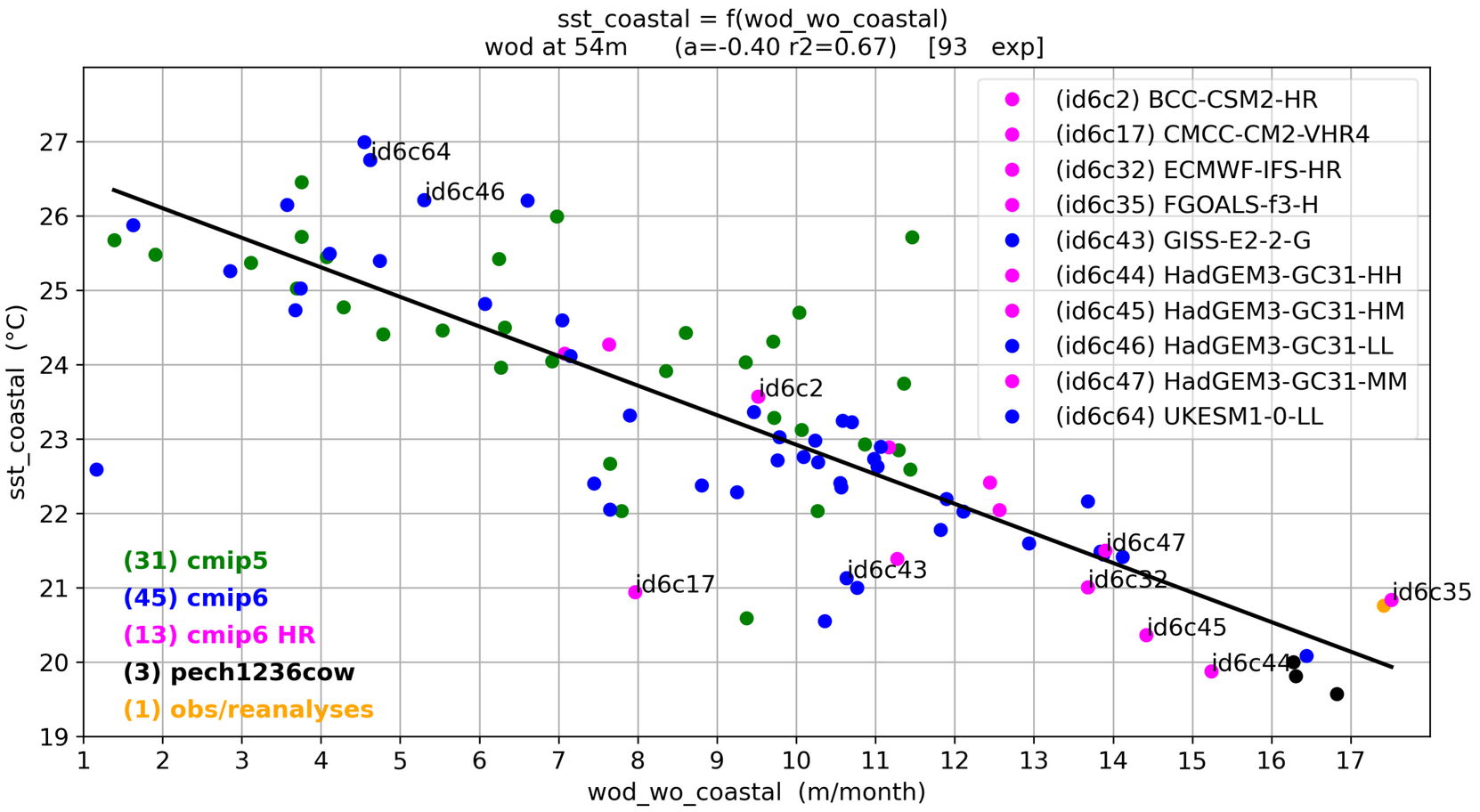
Remplacer par les 89 exp wo!?!





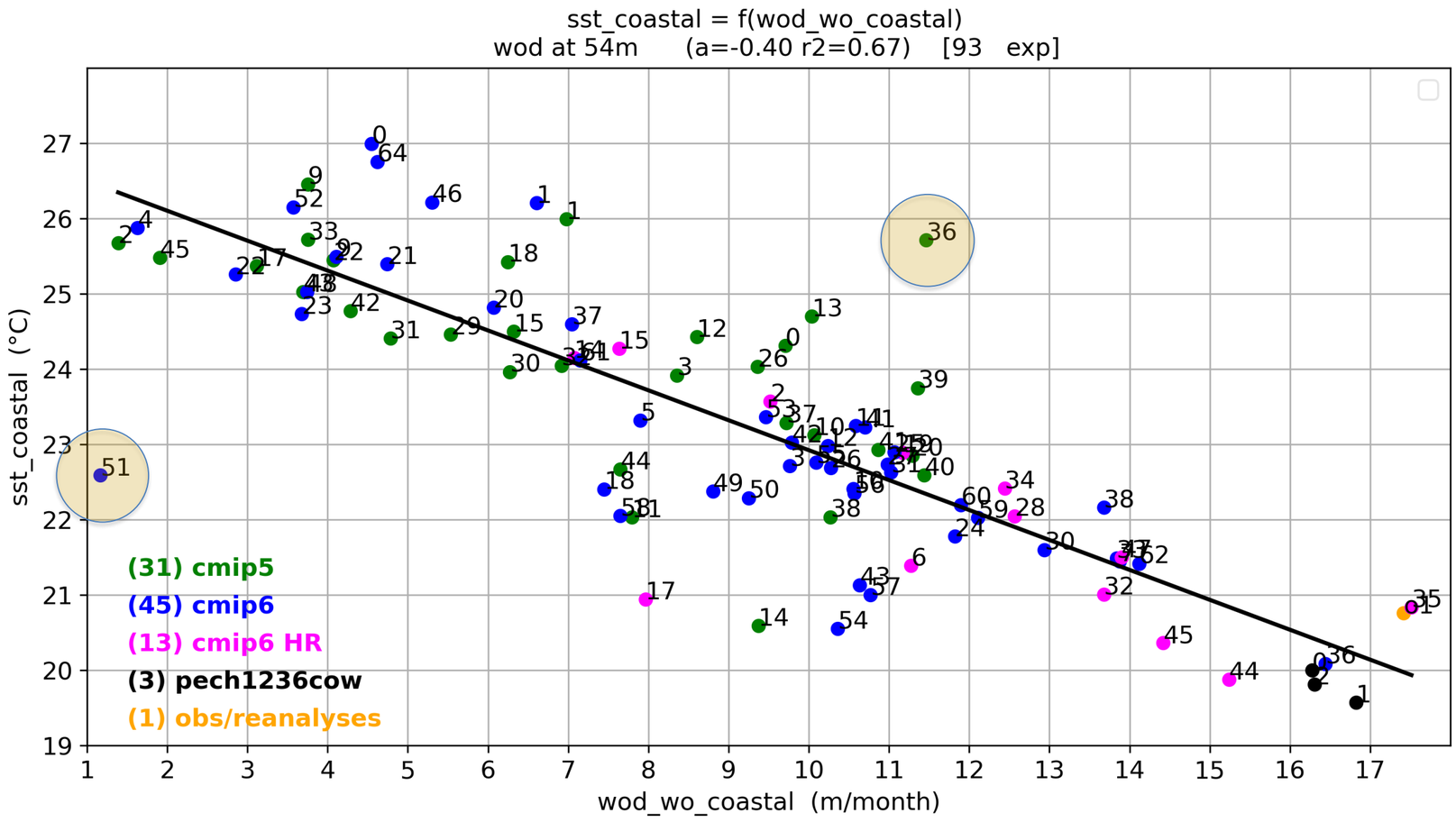
$$sst=f(wo)$$

sst coastal = f (wod+wo coastal)



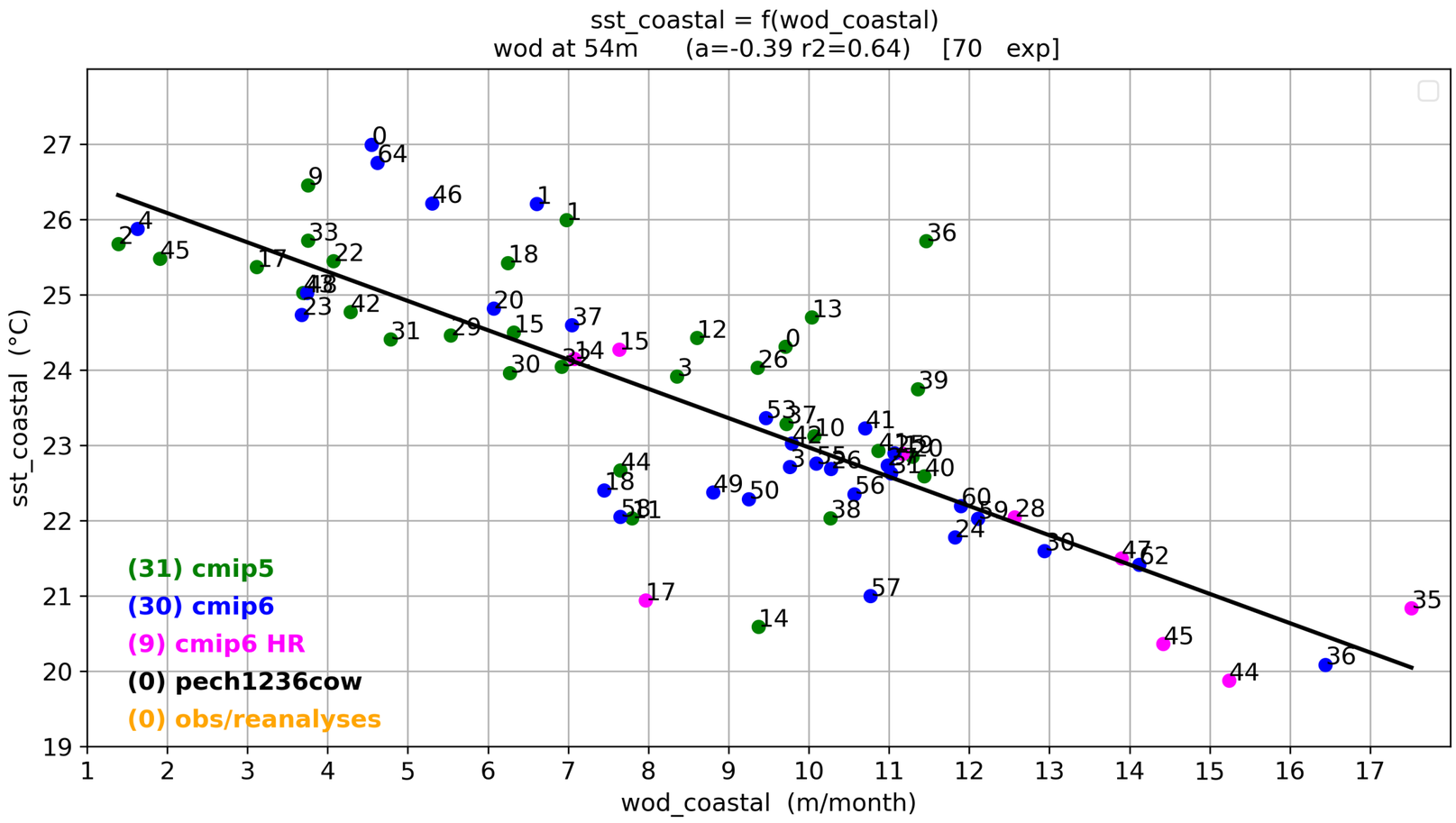
wo | wod | wod+wo

sst coastal = f (wod+wo coastal)

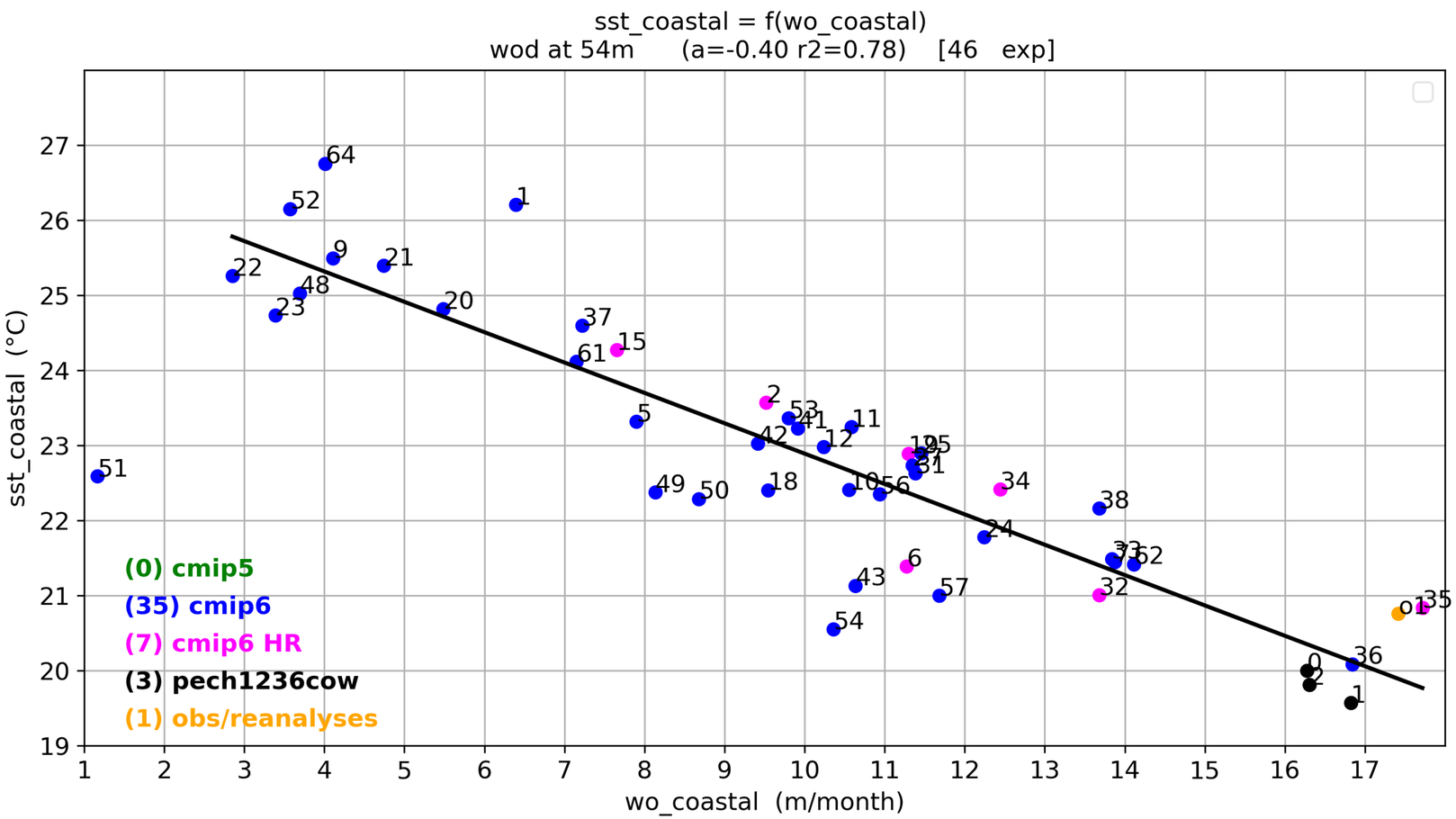


- (id5c36) cmip5_MIROC4h
  - Wo pas si mauvais, mais la subsurface la plus chaude peut-être de tous les cmip!
- (Id6c51) cmip6_MCM-UA-1-0
  - wo quasi nul, mais n'a pas d'EUC!!!
  - Sans doute à cause de la résolution
  - dx=1.88 et dy=2.24 et dz=15!!!!

sst coastal = f (wod coastal)



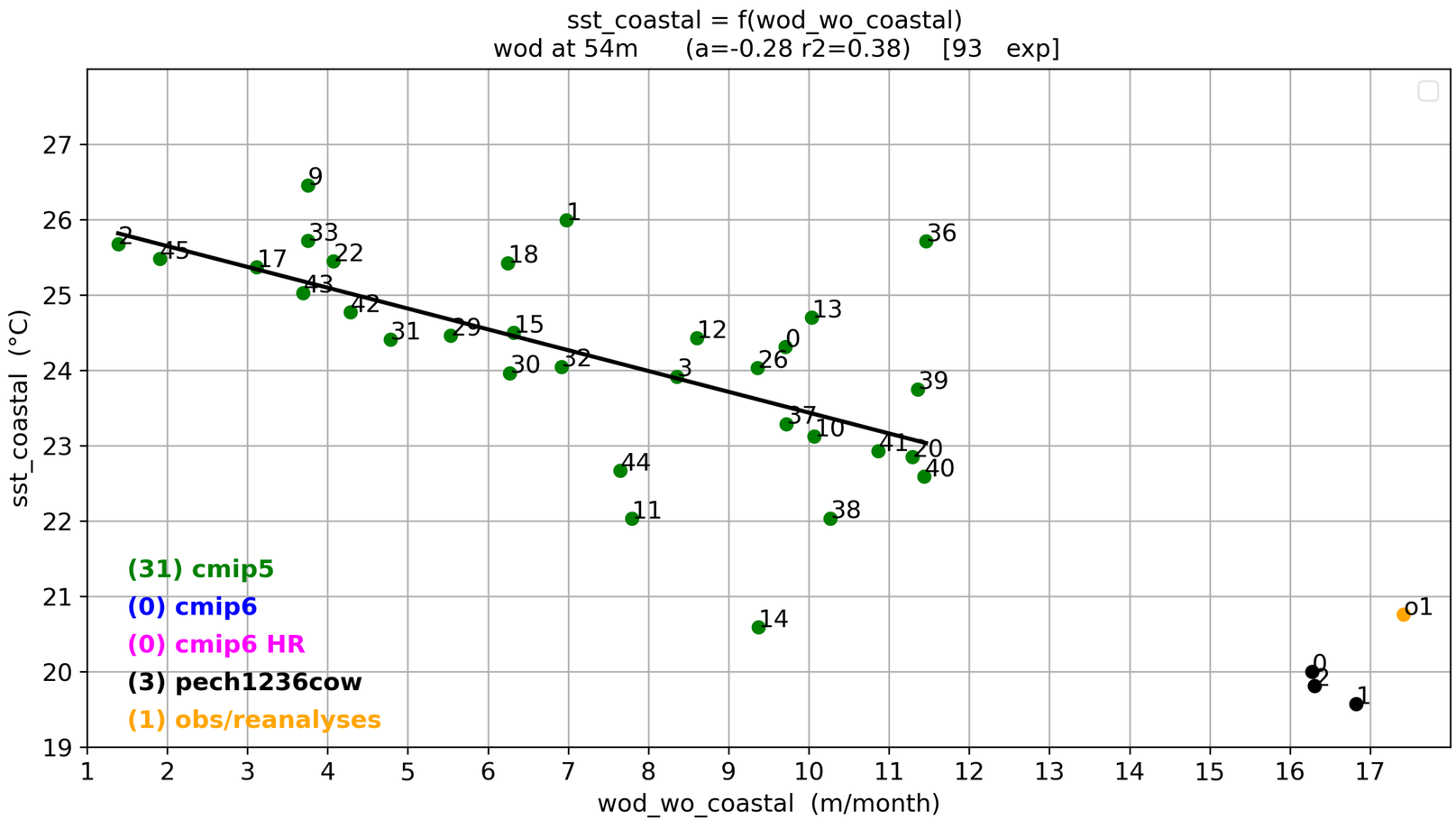
sst coastal = f (wo coastal)



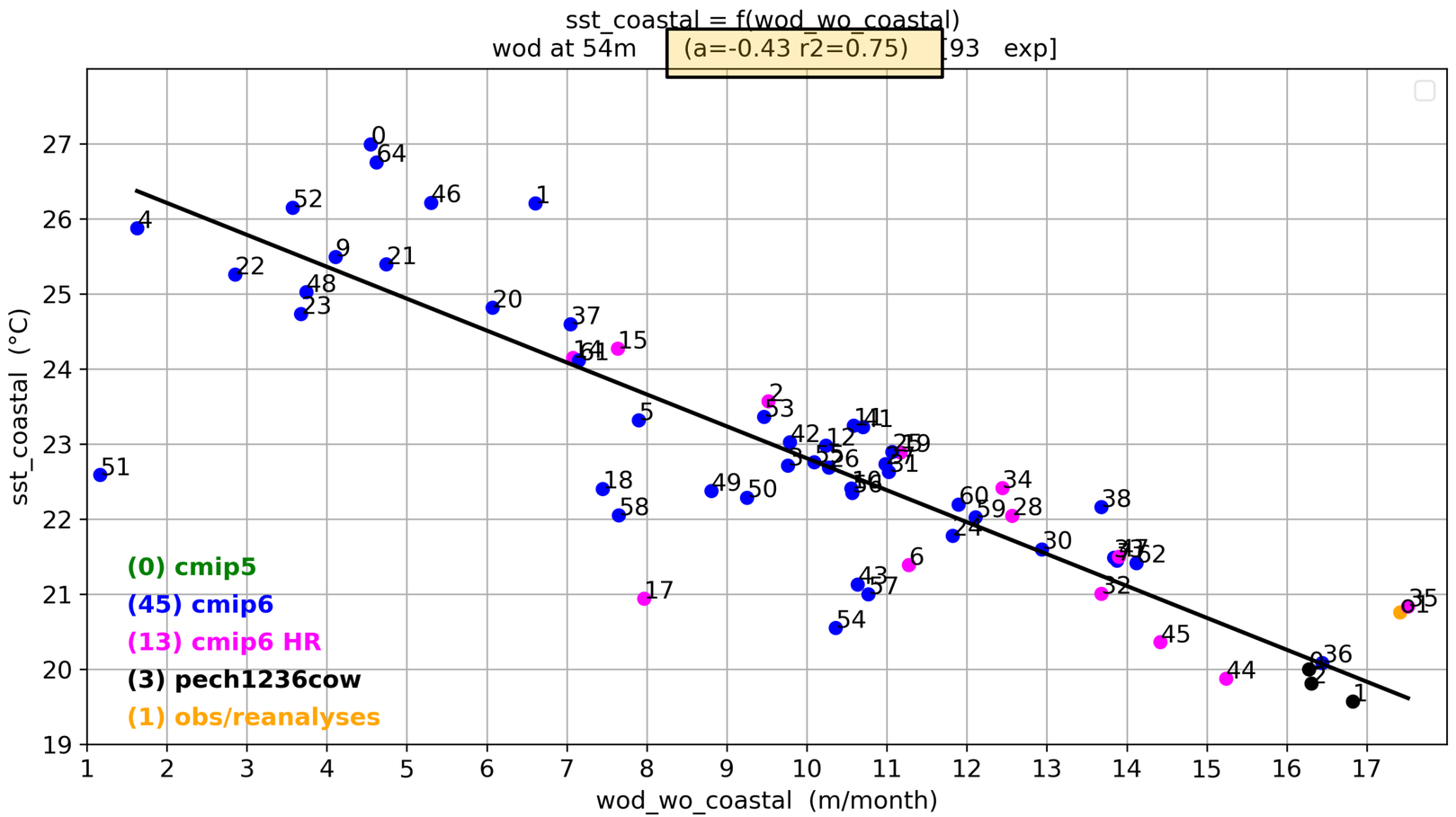
wod+wo

Cmip5 | cmip6

cmip5 : sst coastal = f (wod+wo coastal)



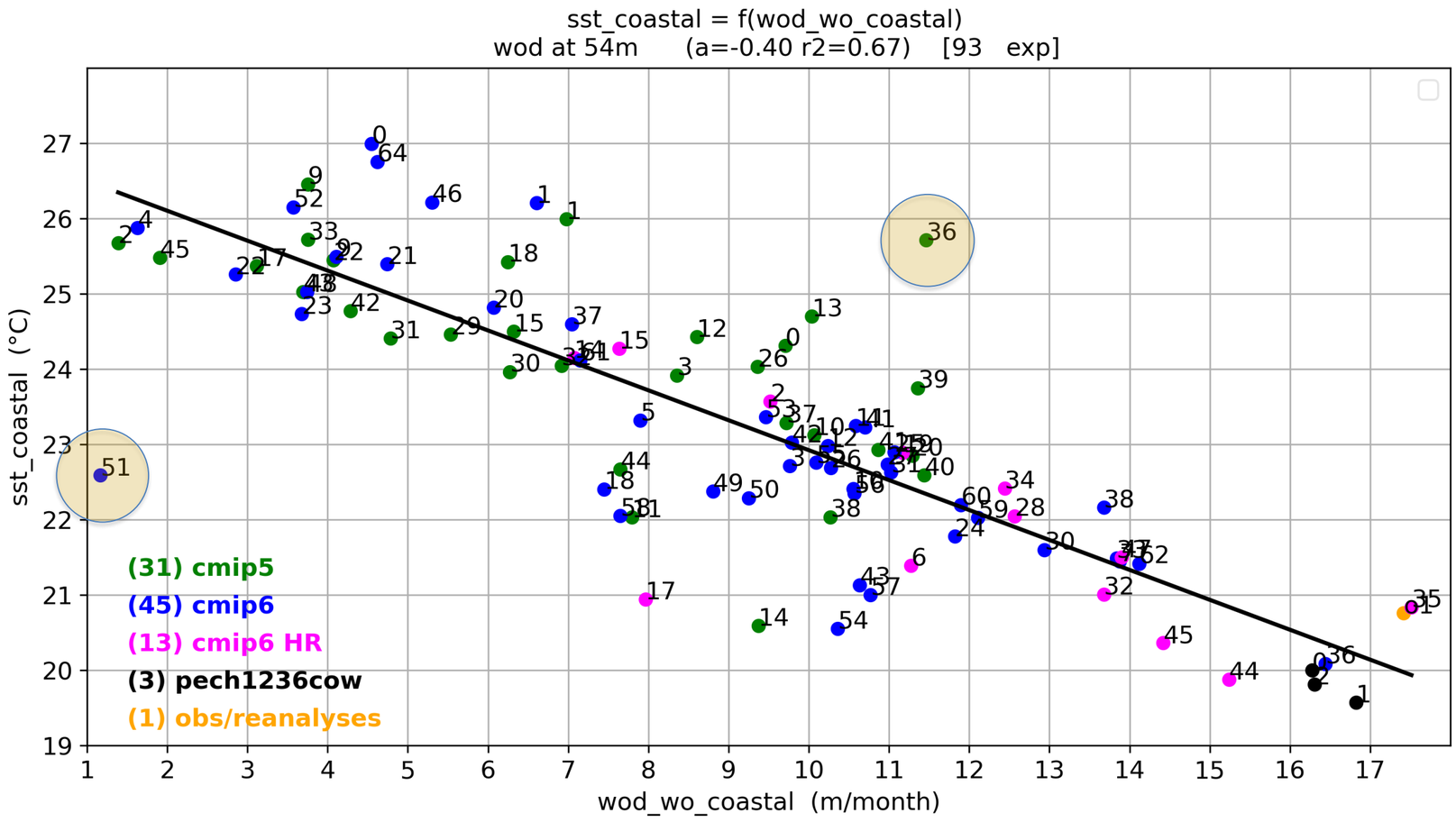
cmip6 : sst coastal = f (wod+wo coastal)



wod+wo

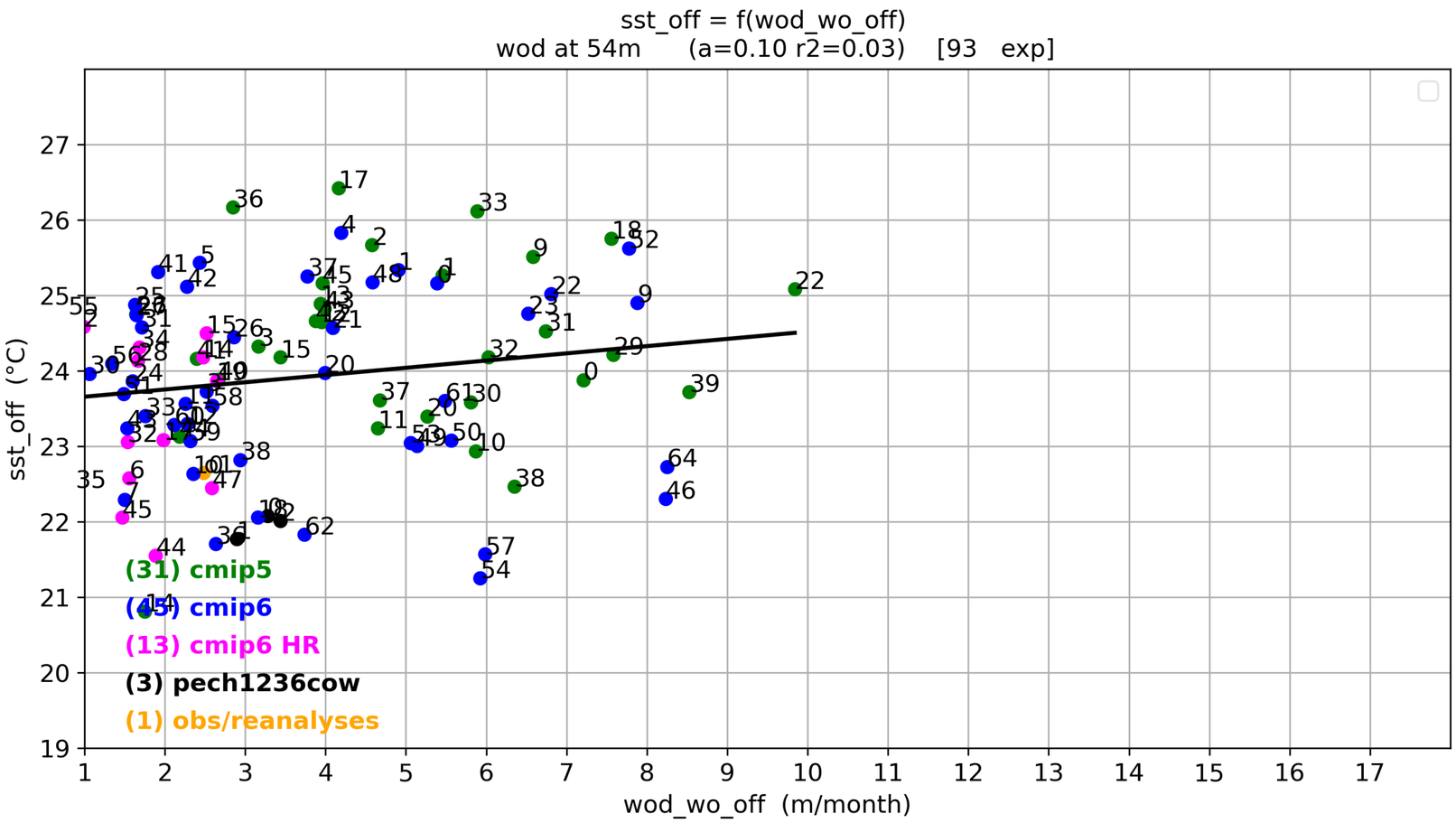
- coastal
- off
- total

sst coastal = f (wod+wo coastal)

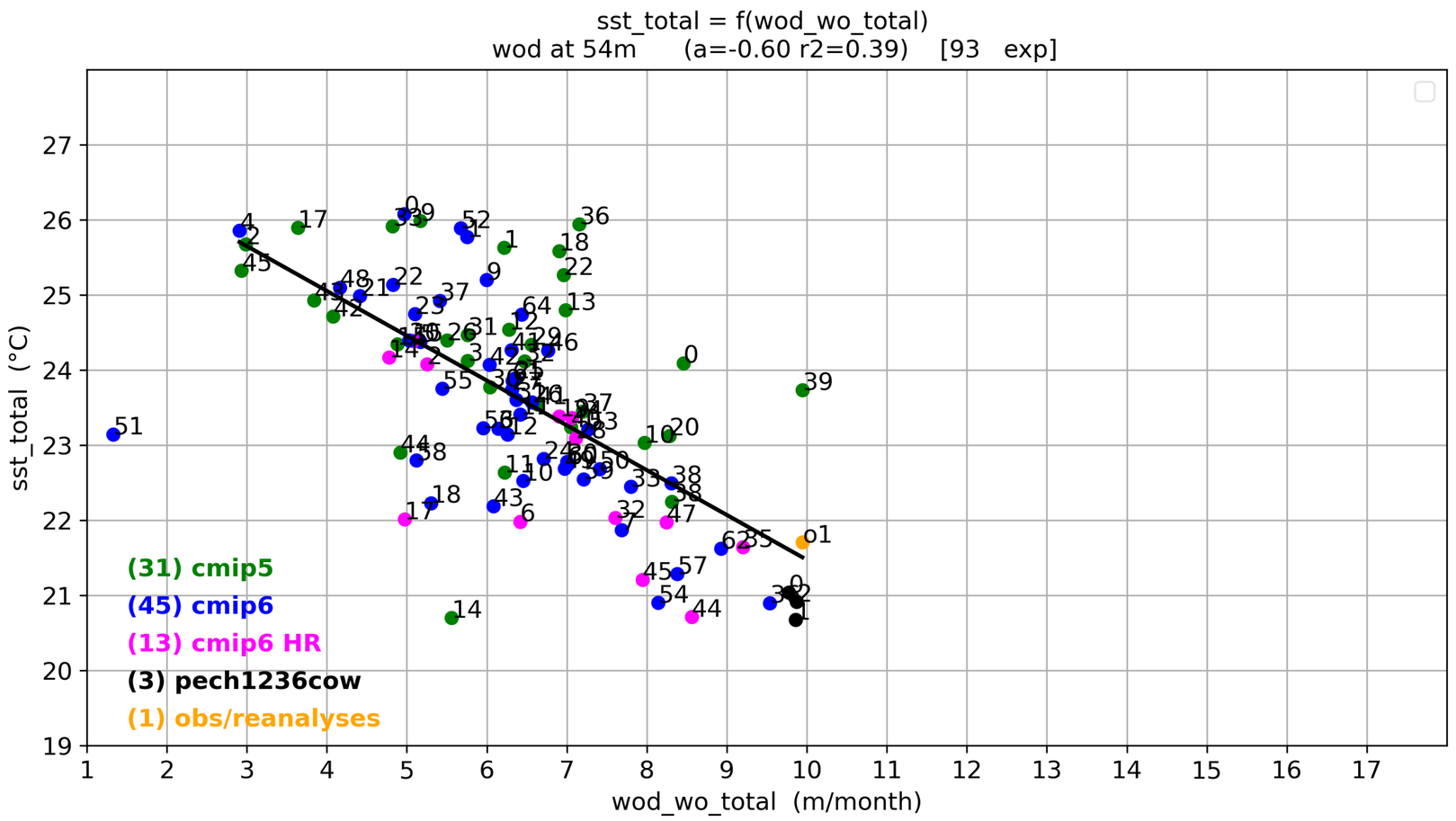


- (id5c36) cmip5_MIROC4h
  - Wo pas si mauvais, mais la subsurface la plus chaude peut-être de tous les cmip!
- (Id6c51) cmip6_MCM-UA-1-0
  - wo quasi nul, mais n'a pas d'EUC!!!

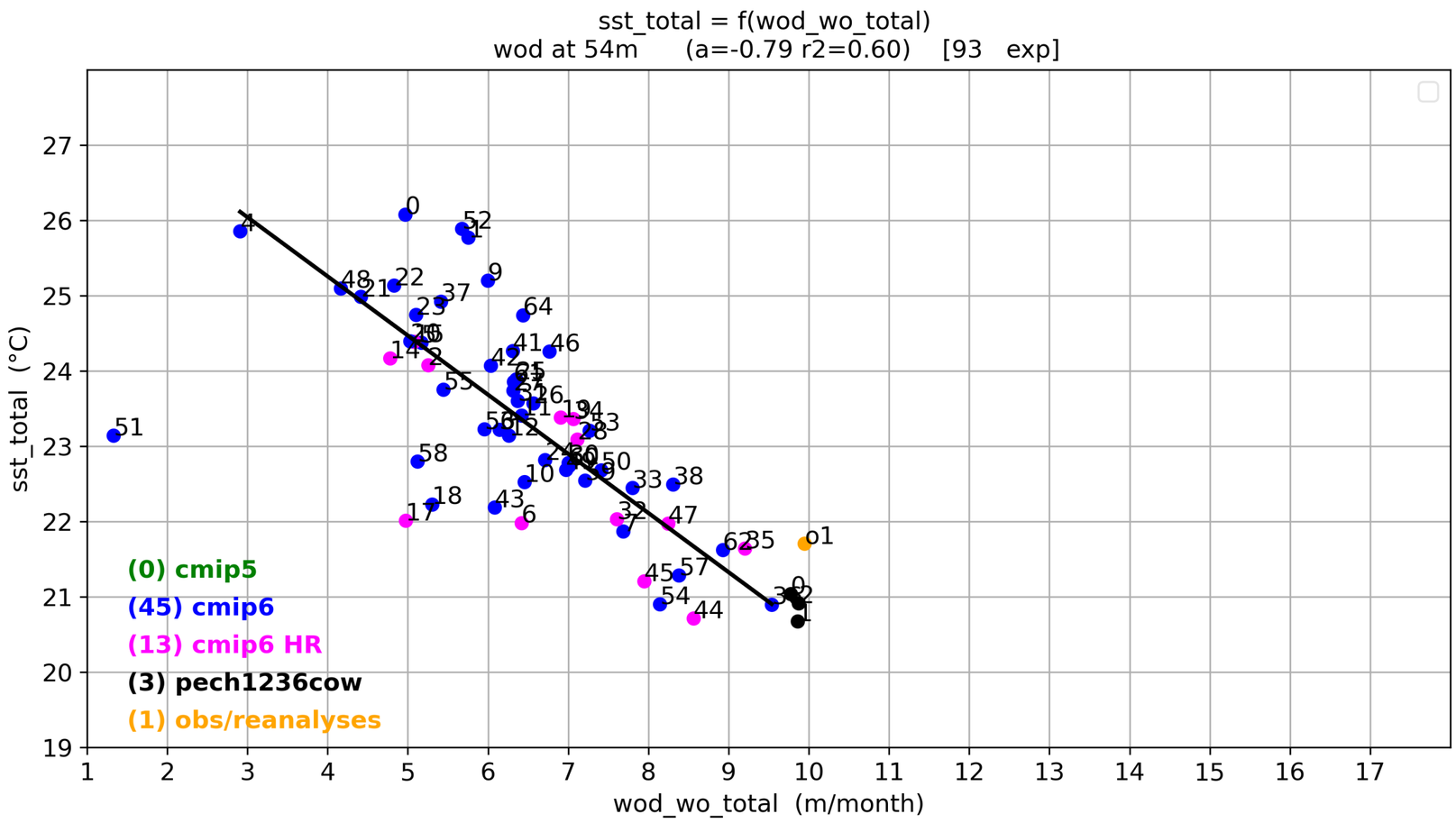
sst off = f (wod+wo off)



sst total = f (wod+wo total)



cmip6 : sst total = f (wod+wo total)

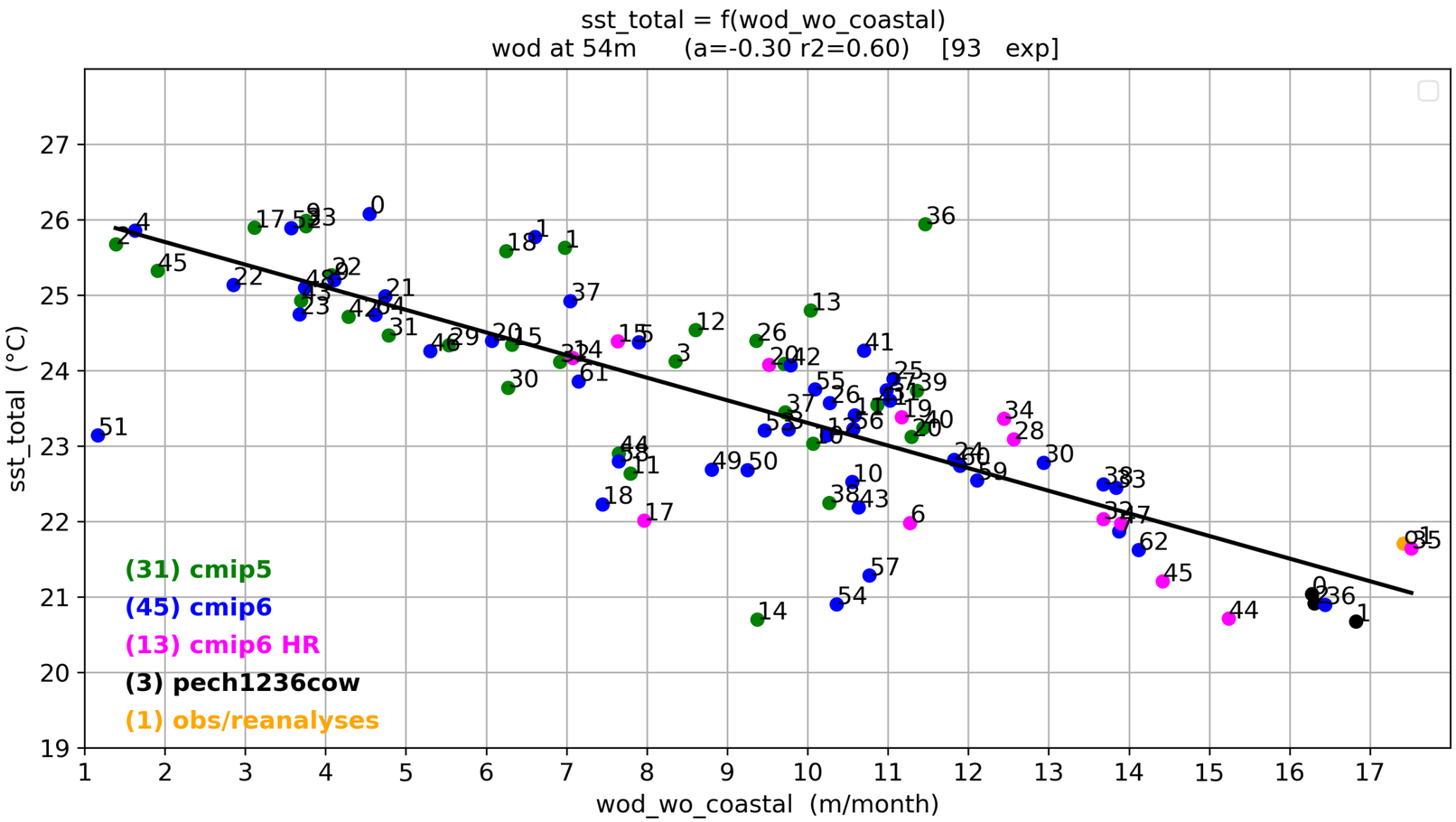


- (id6c44) cmip6_HadGEM3-GC31-HH

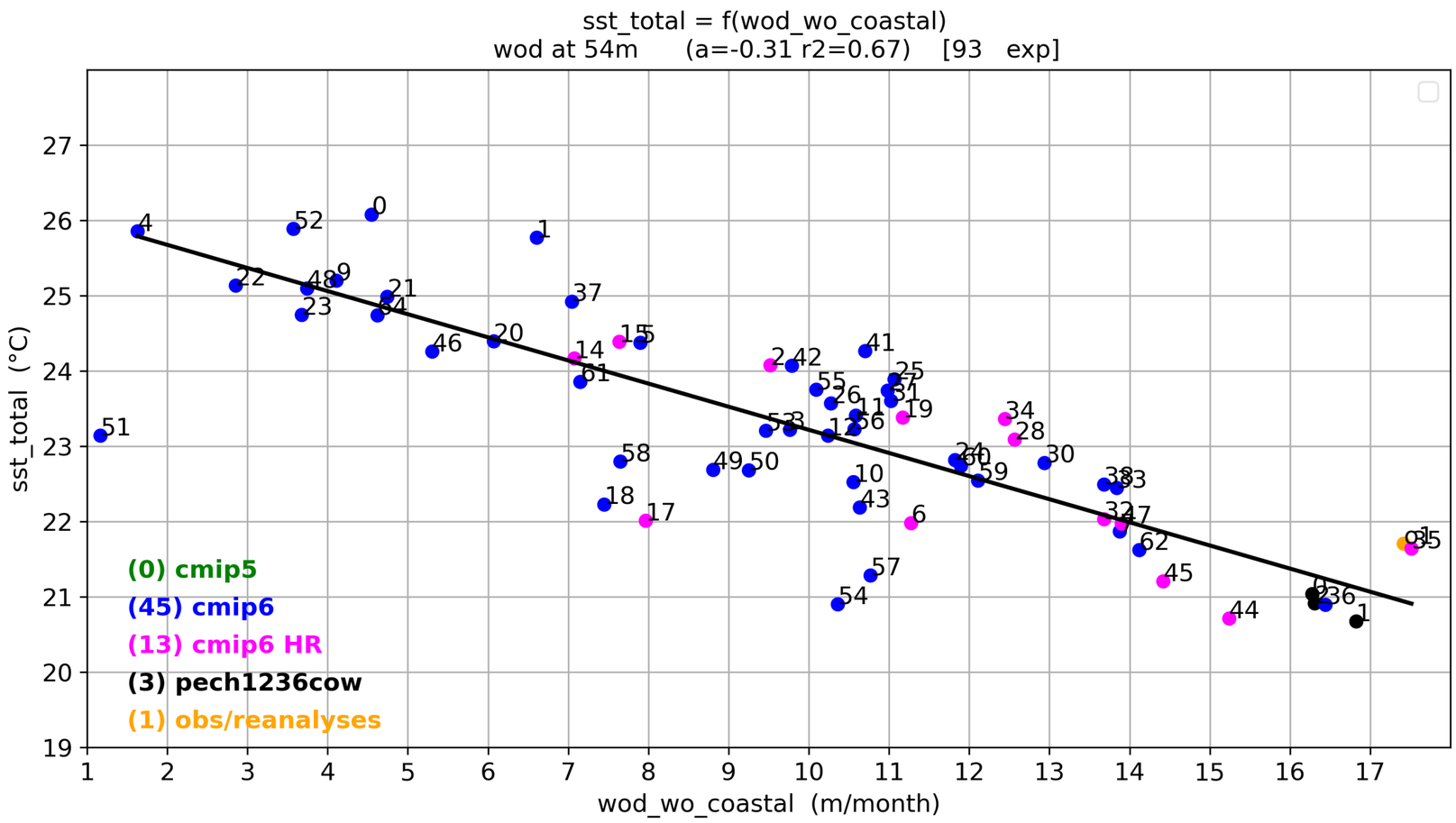
  passe de
  - wod = 2 pour off
  - Wod=15 pour coastal

  Le différenciel entre coastal/wo a-t-il de l'importance?

sst total = f (wod+wo coastal)



cmip6 : sst total = f (wod+wo coastal)



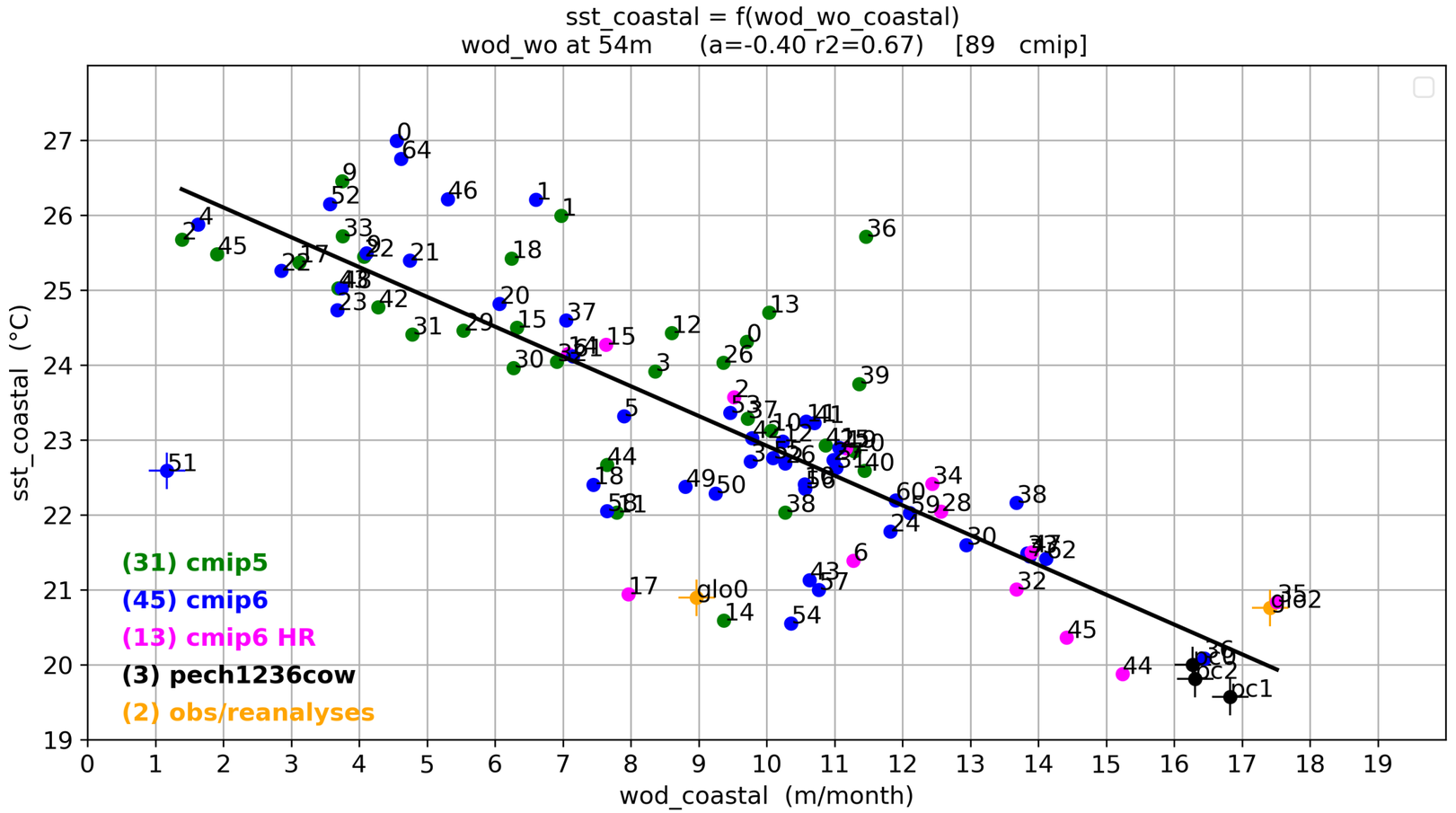
wod 54m

/

Wod 10-70m

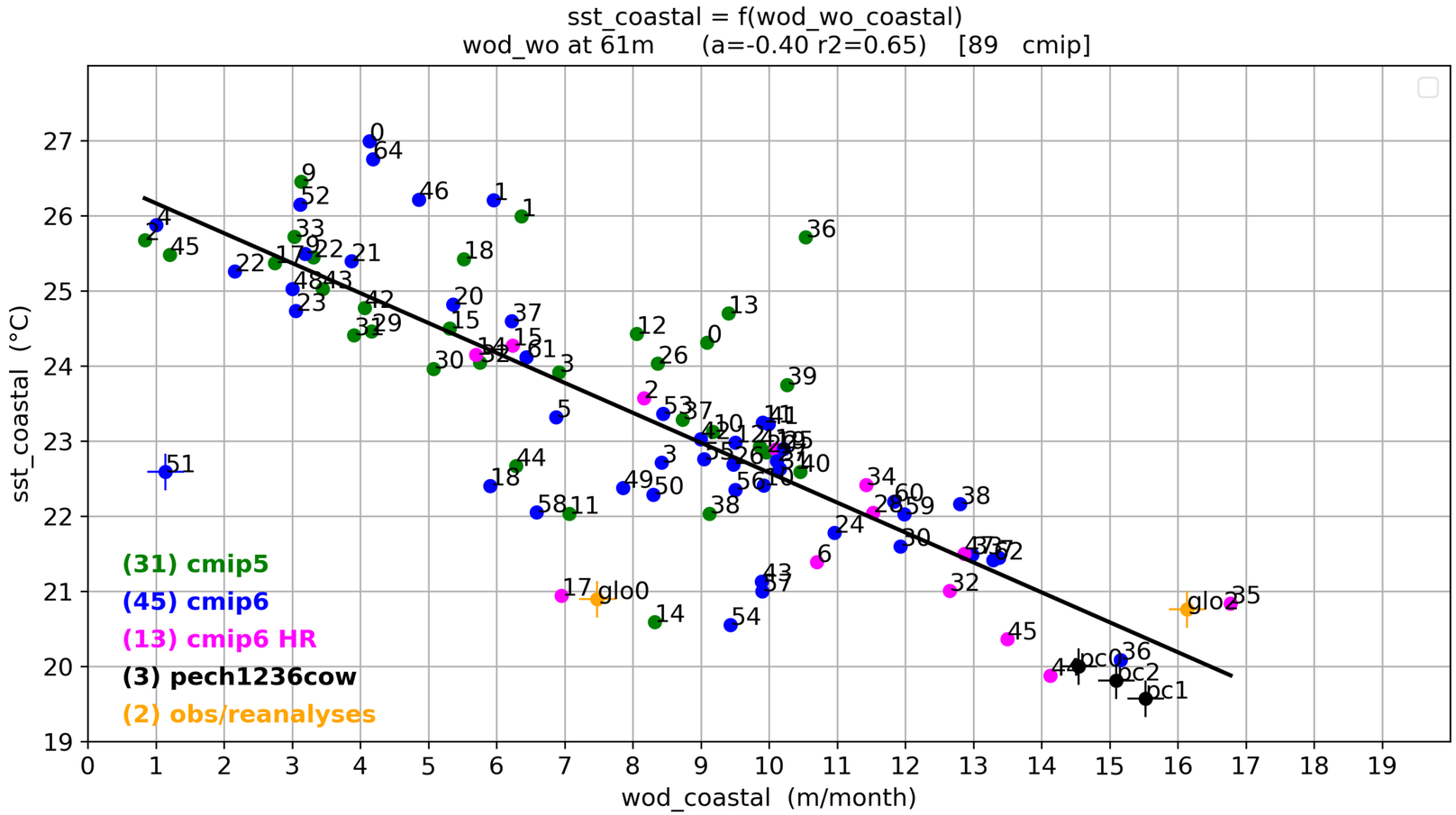
54m

sst coastal = f (wod+wo coastal)



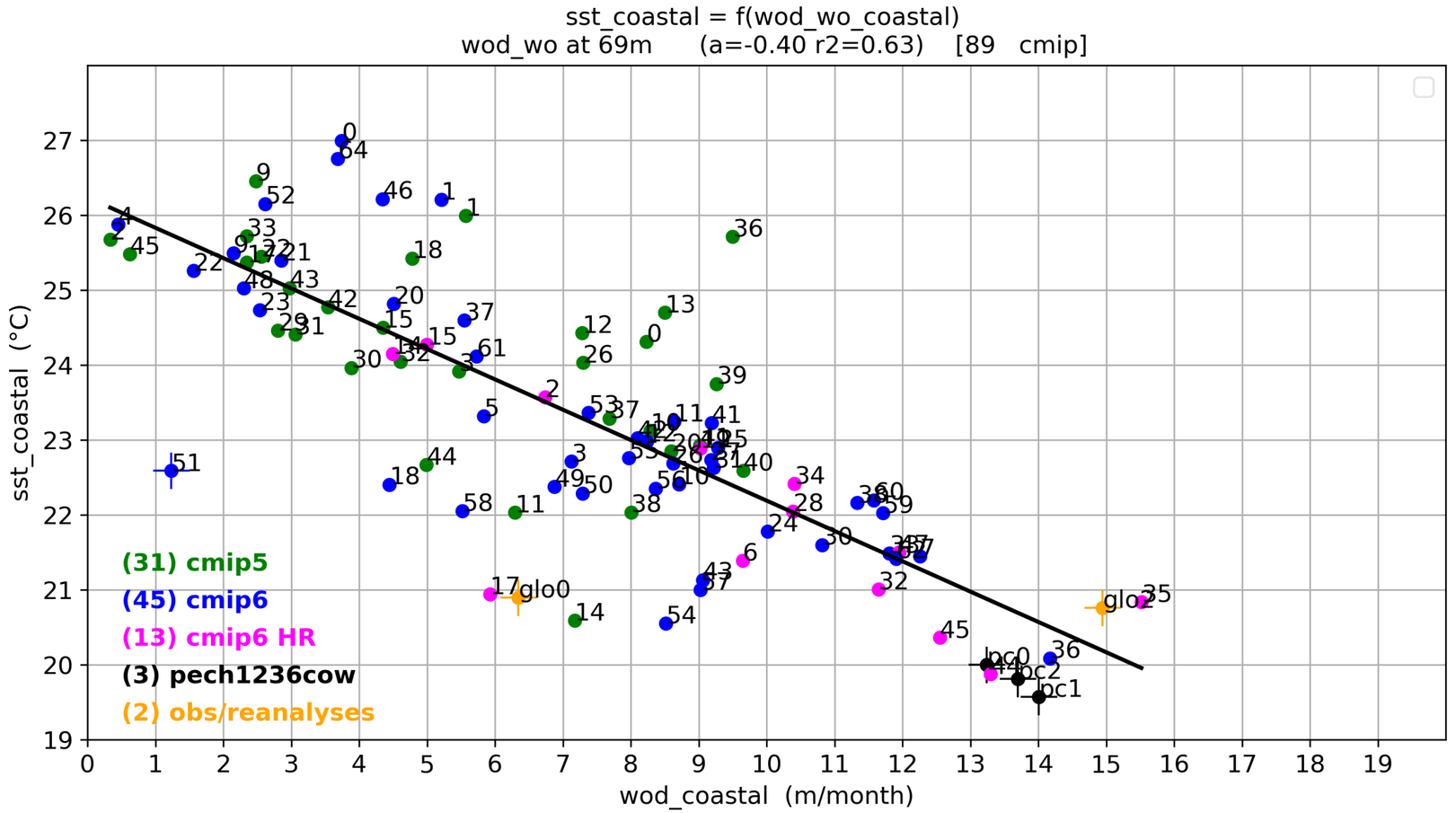
61m

sst coastal = f (wod+wo coastal)



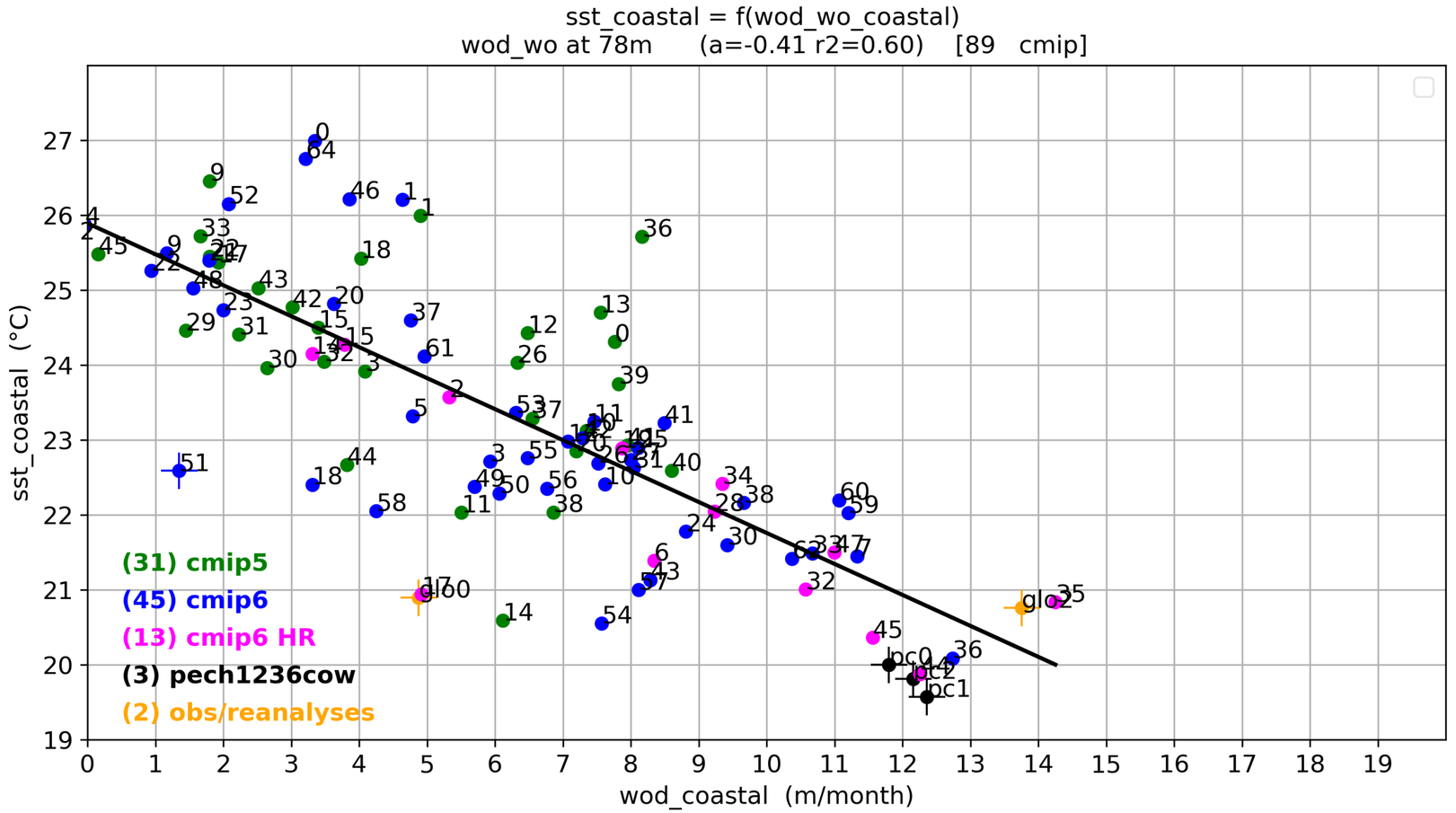
69m

sst coastal = f (wod+wo coastal)



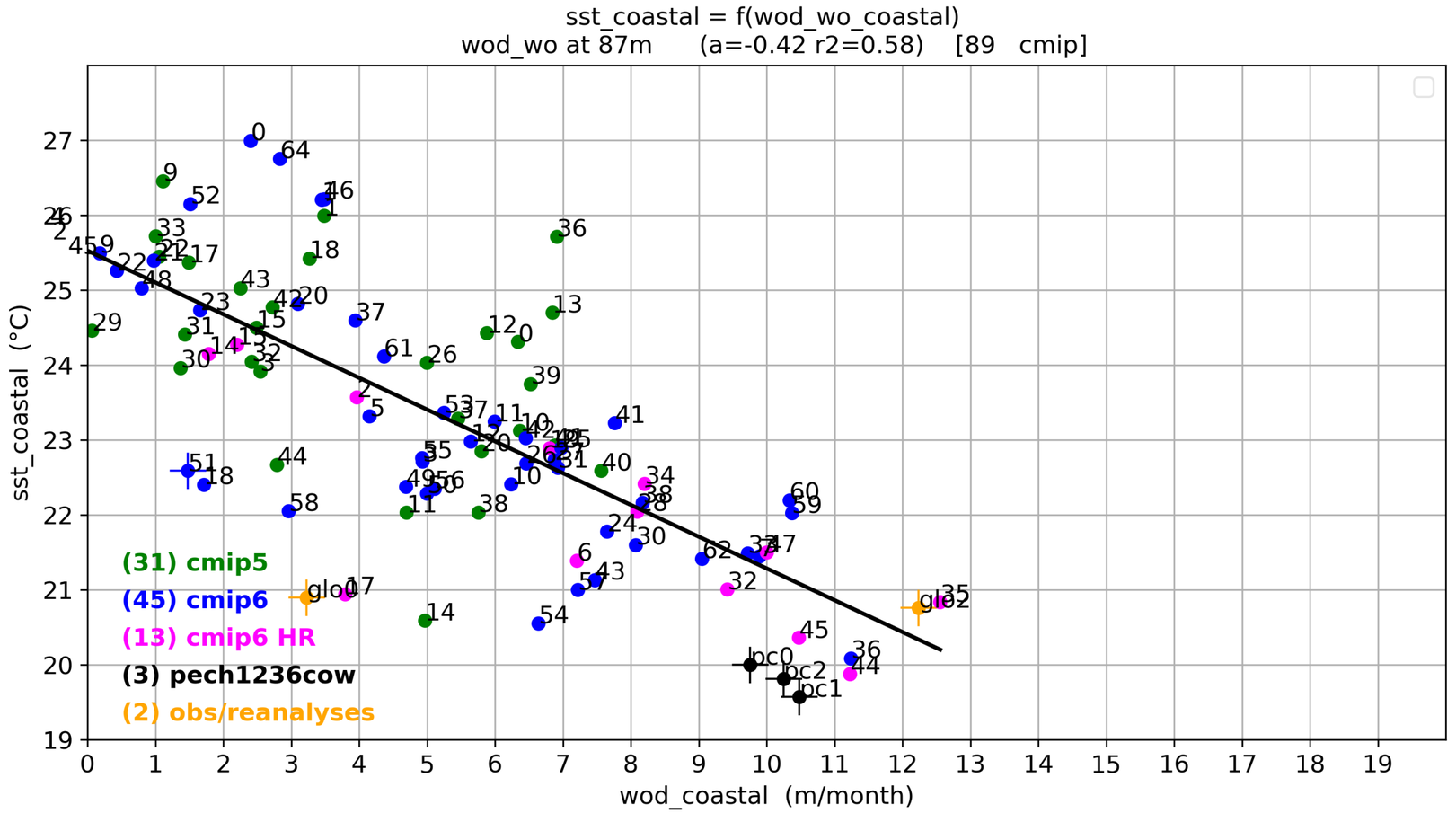
78m

sst coastal = f (wod+wo coastal)



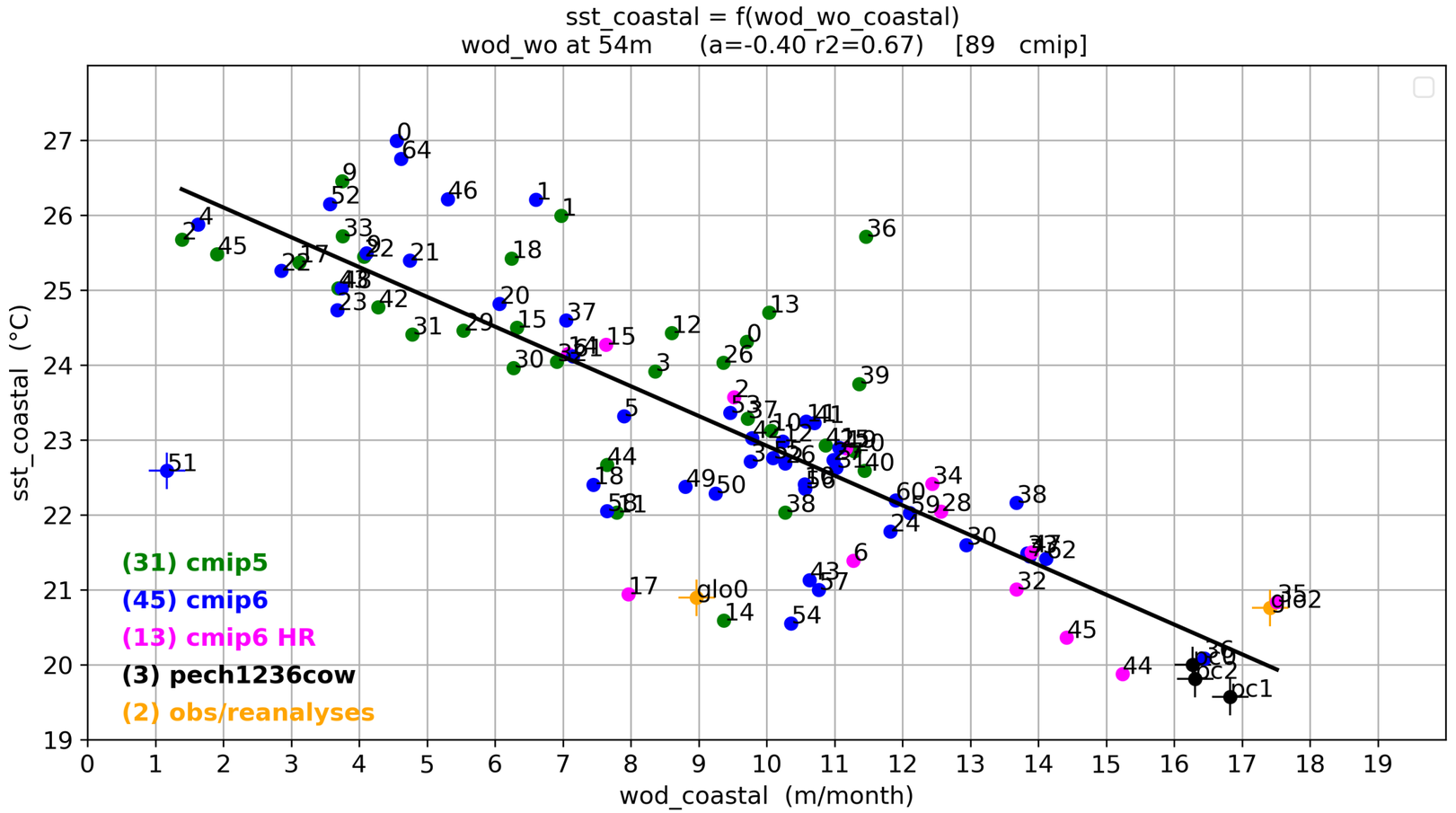
87m

sst coastal = f (wod+wo coastal)



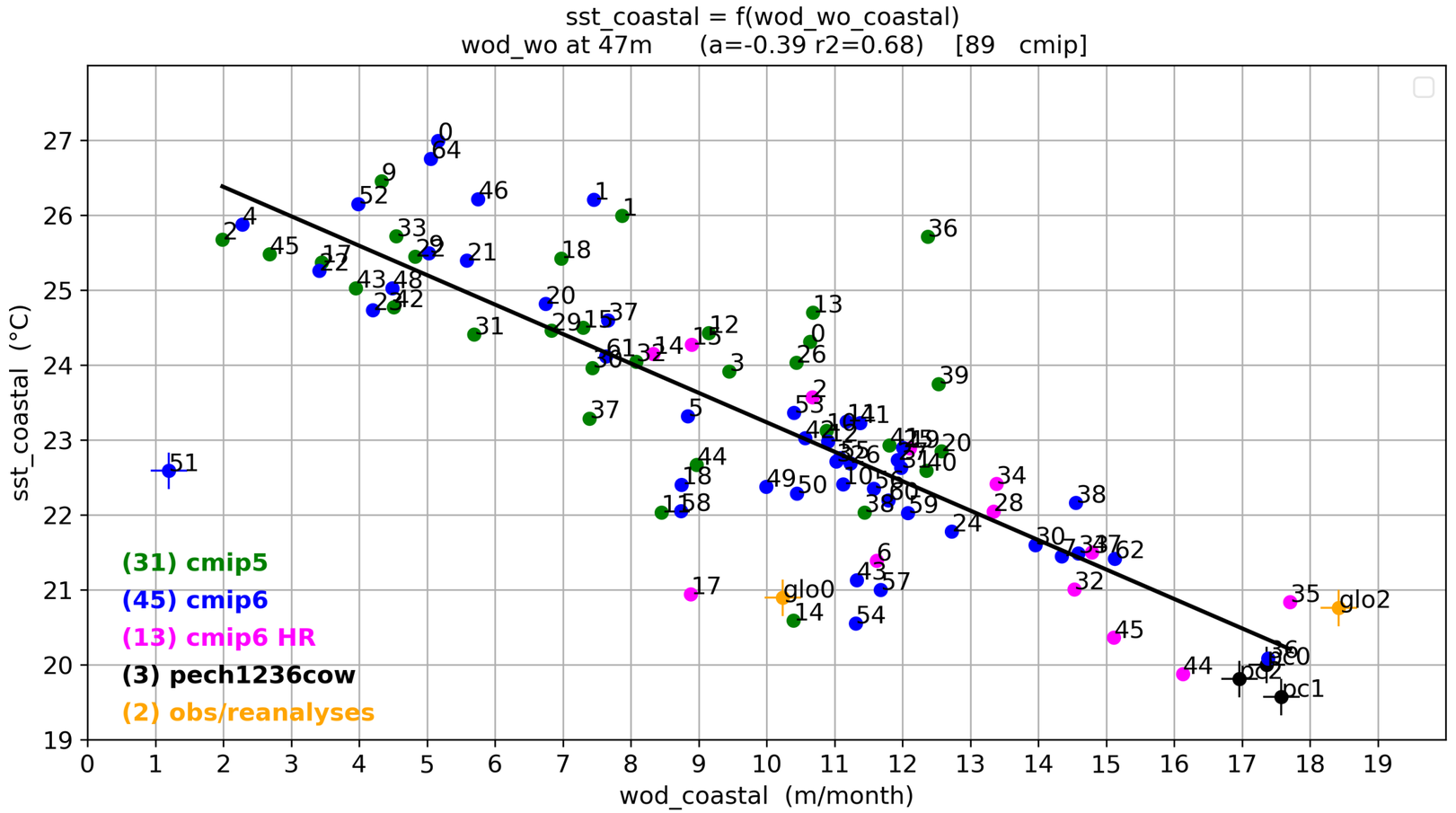
54m

sst coastal = f (wod+wo coastal)



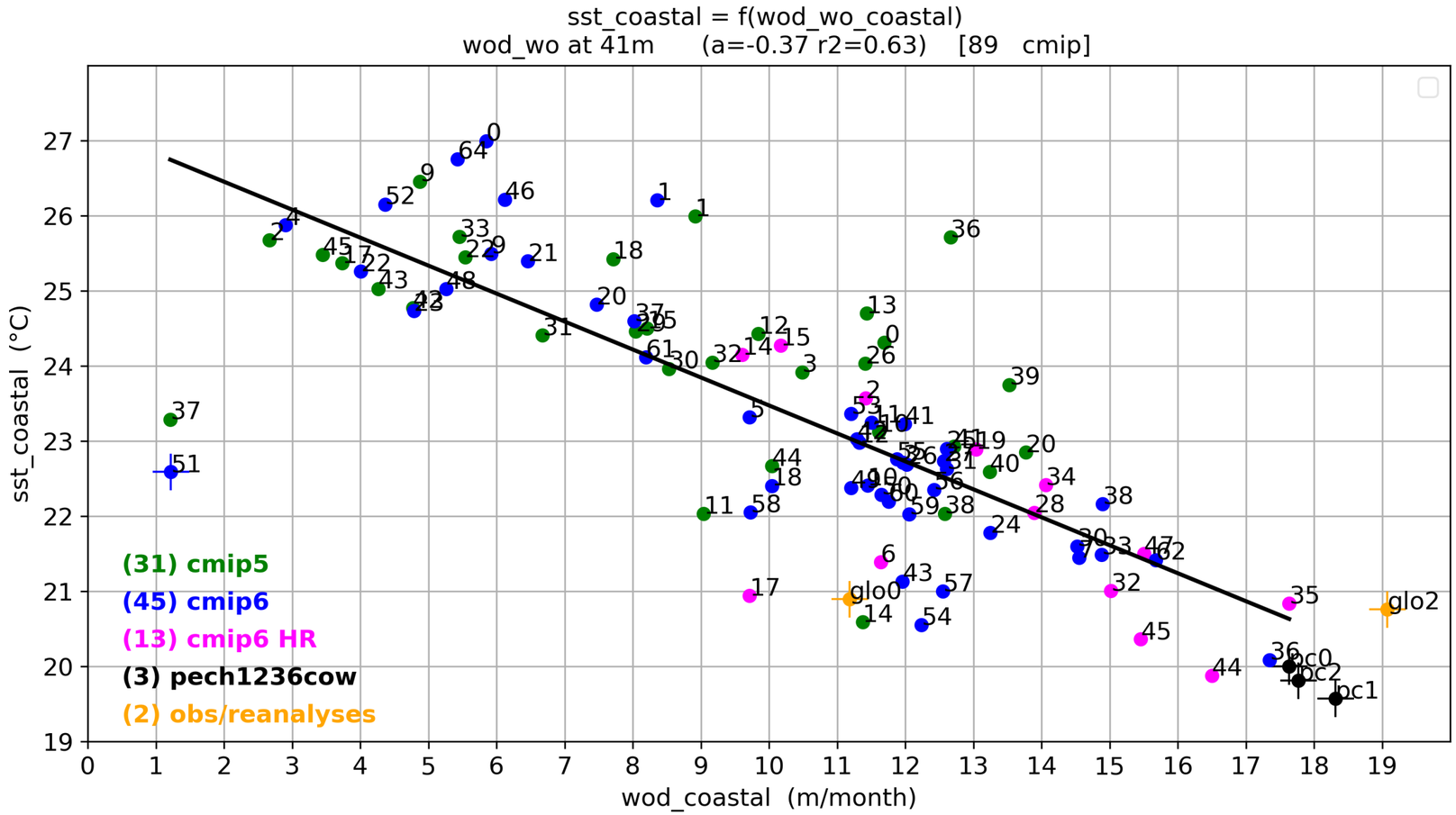
47m

sst coastal = f (wod+wo coastal)



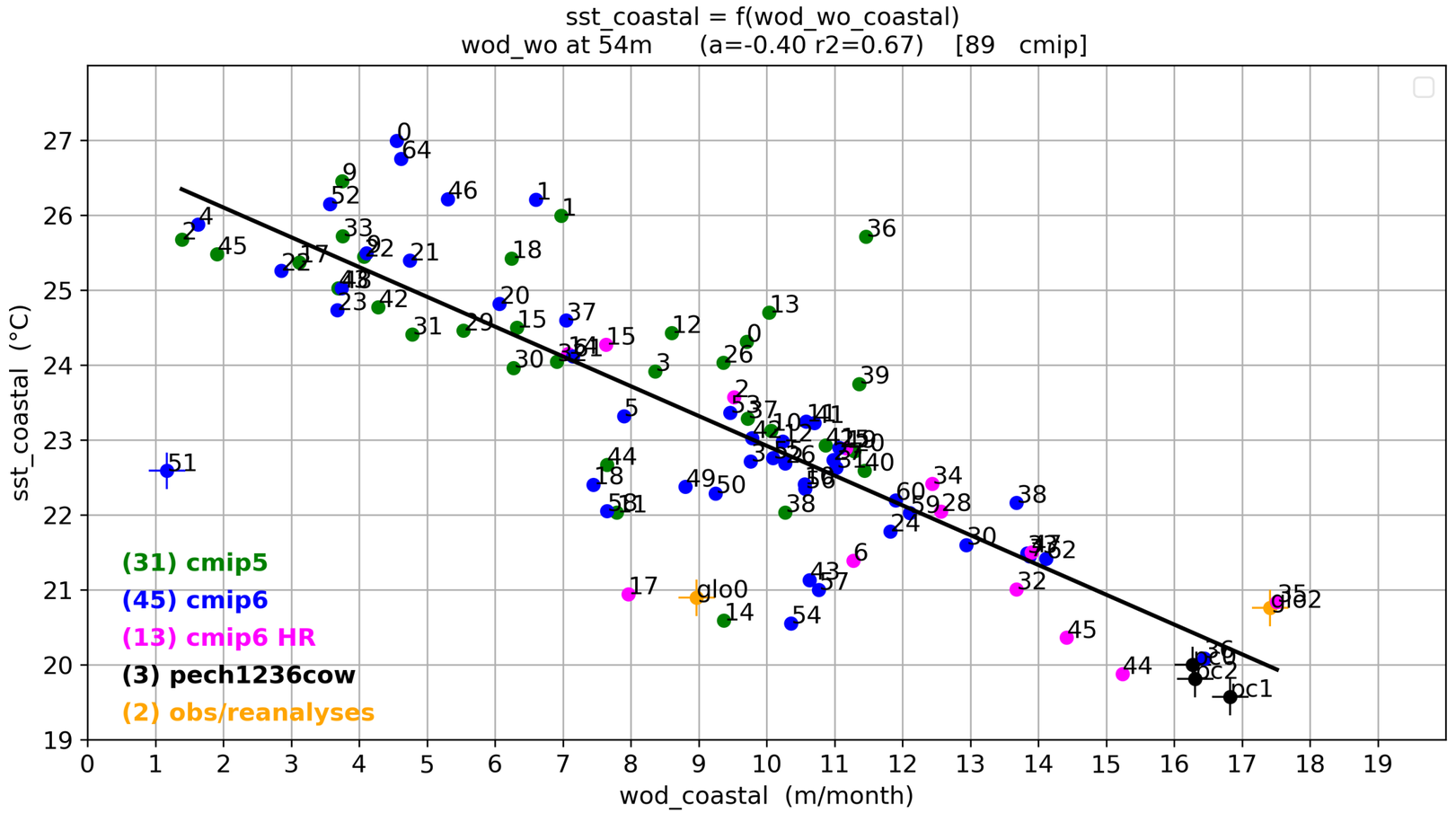
41m

sst coastal = f (wod+wo coastal)



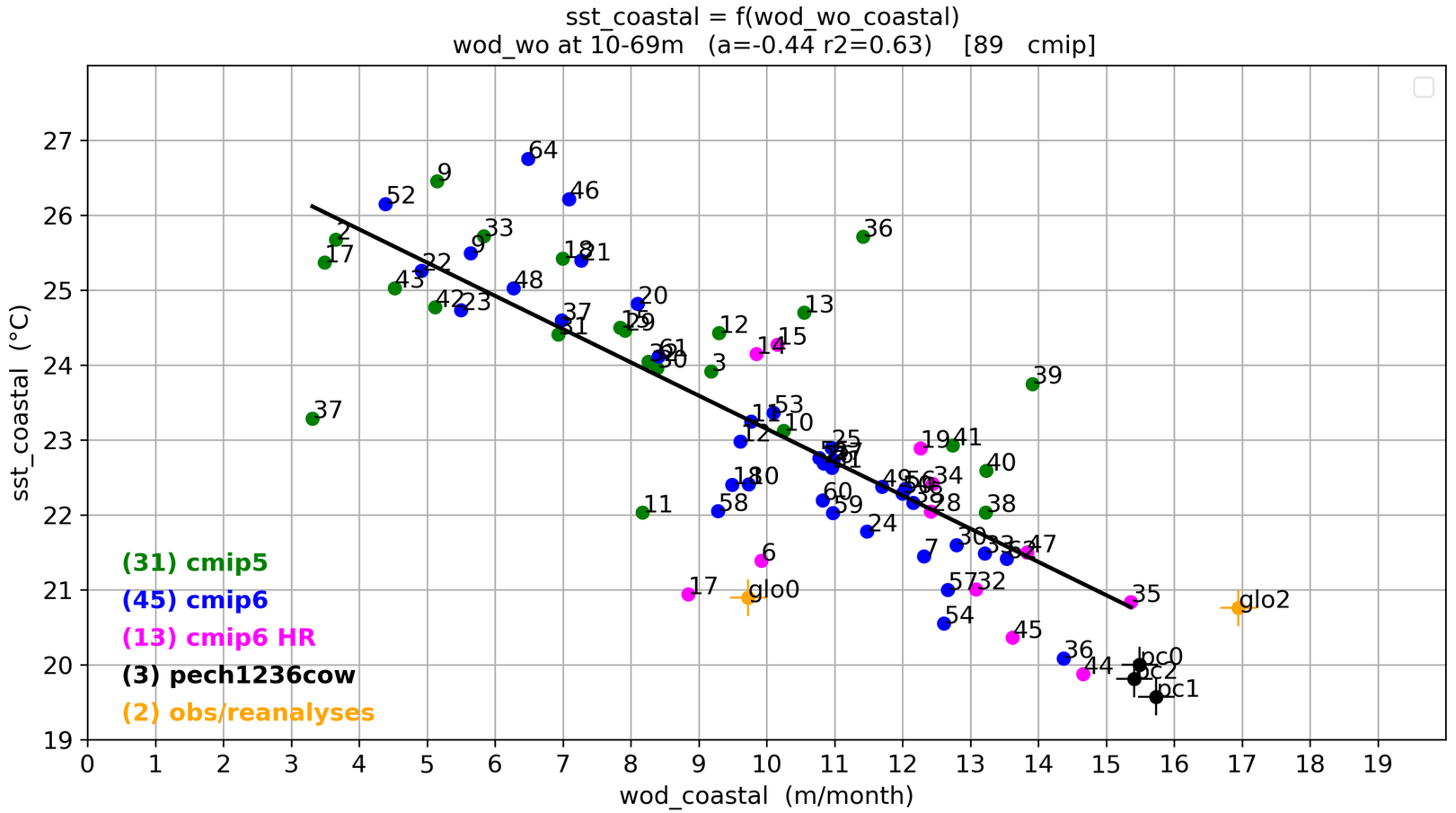
54m

sst coastal = f (wod+wo coastal)



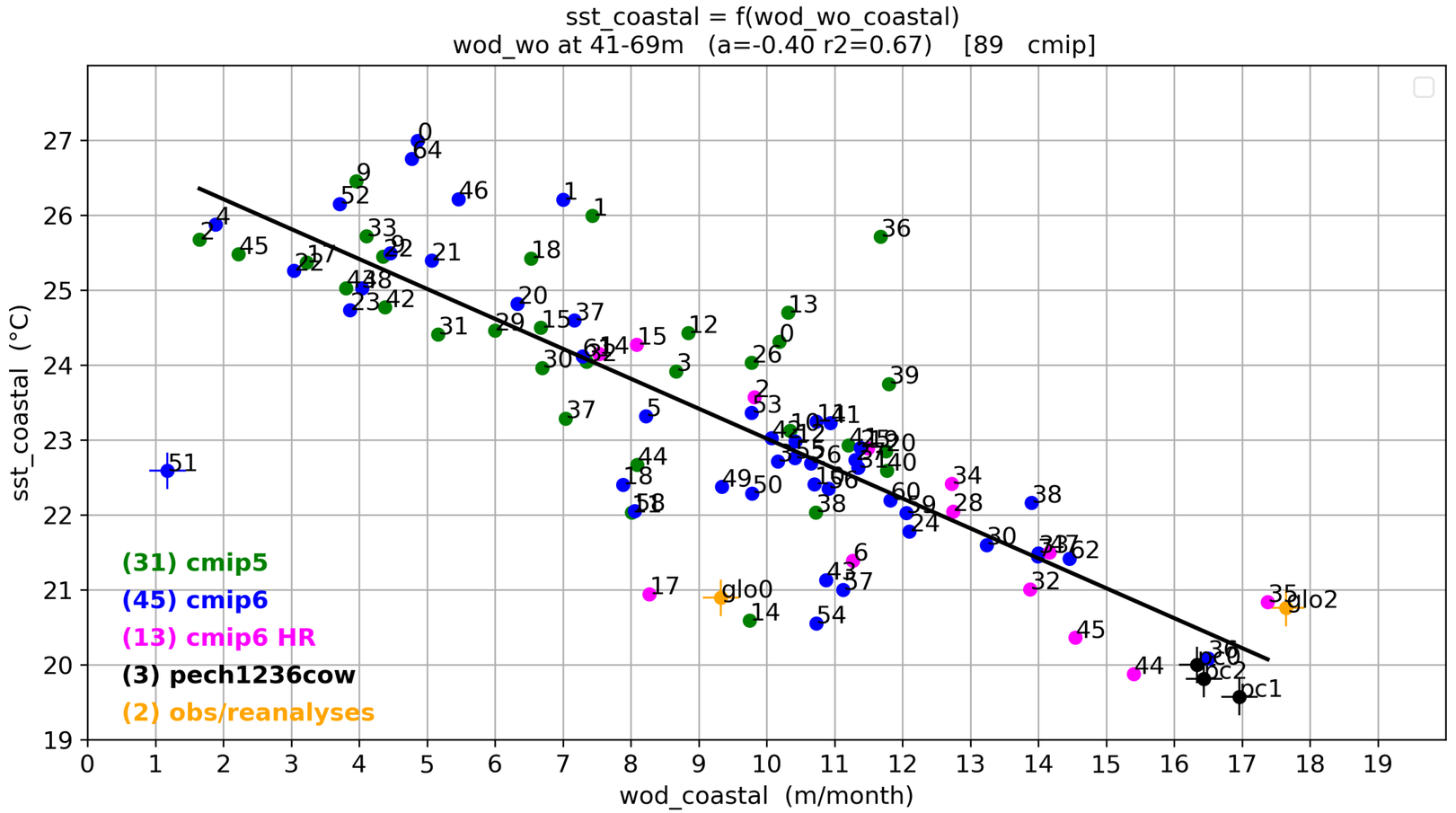
10-69m

sst coastal = f (wod+wo coastal)



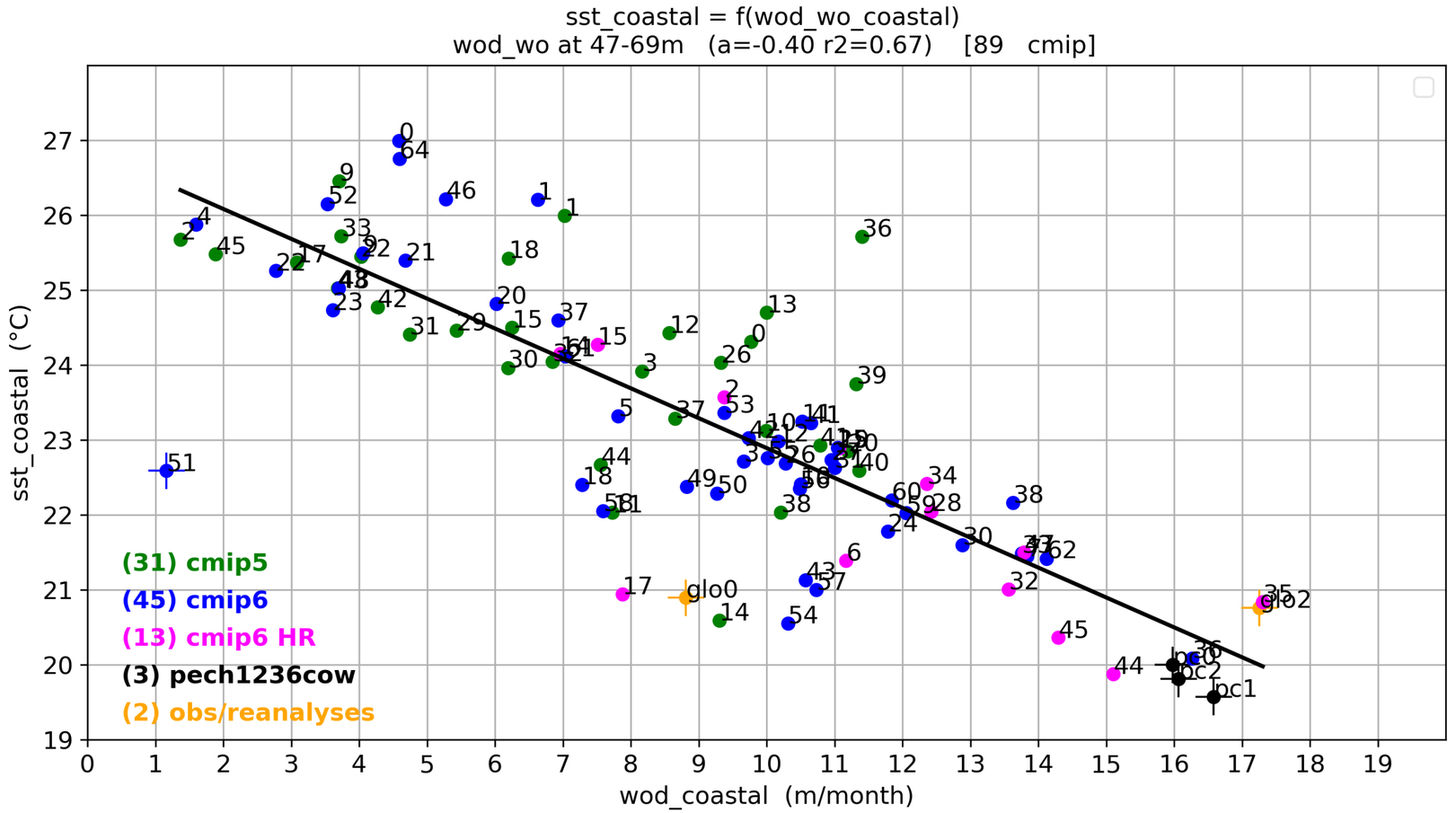
41-69m

sst coastal = f (wod+wo coastal)



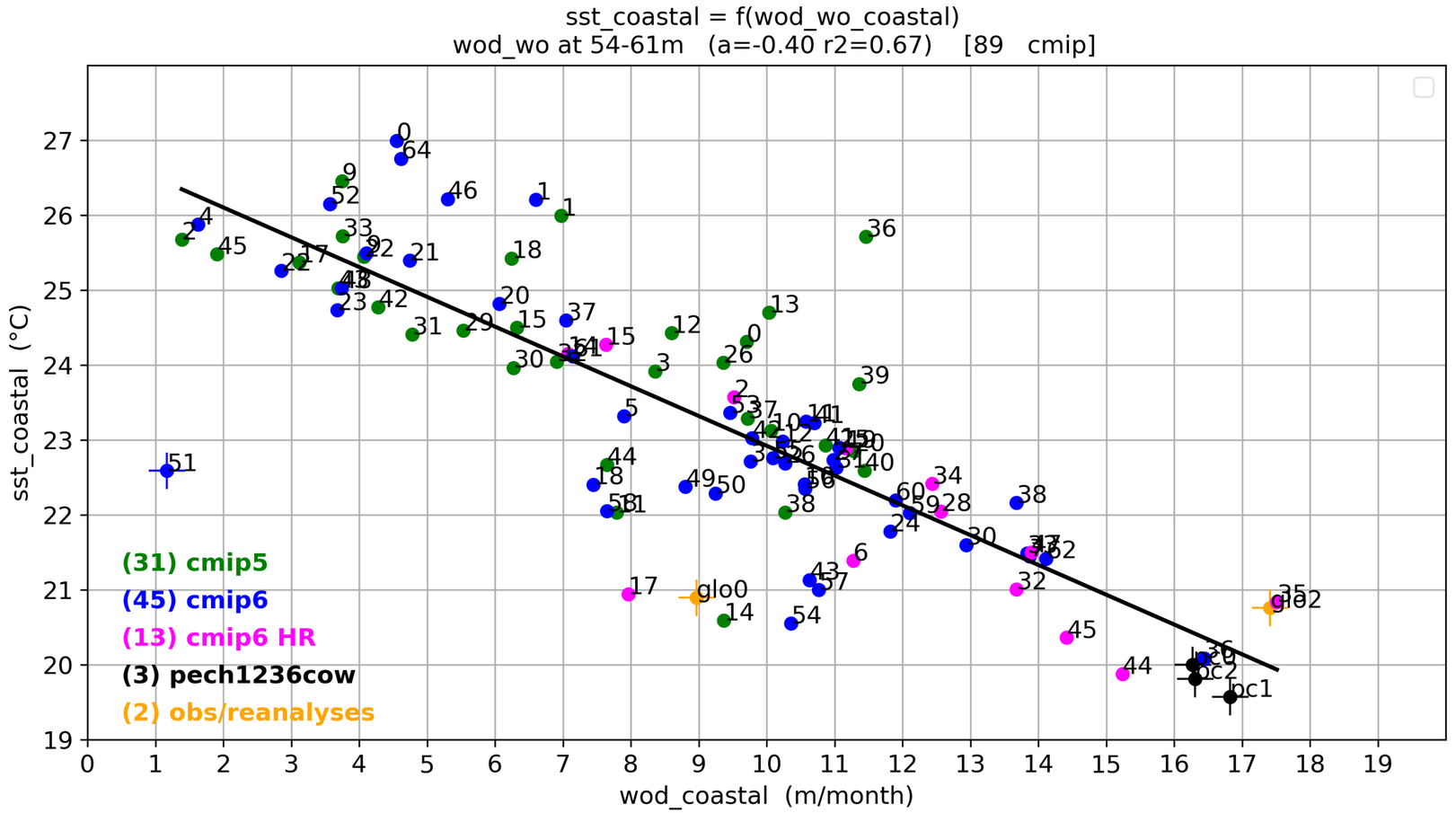
47-69m

sst coastal = f (wod+wo coastal)



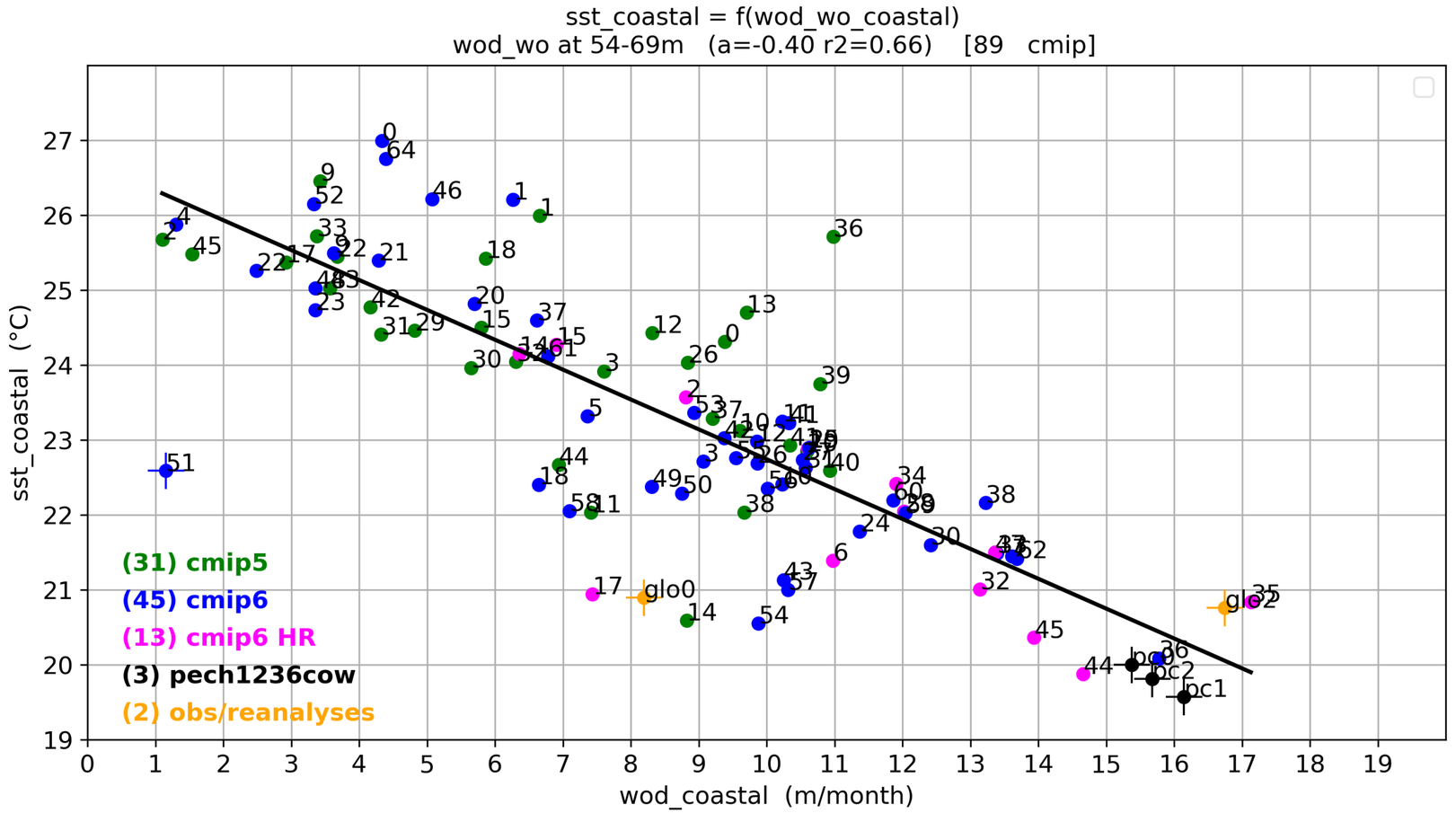
54-61m

sst coastal = f (wod+wo coastal)



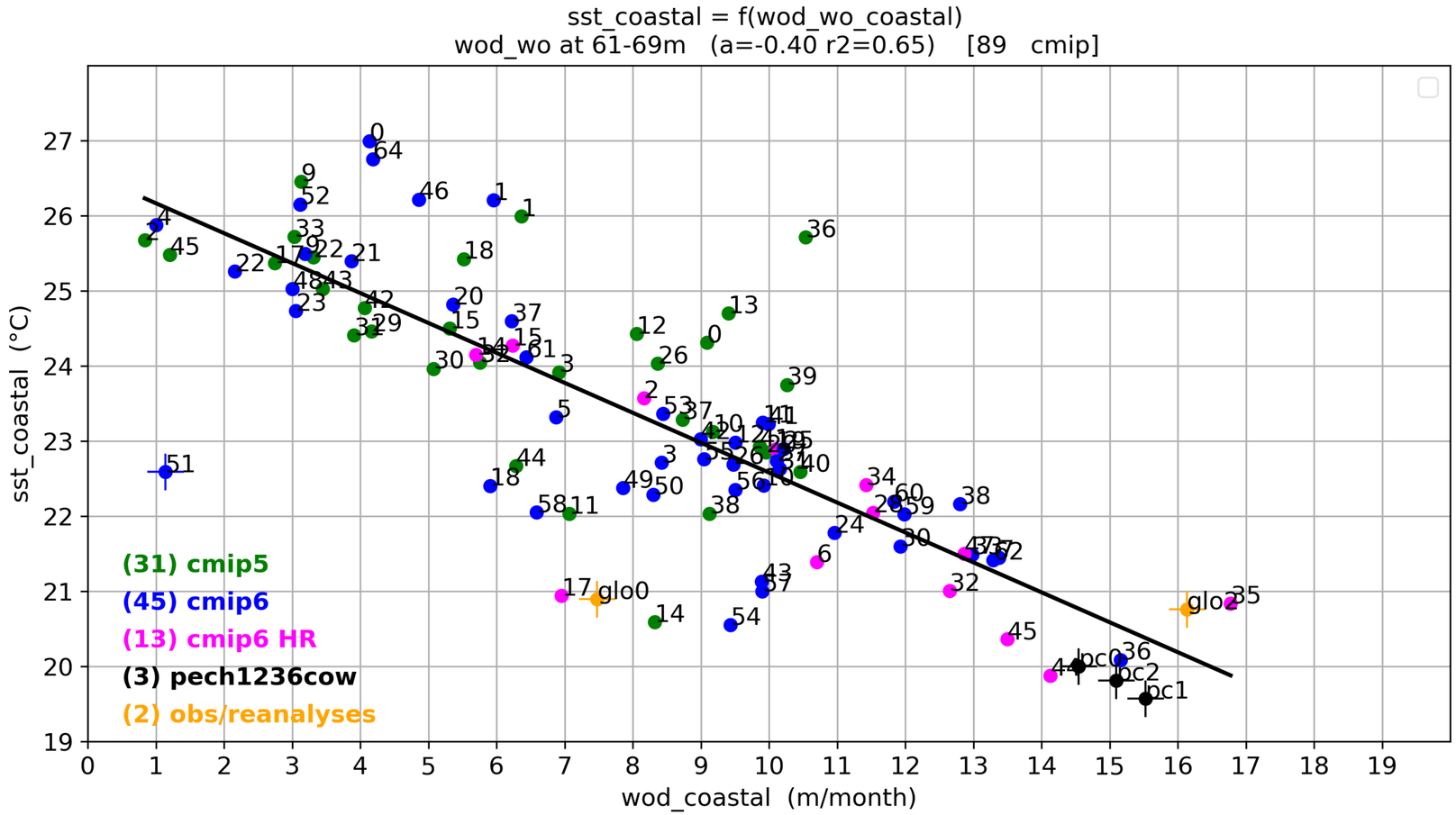
54-69m

sst coastal = f (wod+wo coastal)



61-69m

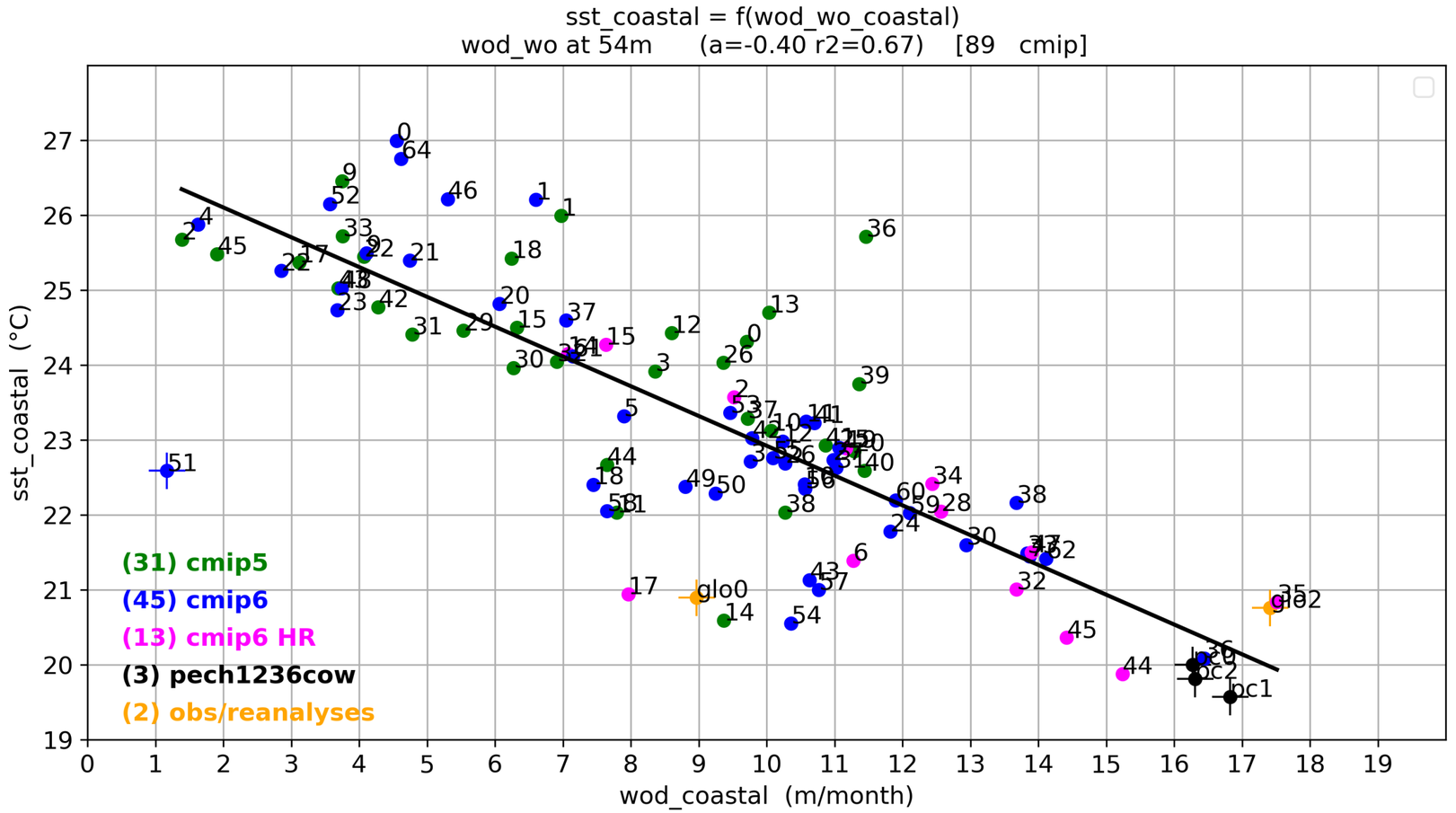
sst coastal = f (wod+wo coastal)



sst- T_31-108m =f(wo)

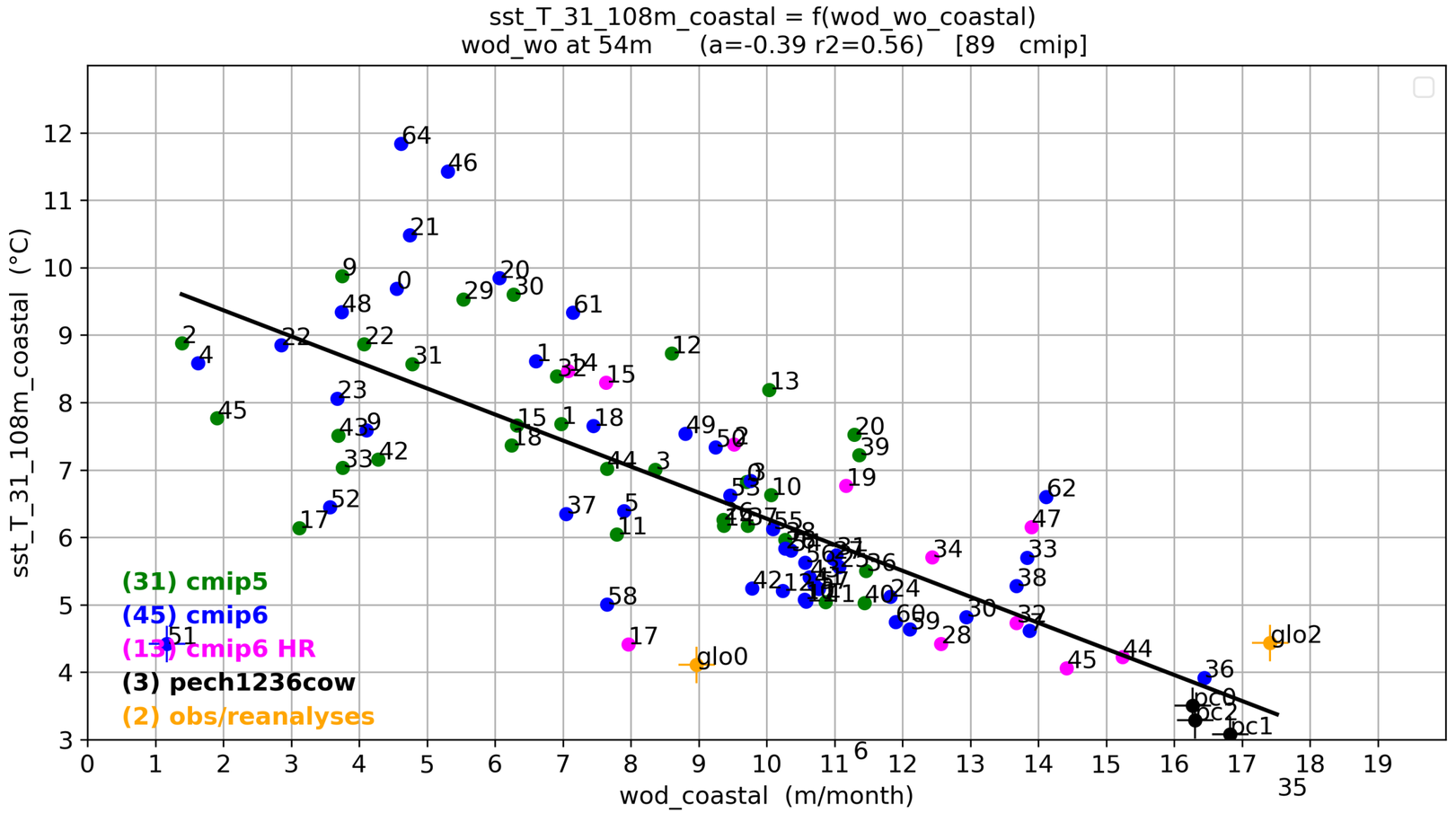
54m

sst coastal = f (wod+wo coastal)



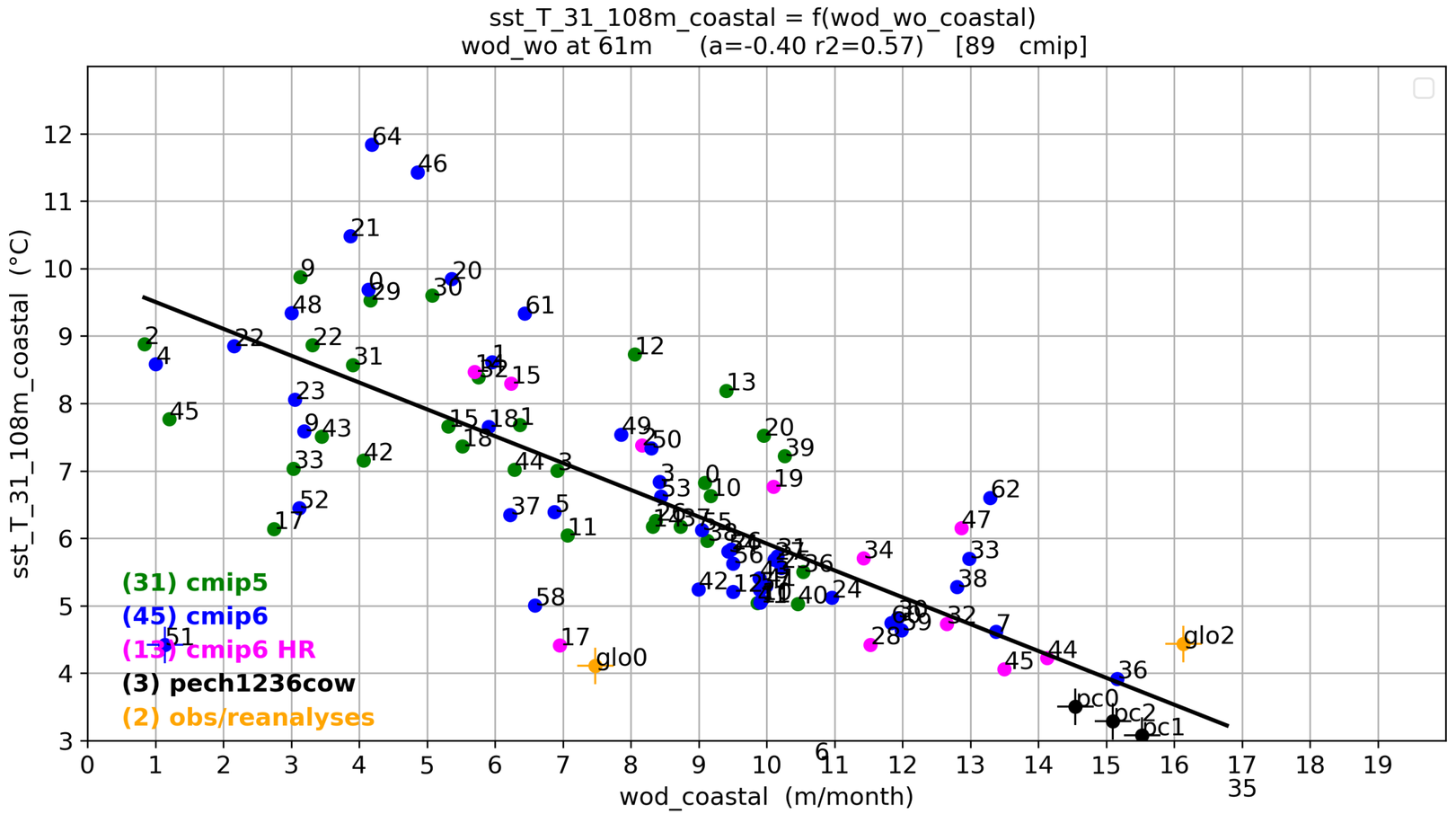
54m

sst – T_31-108m coastal = f (wod+wo coastal)



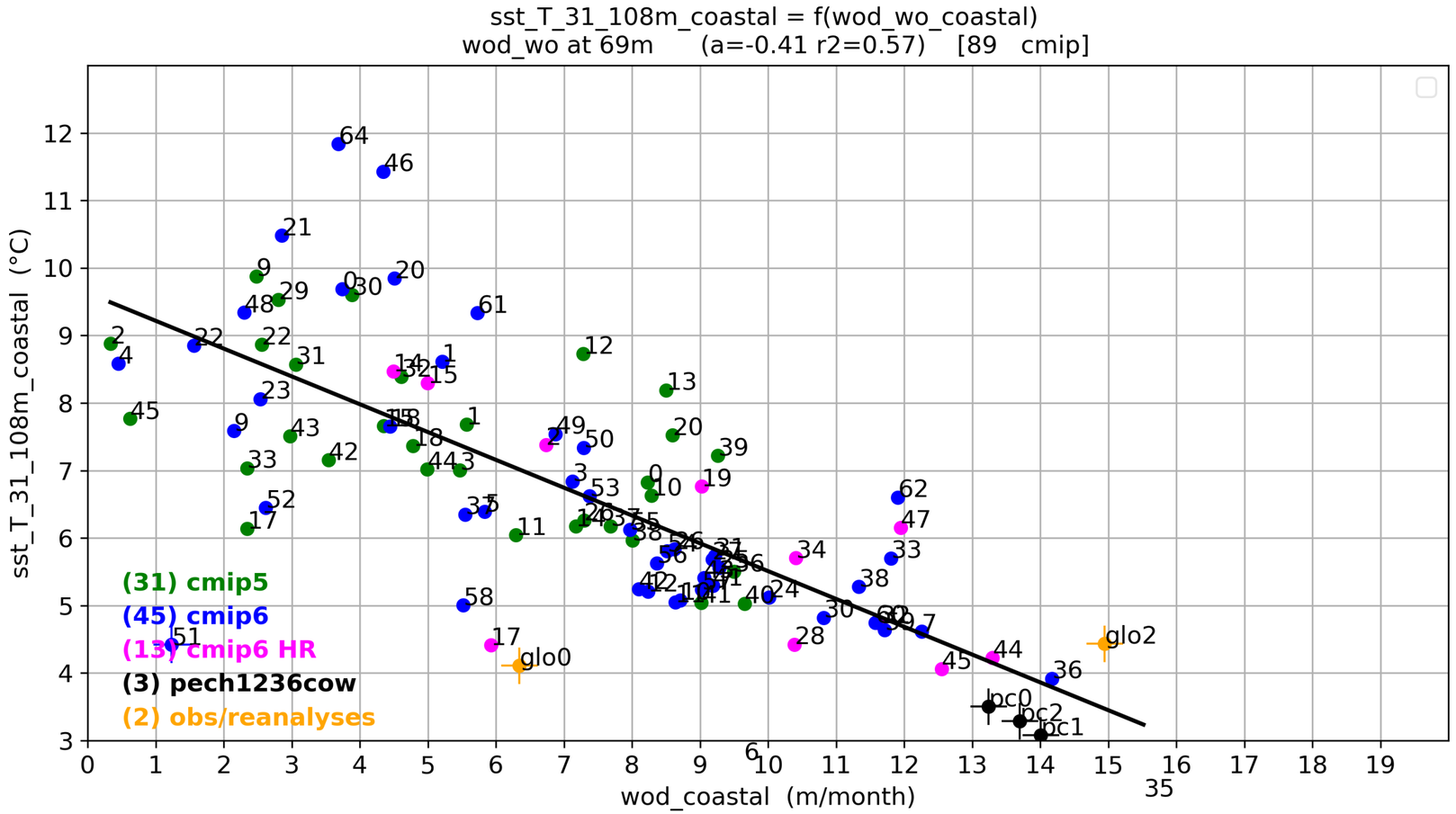
61m

sst – T_31-108m coastal = f (wod+wo coastal)



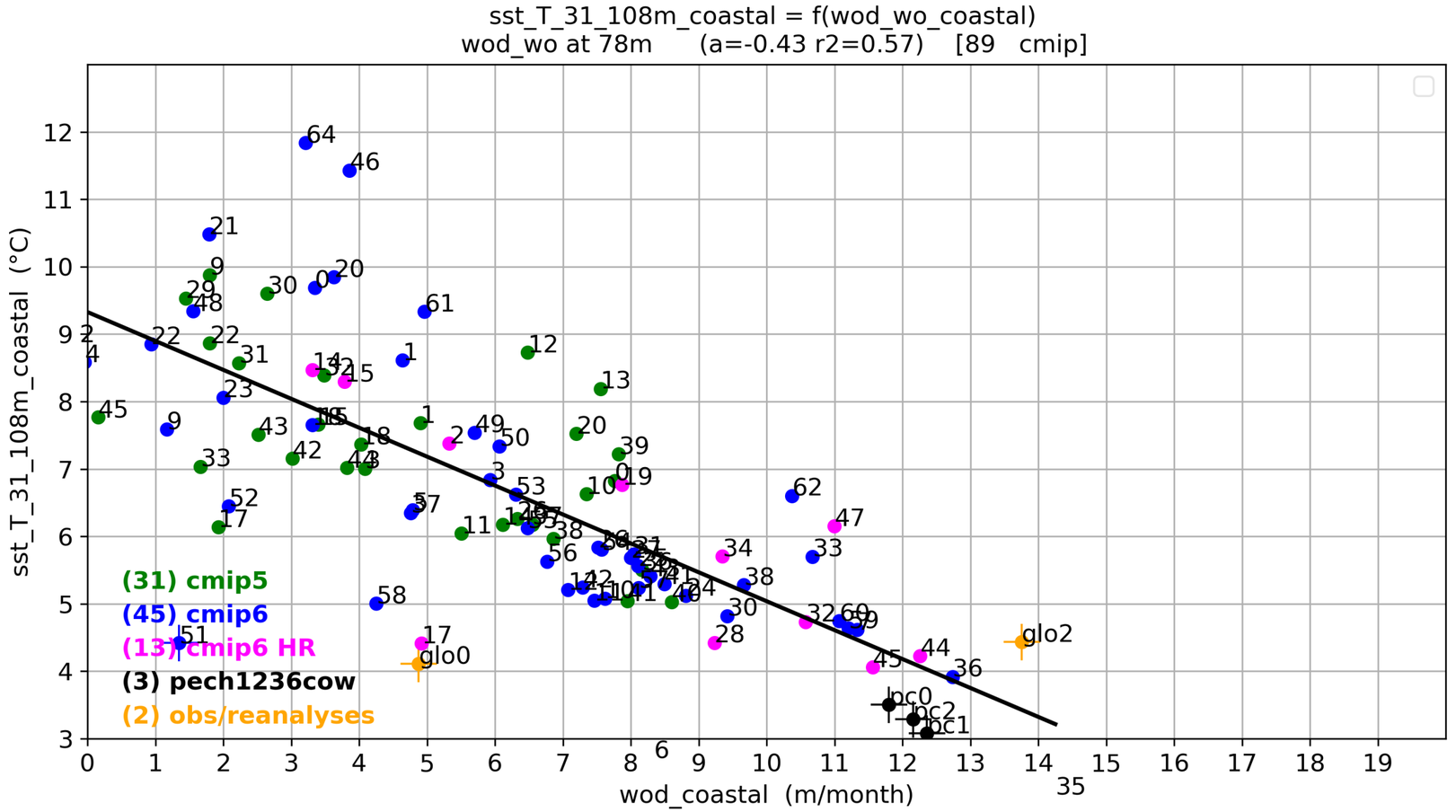
69m

sst – T_31-108m coastal = f (wod+wo coastal)



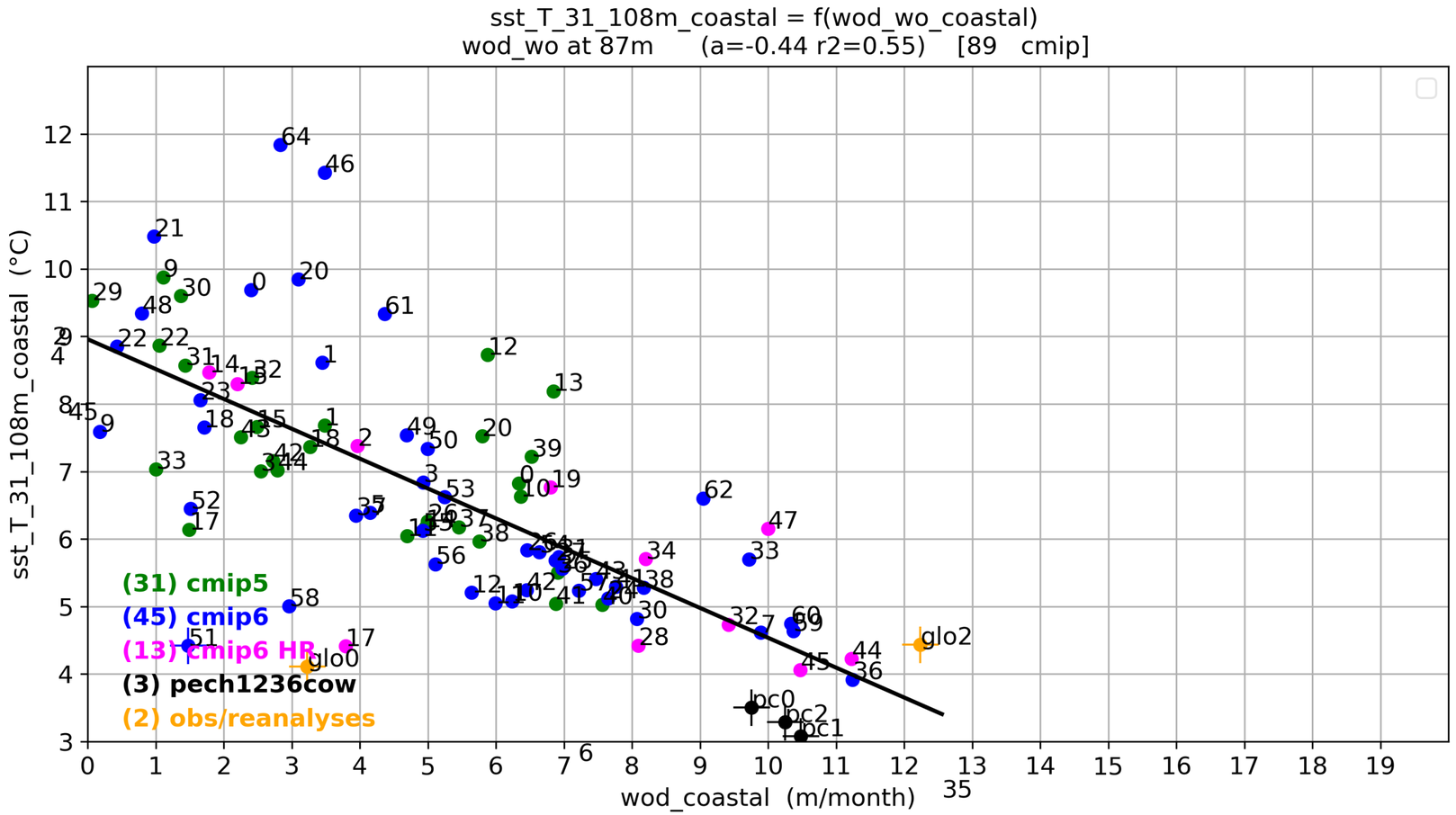
78m

sst – T_31-108m coastal = f (wod+wo coastal)



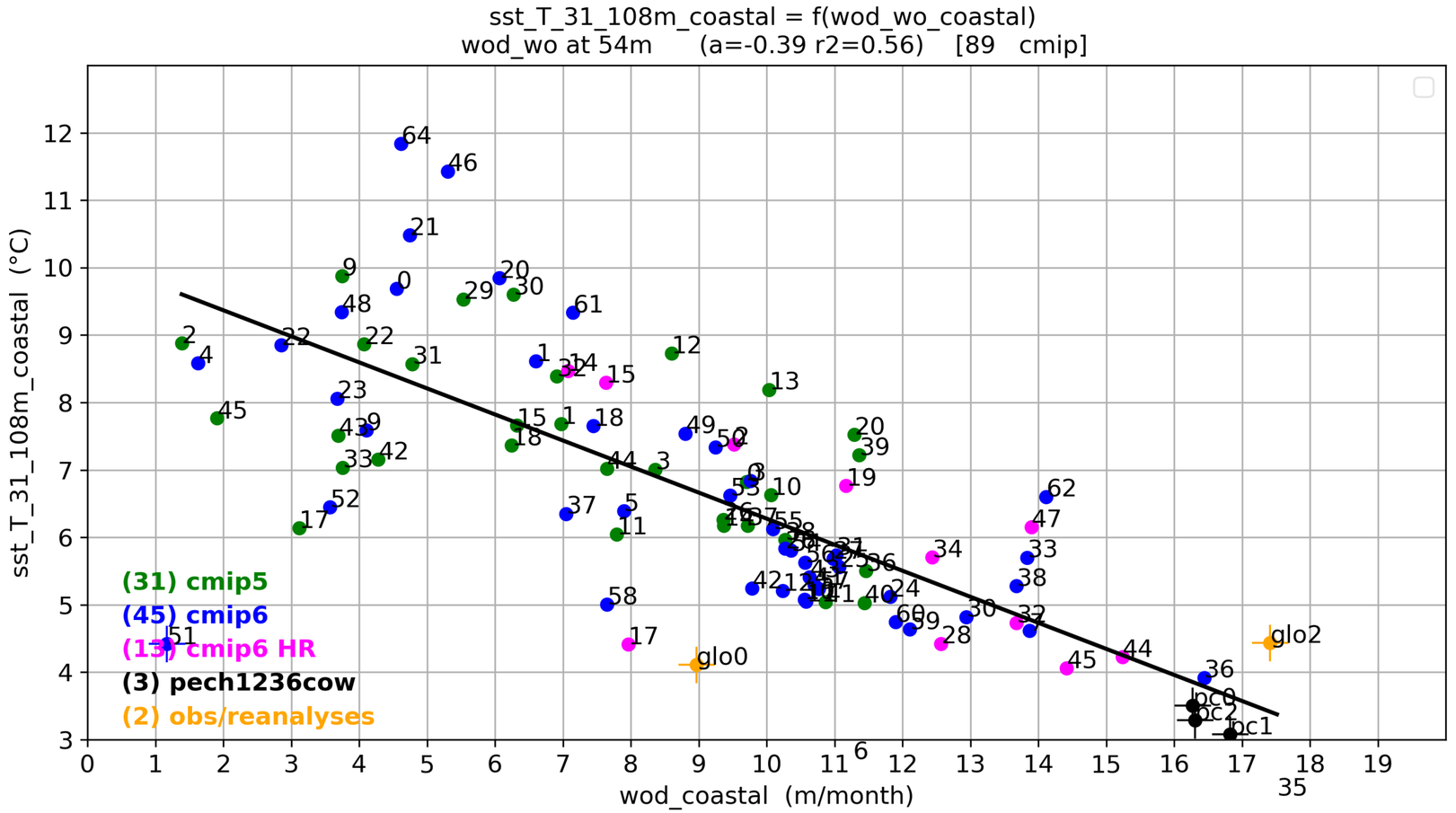
87m

sst – T_31-108m coastal = f (wod+wo coastal)



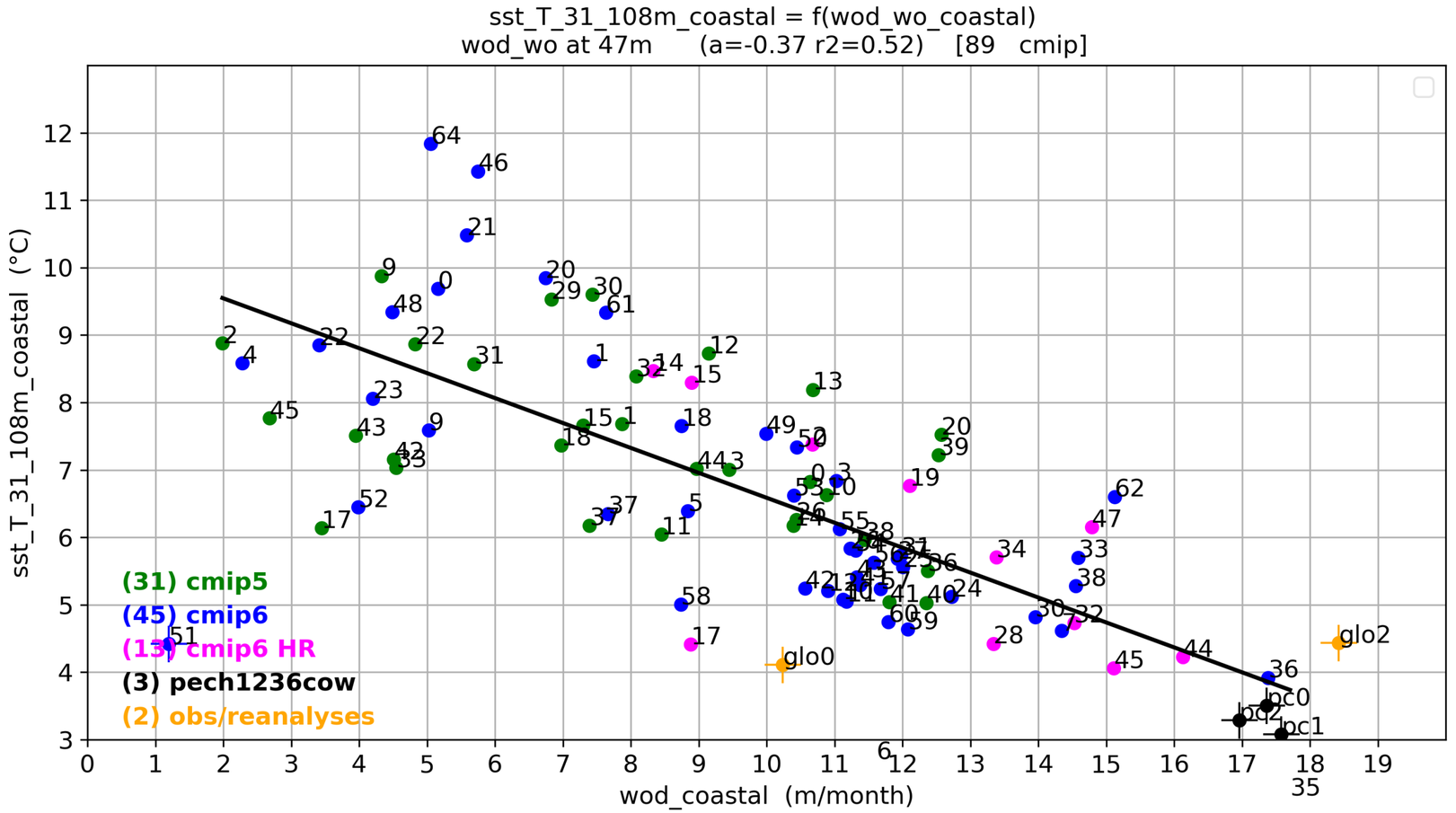
54m

sst – T_31-108m coastal = f (wod+wo coastal)



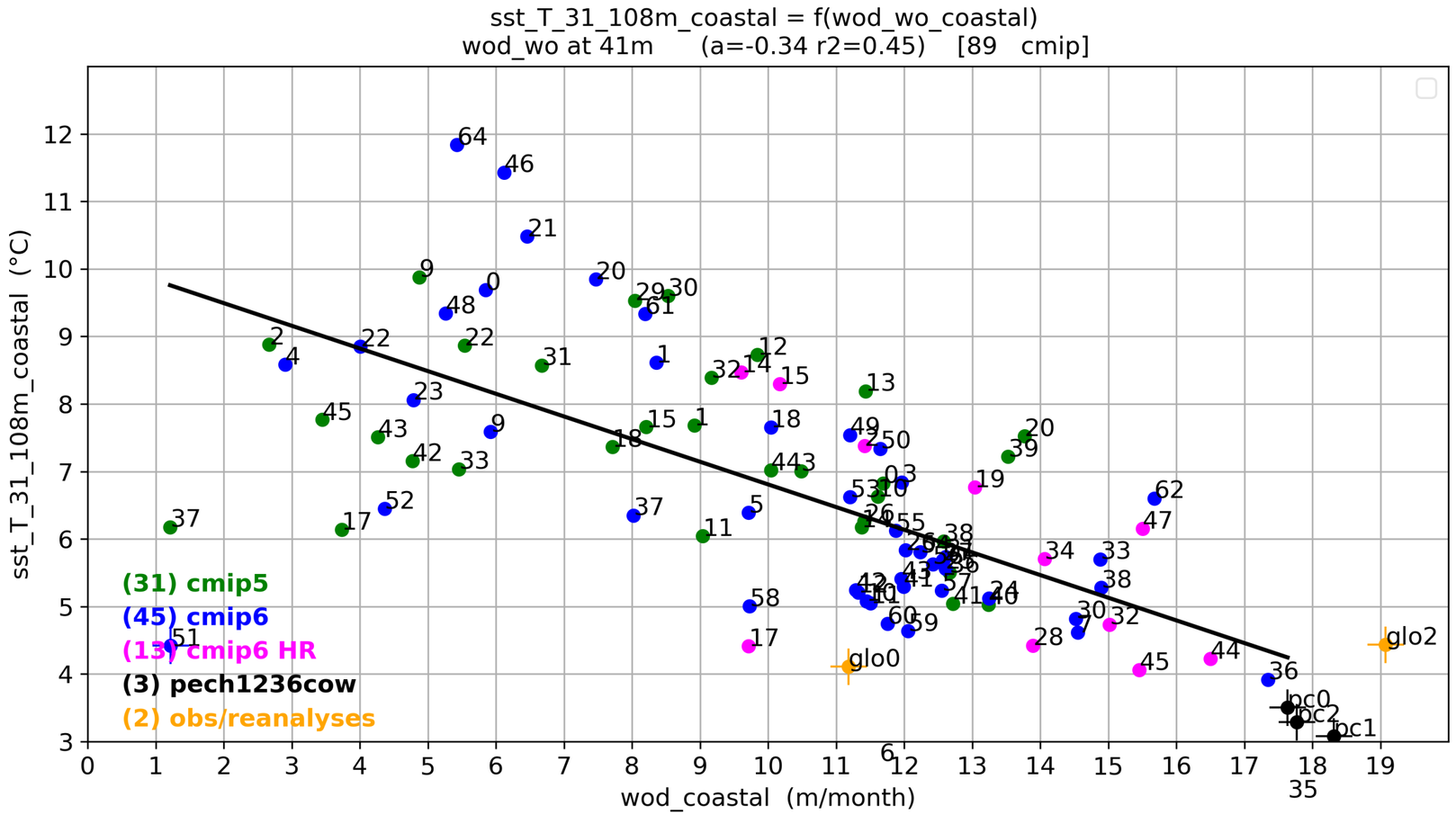
47m

sst – T_31-108m coastal = f (wod+wo coastal)



41m

sst – T_31-108m coastal = f (wod+wo coastal)

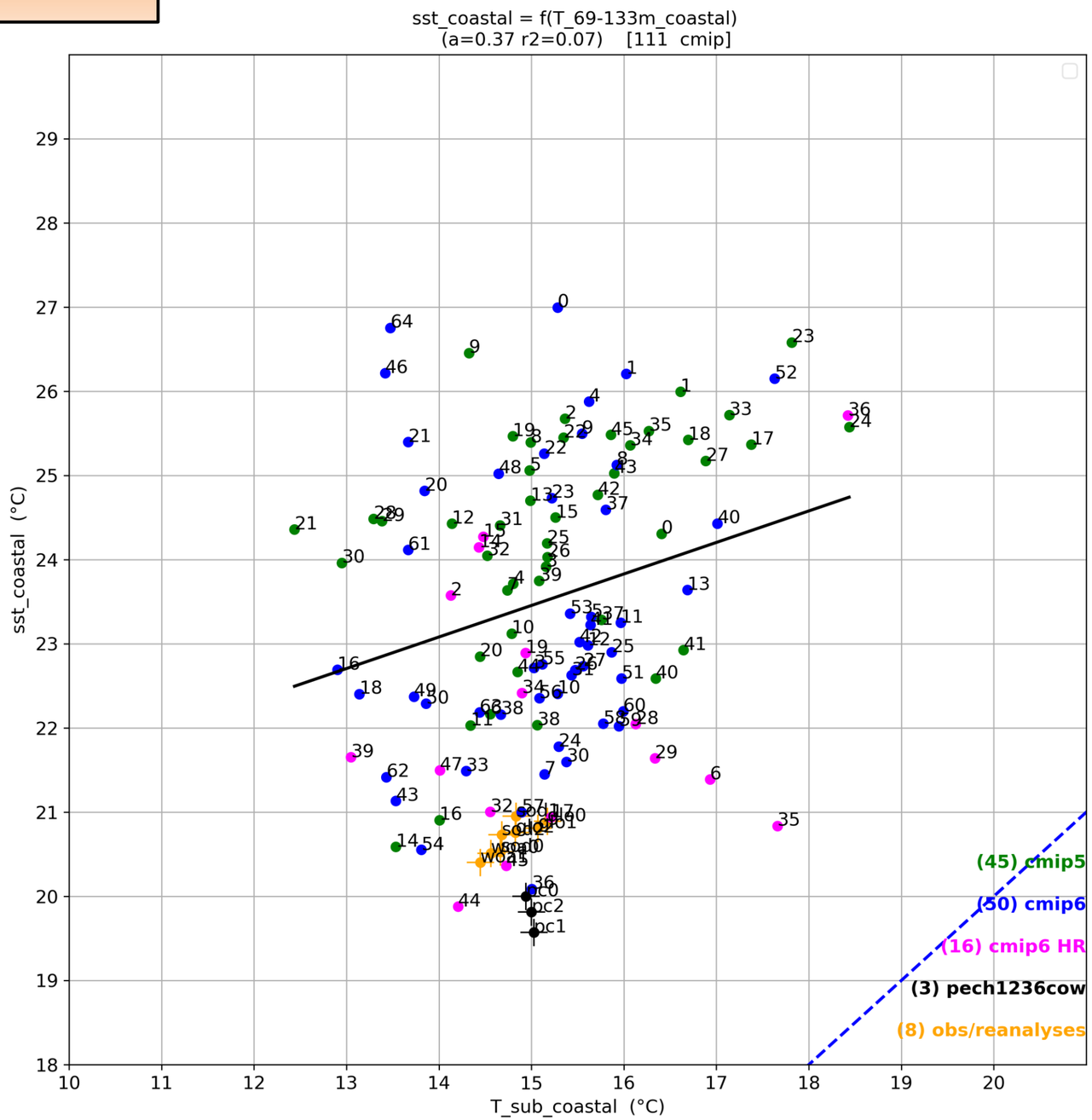


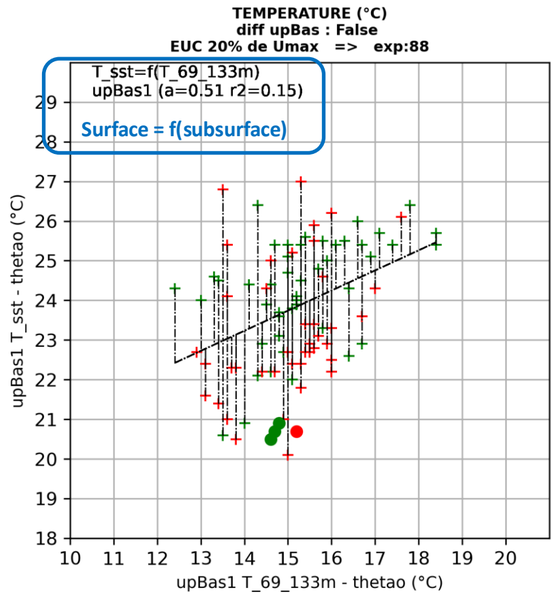
sst = f(T_sub)

On avait jamais fait de variation directement pour sst=f(T_sub)

69-133m

sst coastal = f (T_sub_coastal)



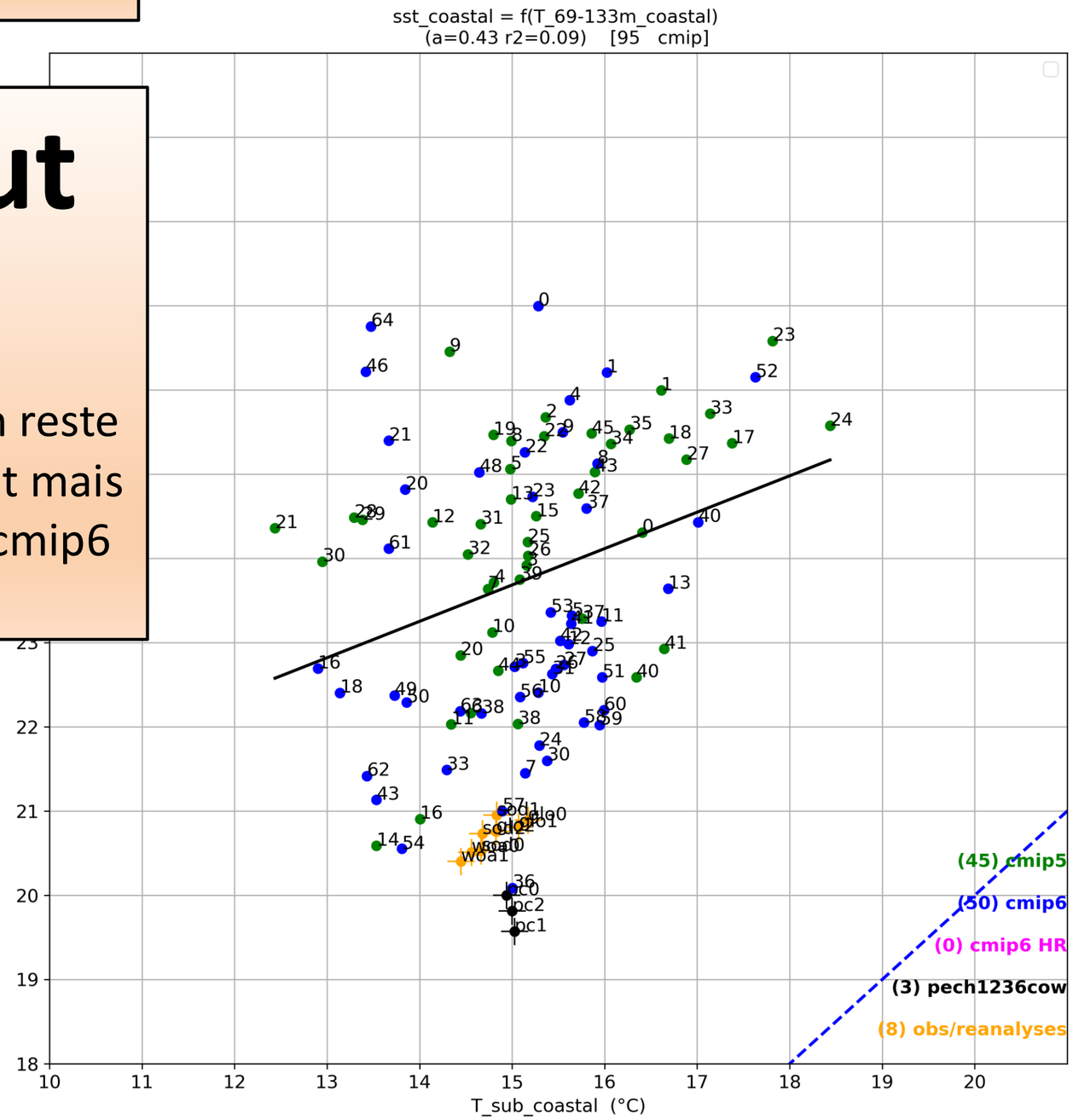


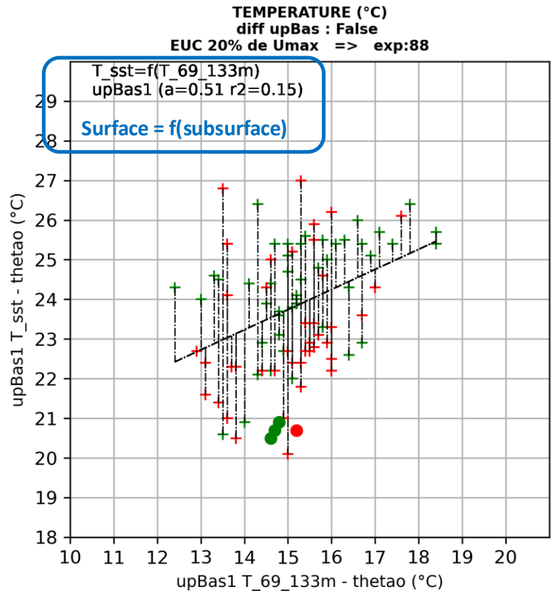
69-133m

sst coastal = f (T_sub_coastal)

Without HR

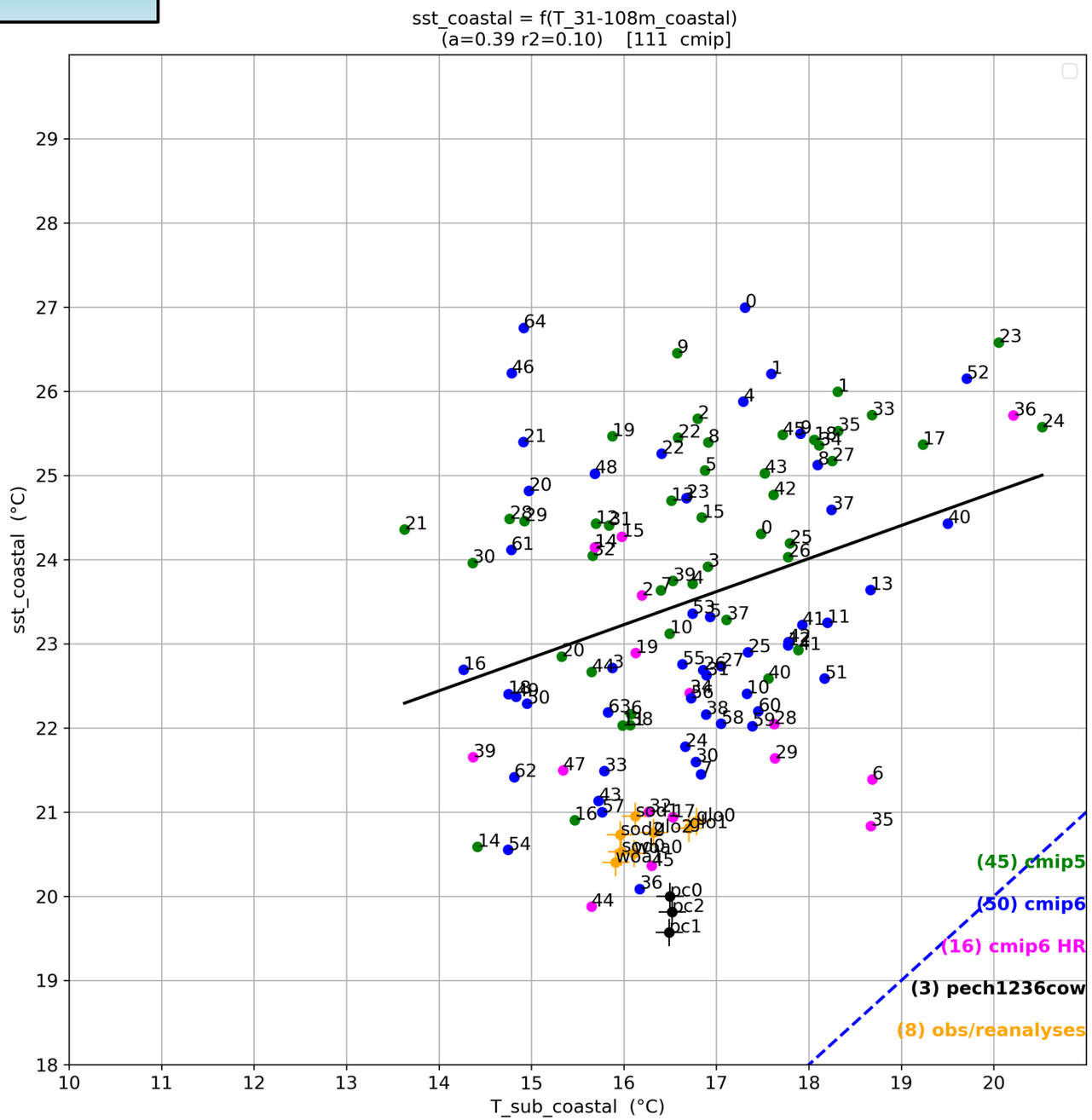
Pente et corrélation reste moins forte qu'avant mais parce qu'il y a des cmip6 en plus





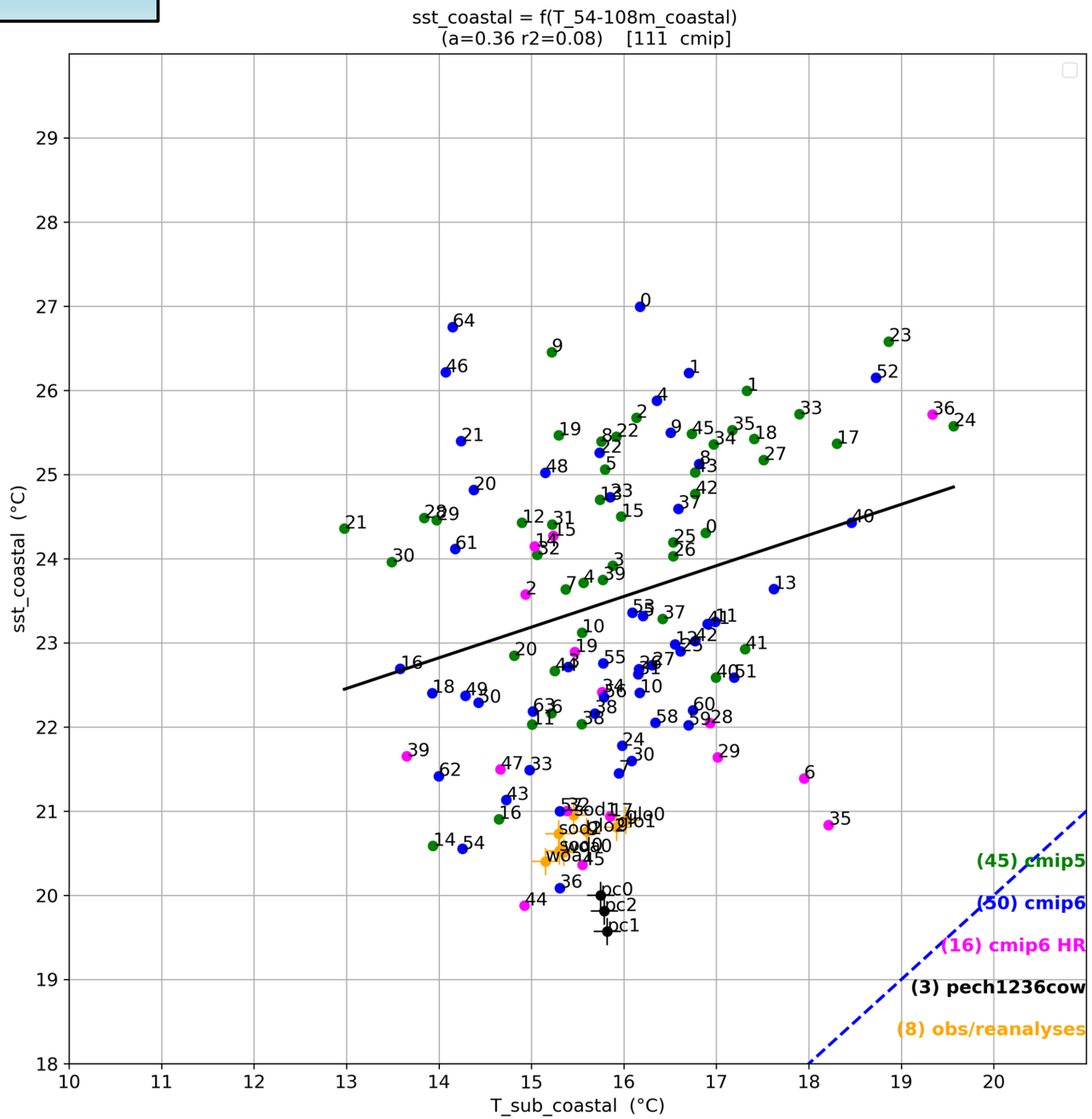
31-108m

sst coastal = f (T_sub_coastal)



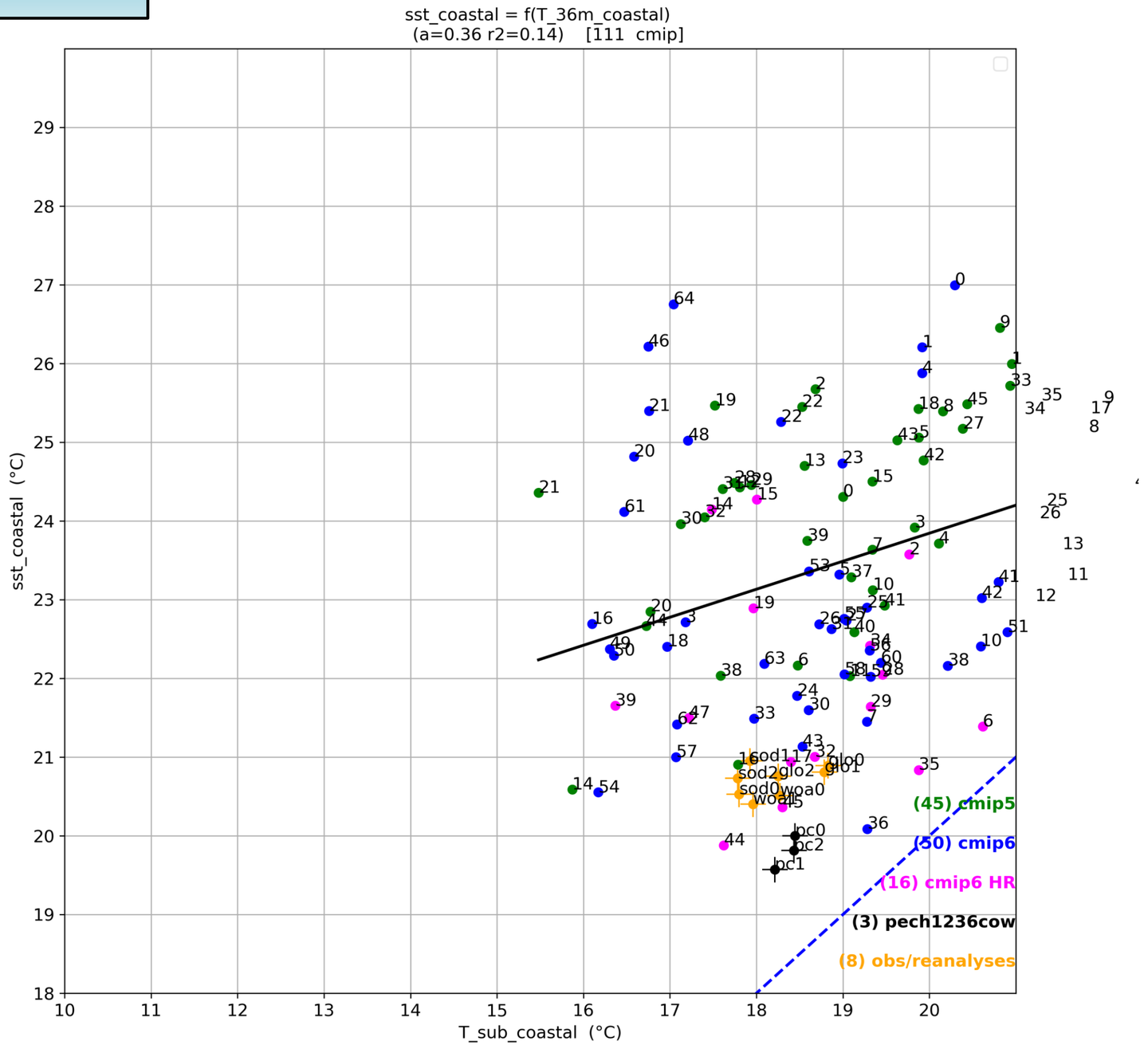
54-108m

sst coastal = f (T_sub_coastal)



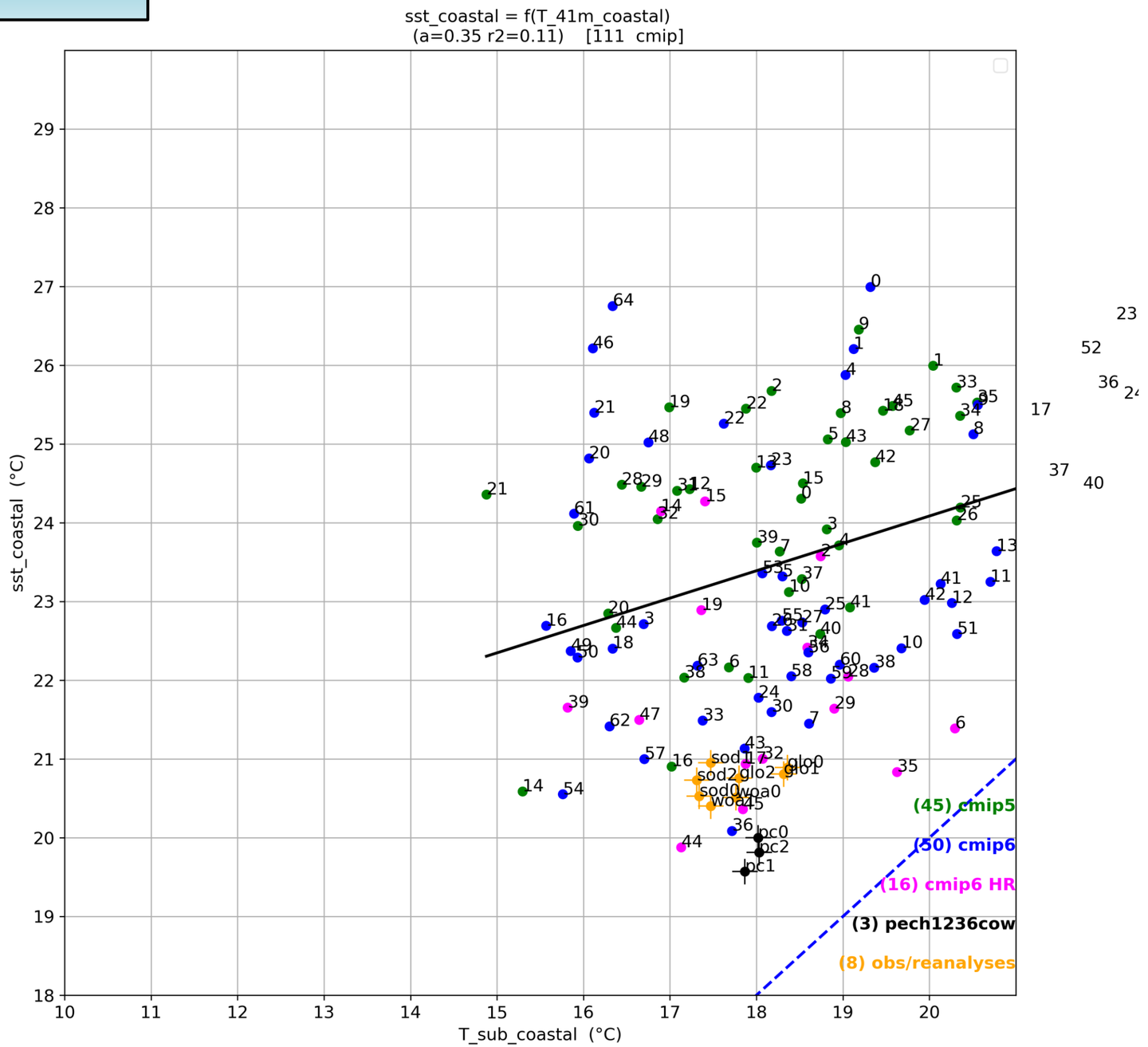
36m

sst coastal = f (T_sub_coastal)



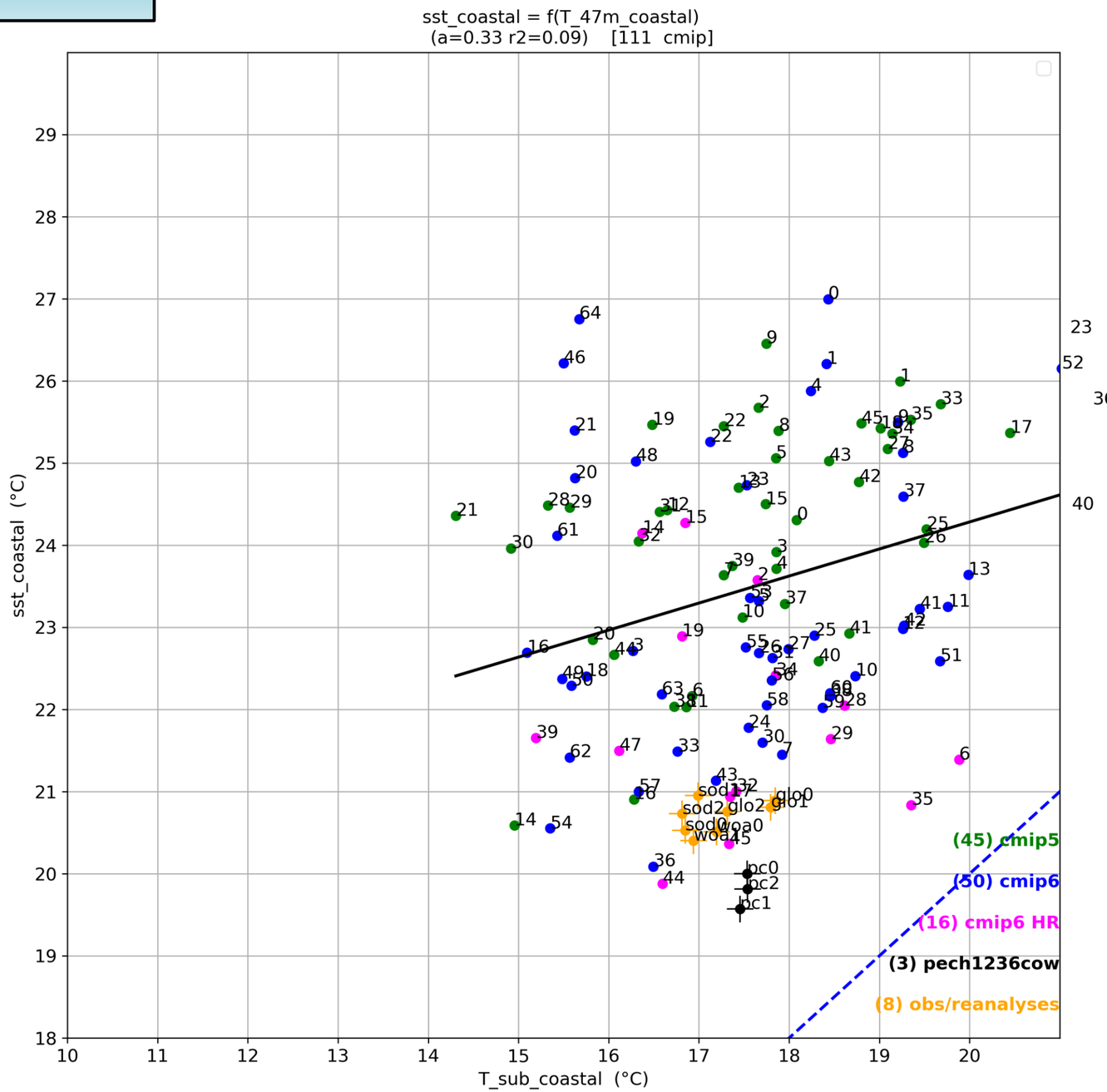
41m

sst coastal = f (T_sub_coastal)



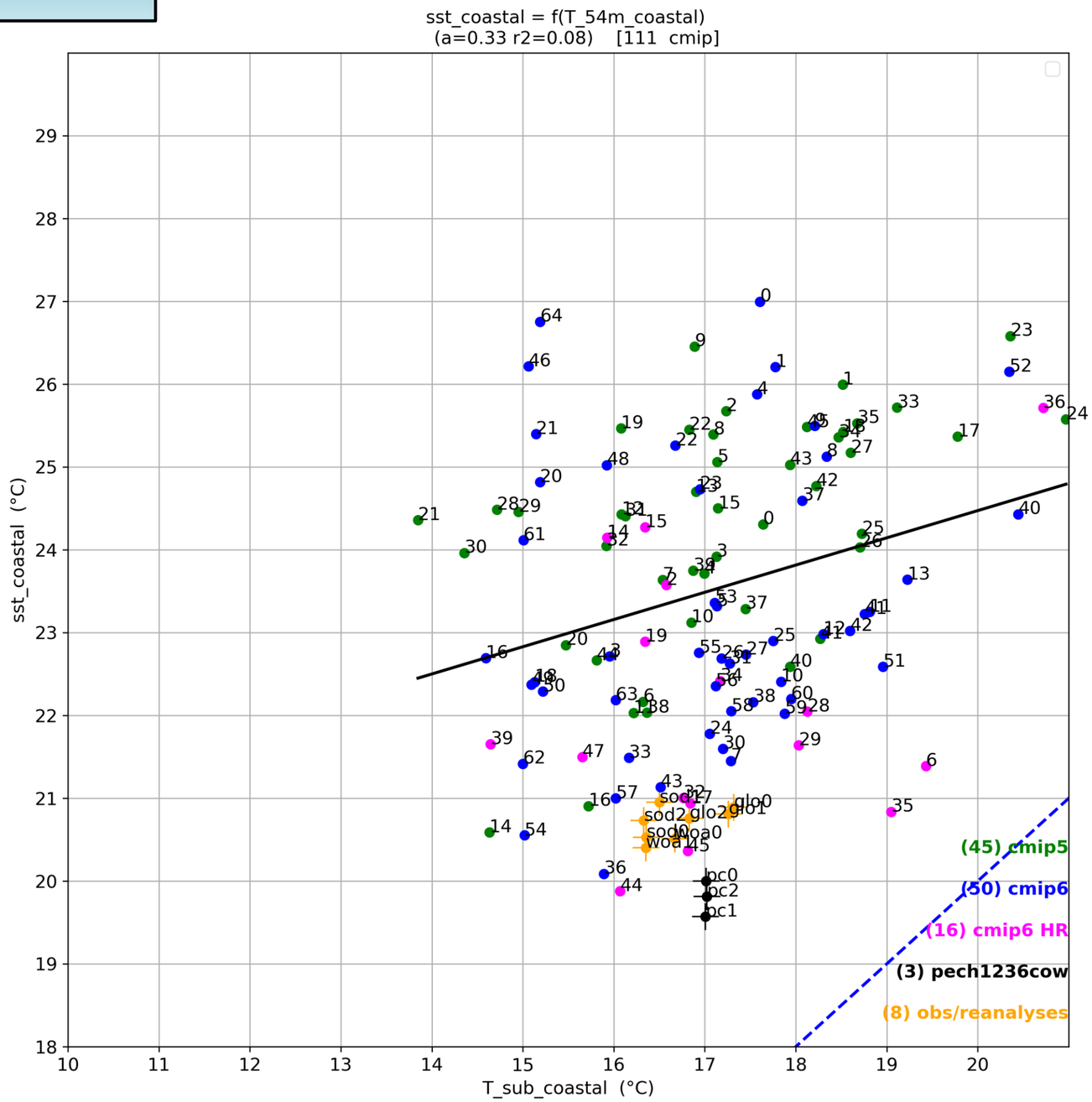
47m

sst coastal = f (T_sub_coastal)



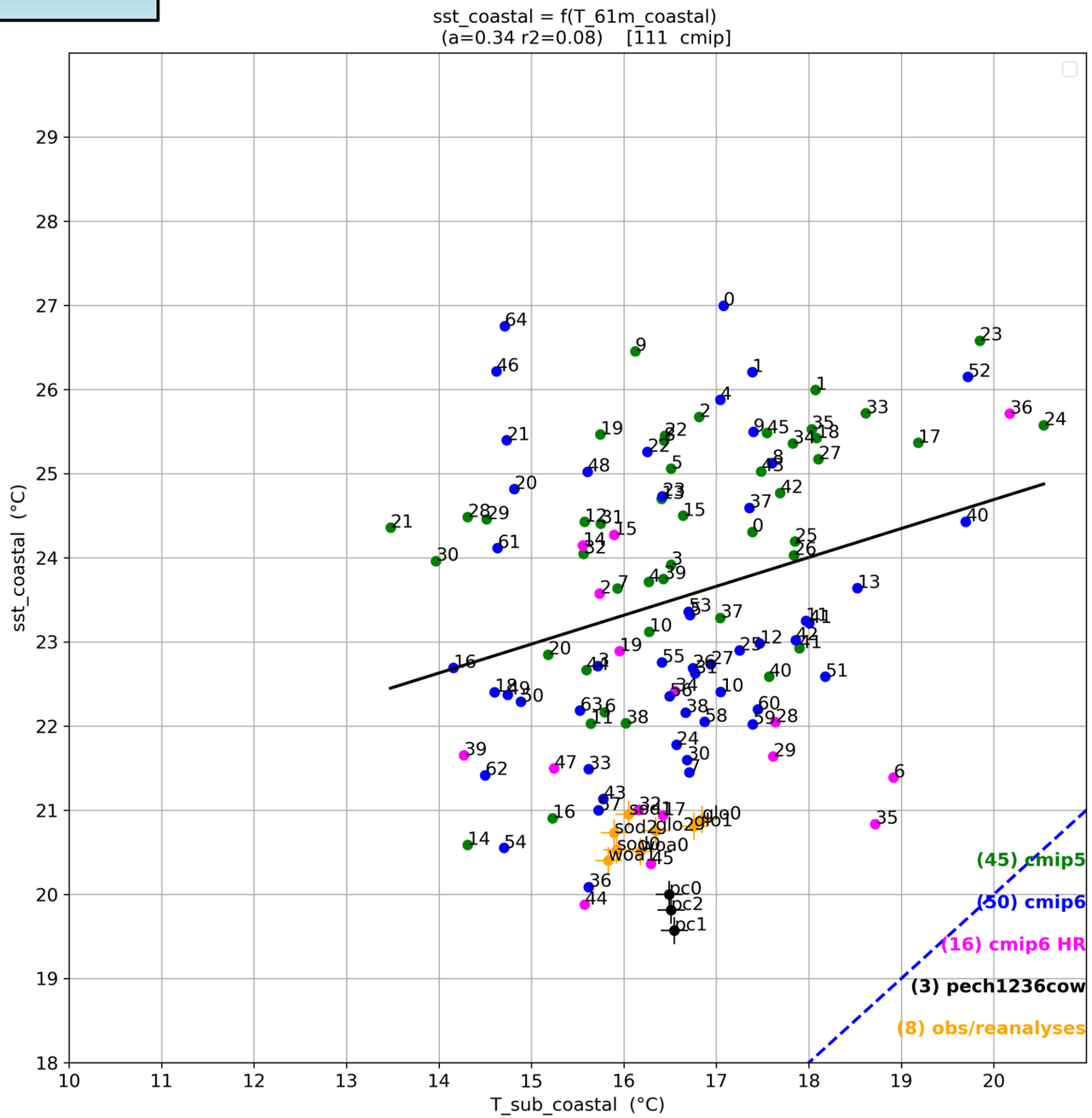
54m

sst coastal = f (T_sub_coastal)



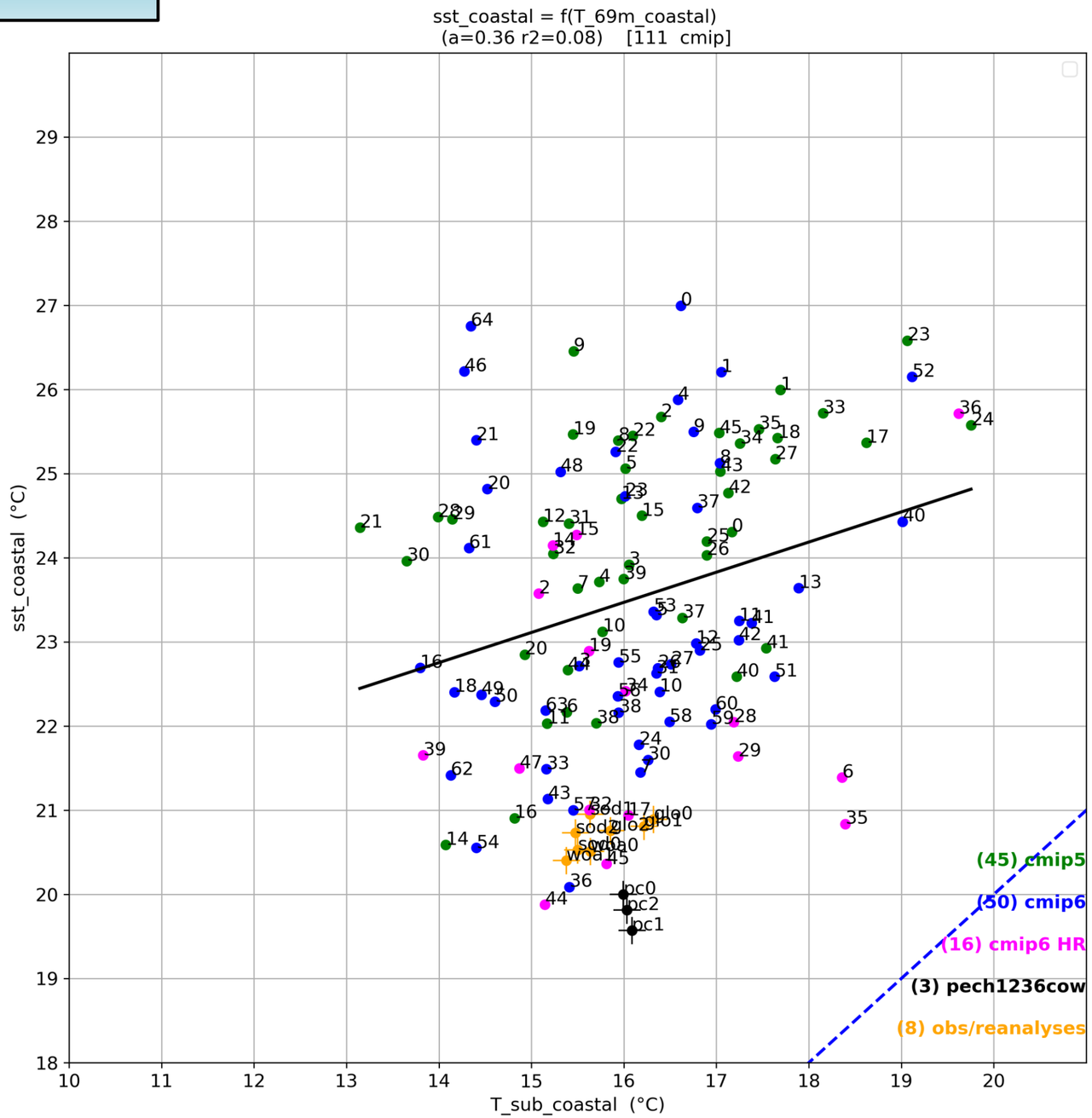
61m

sst coastal = f (T_sub_coastal)



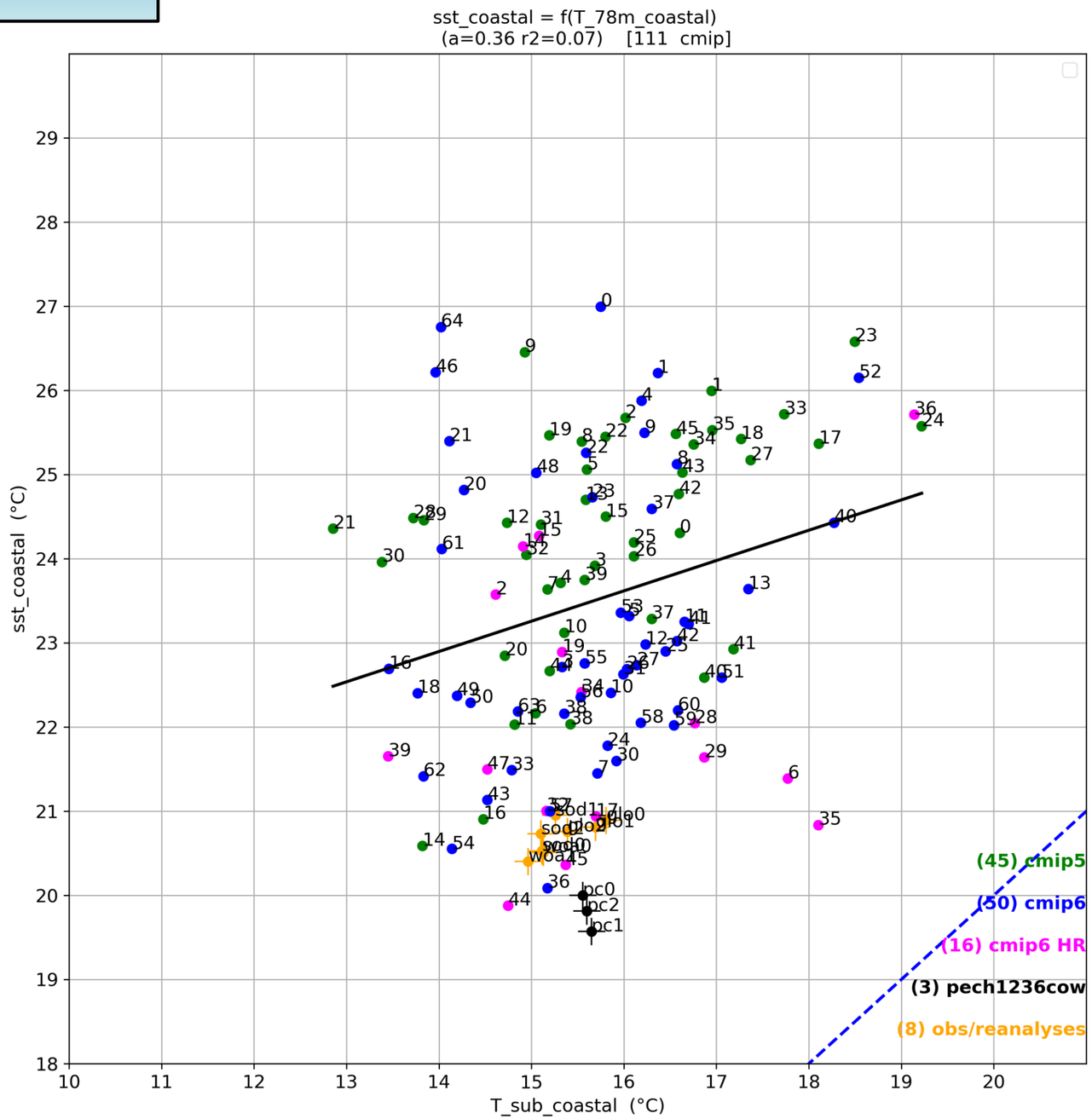
69m

sst coastal = f (T_sub_coastal)



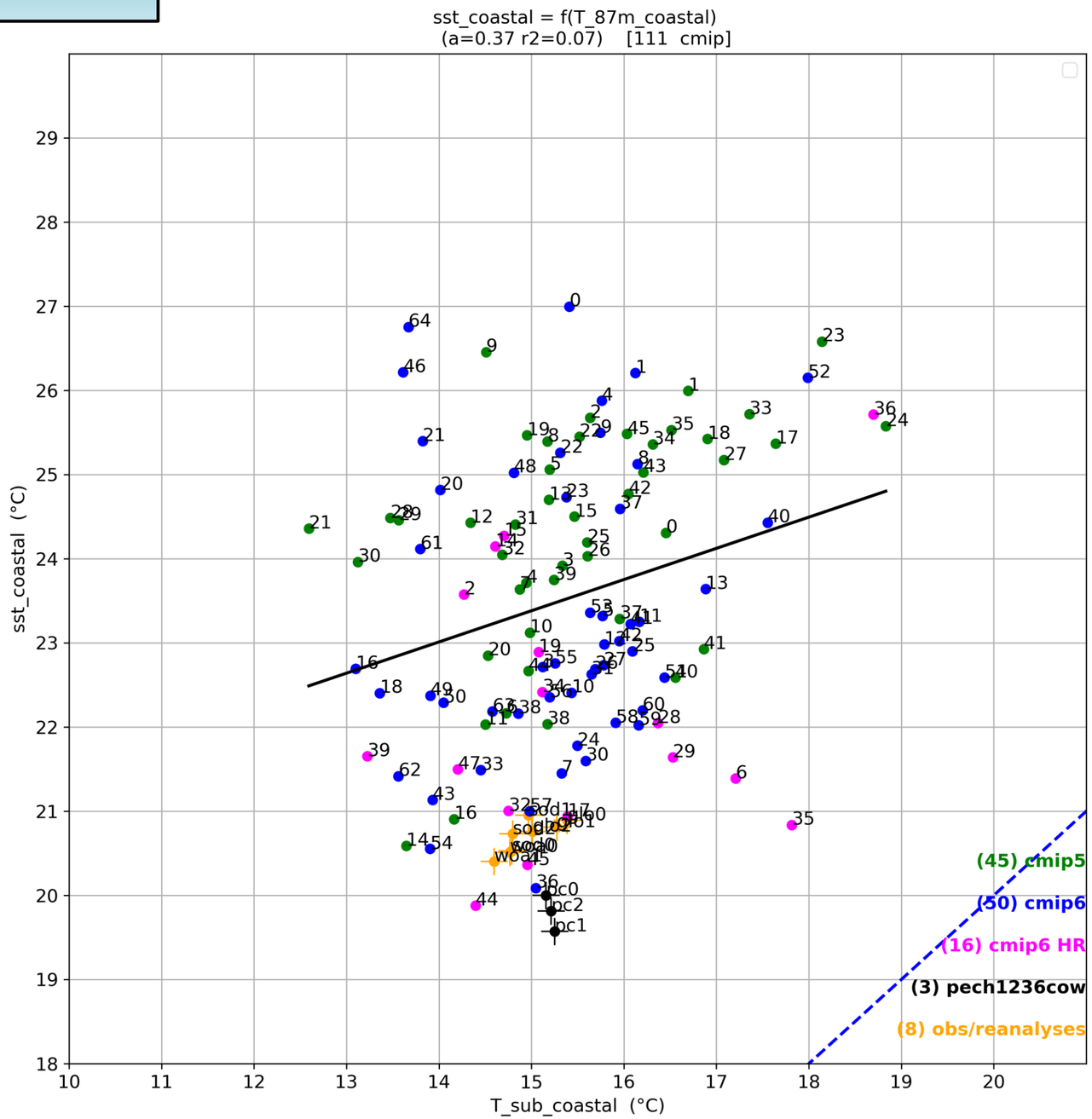
78m

sst coastal = f (T_sub_coastal)



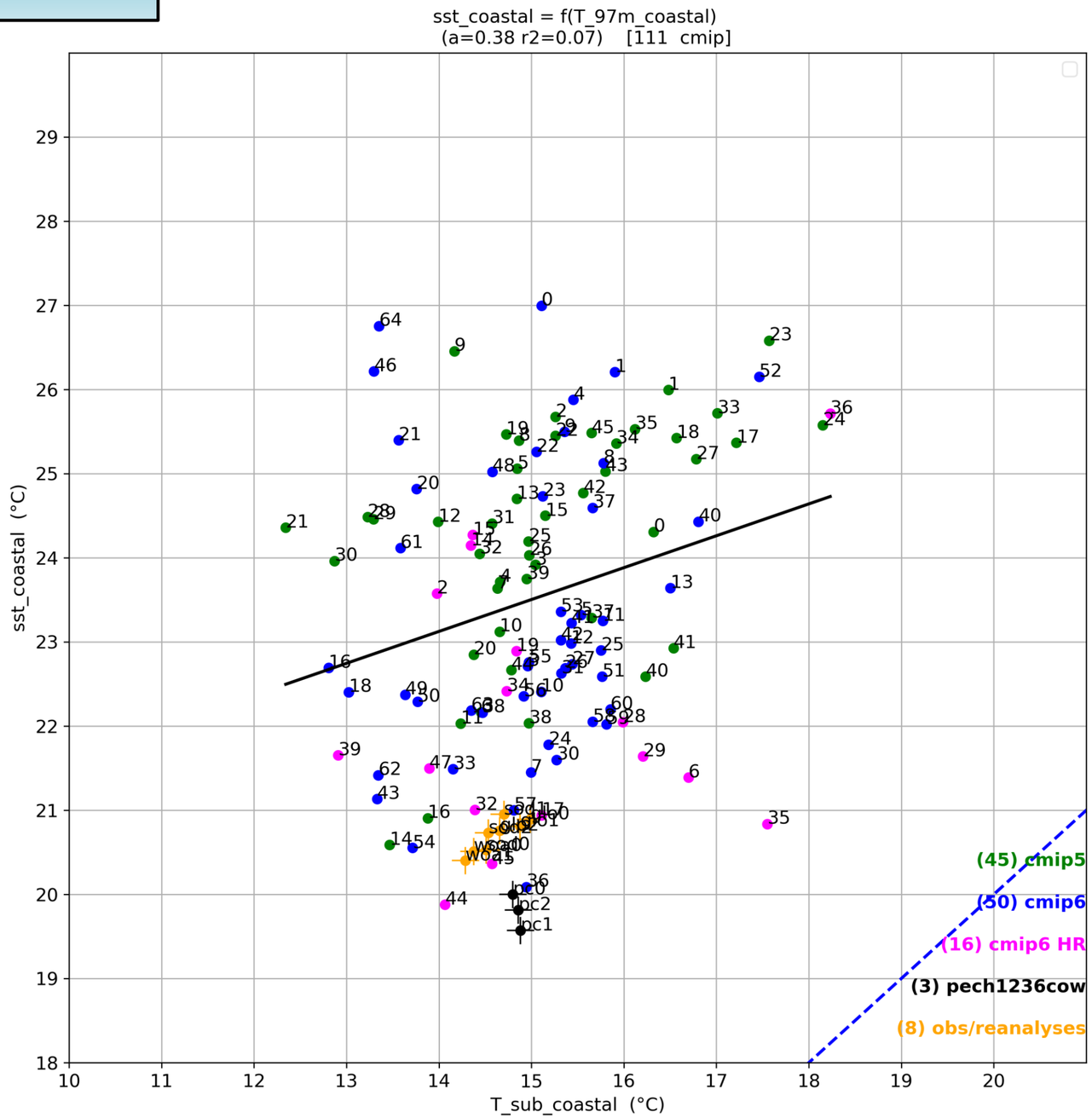
87m

sst coastal = f (T_sub_coastal)



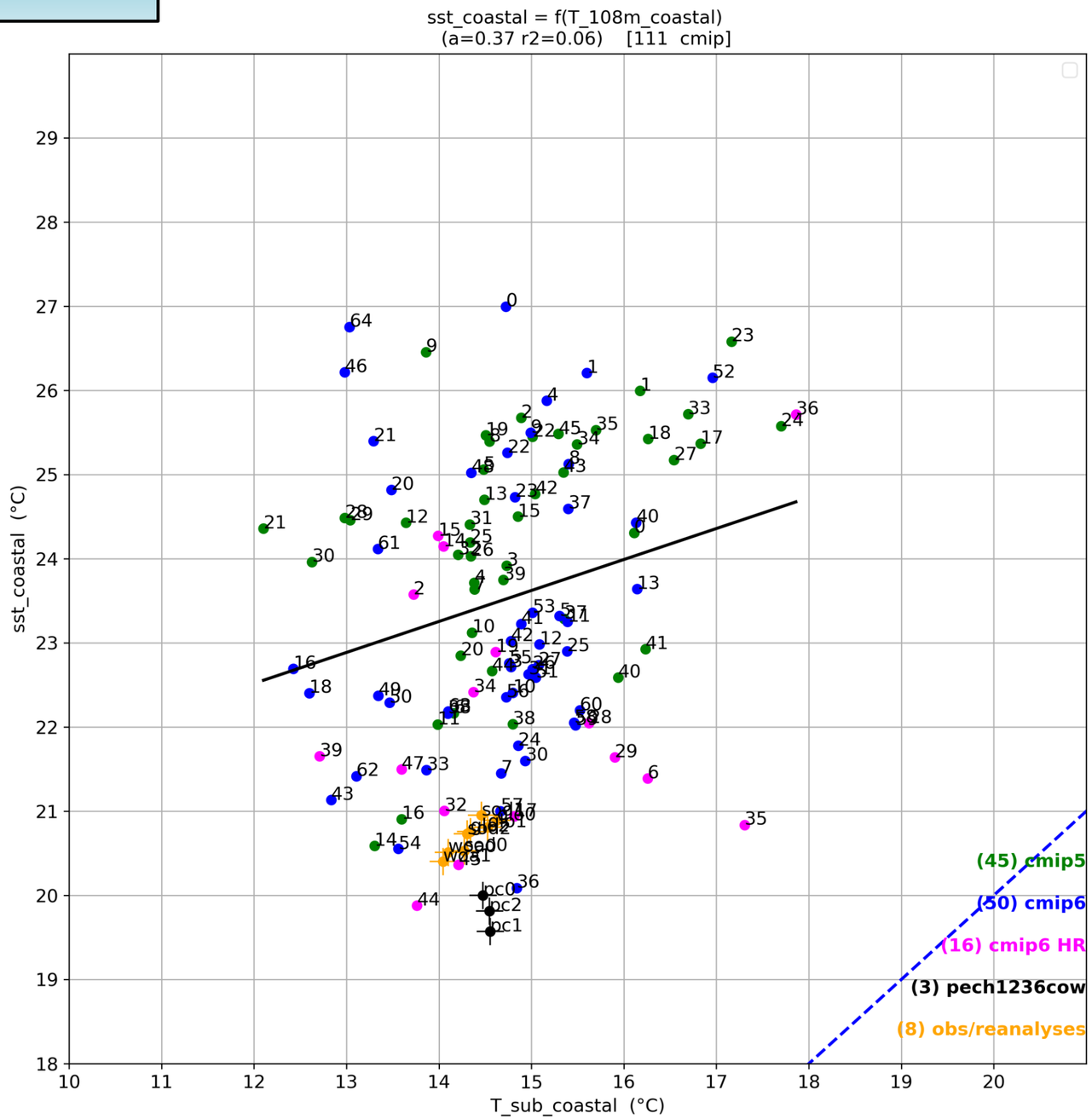
97m

sst coastal = f (T_sub_coastal)



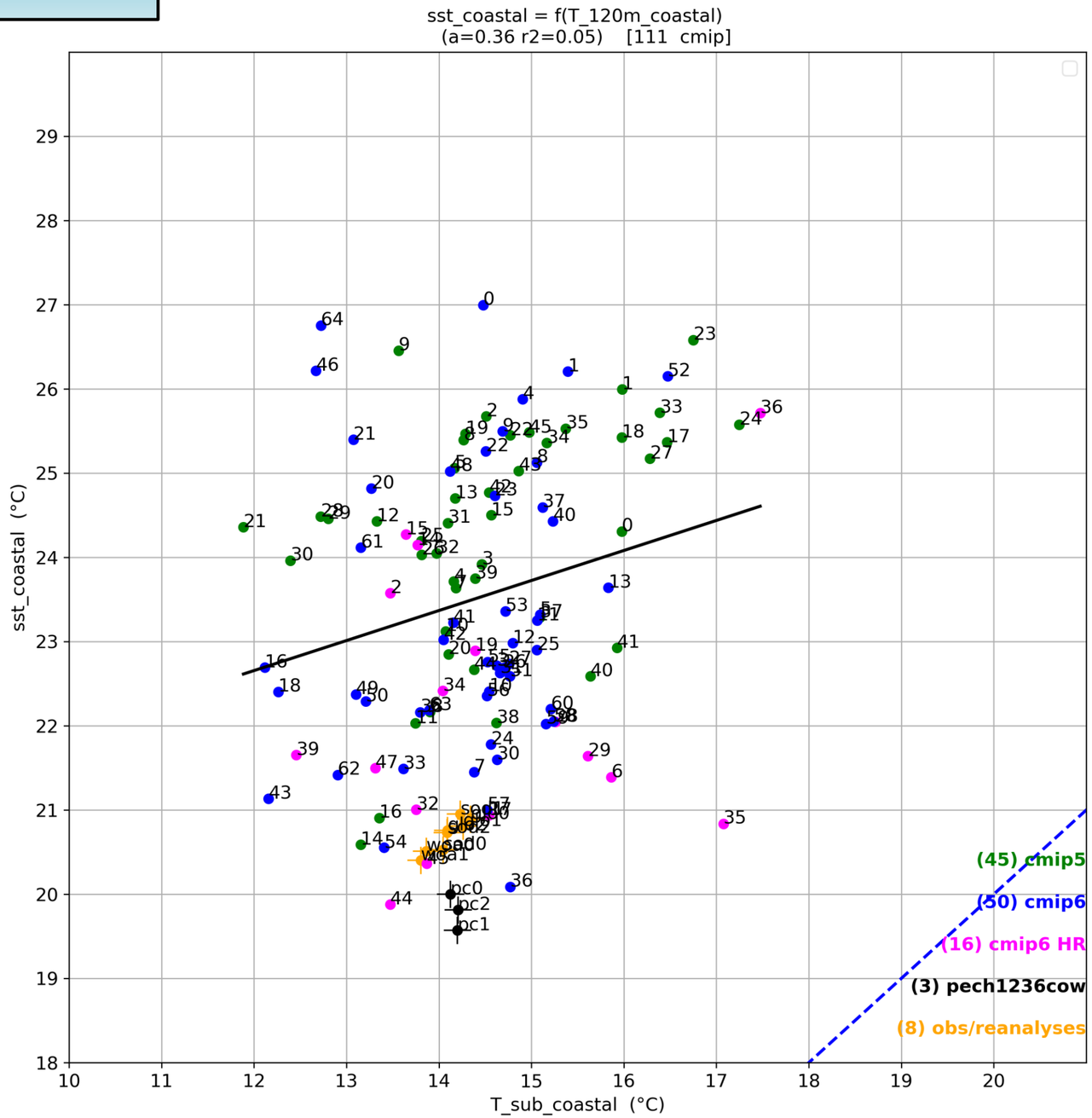
108m

sst coastal = f (T_sub_coastal)



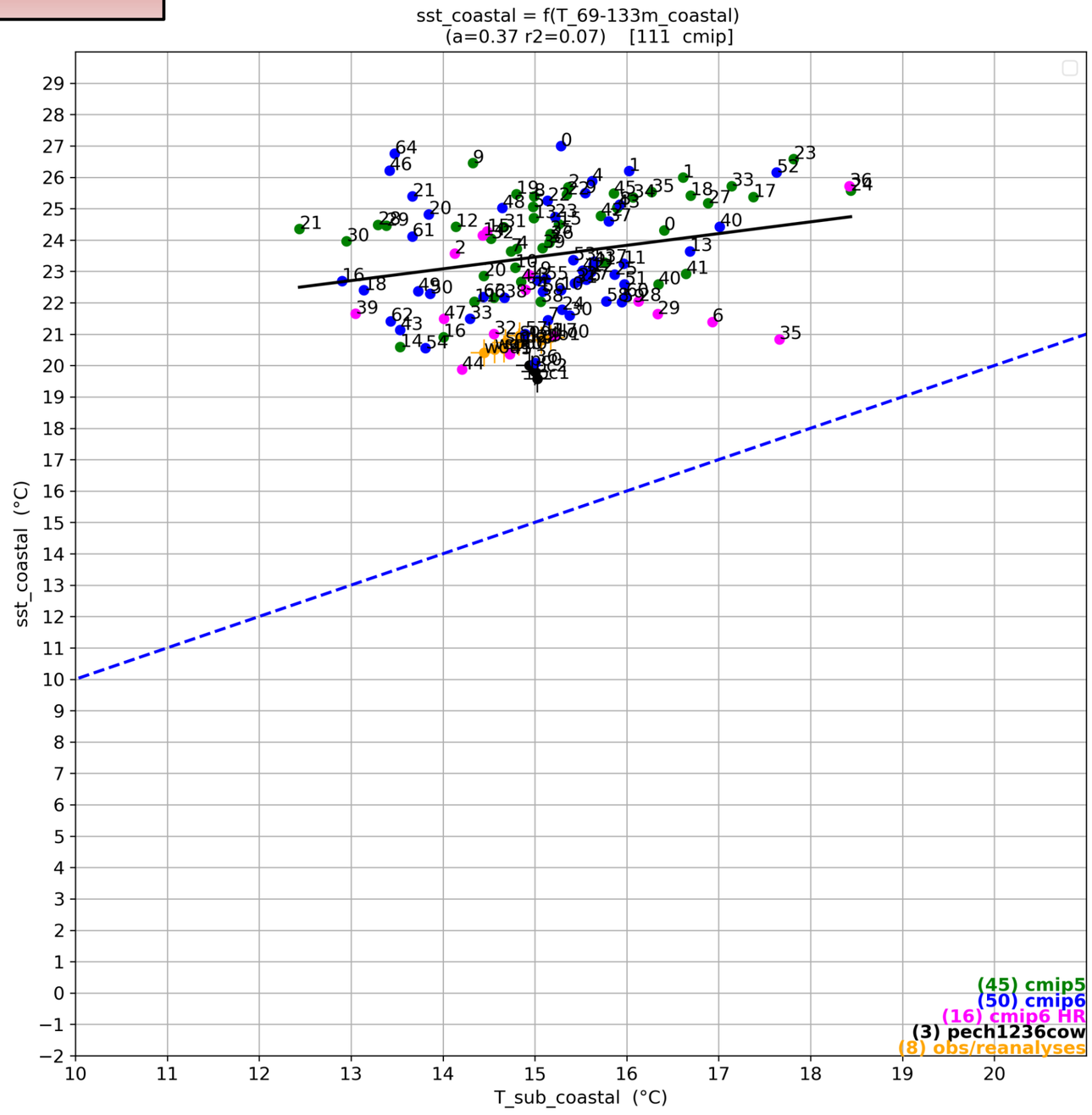
120m

sst coastal = f (T_sub_coastal)



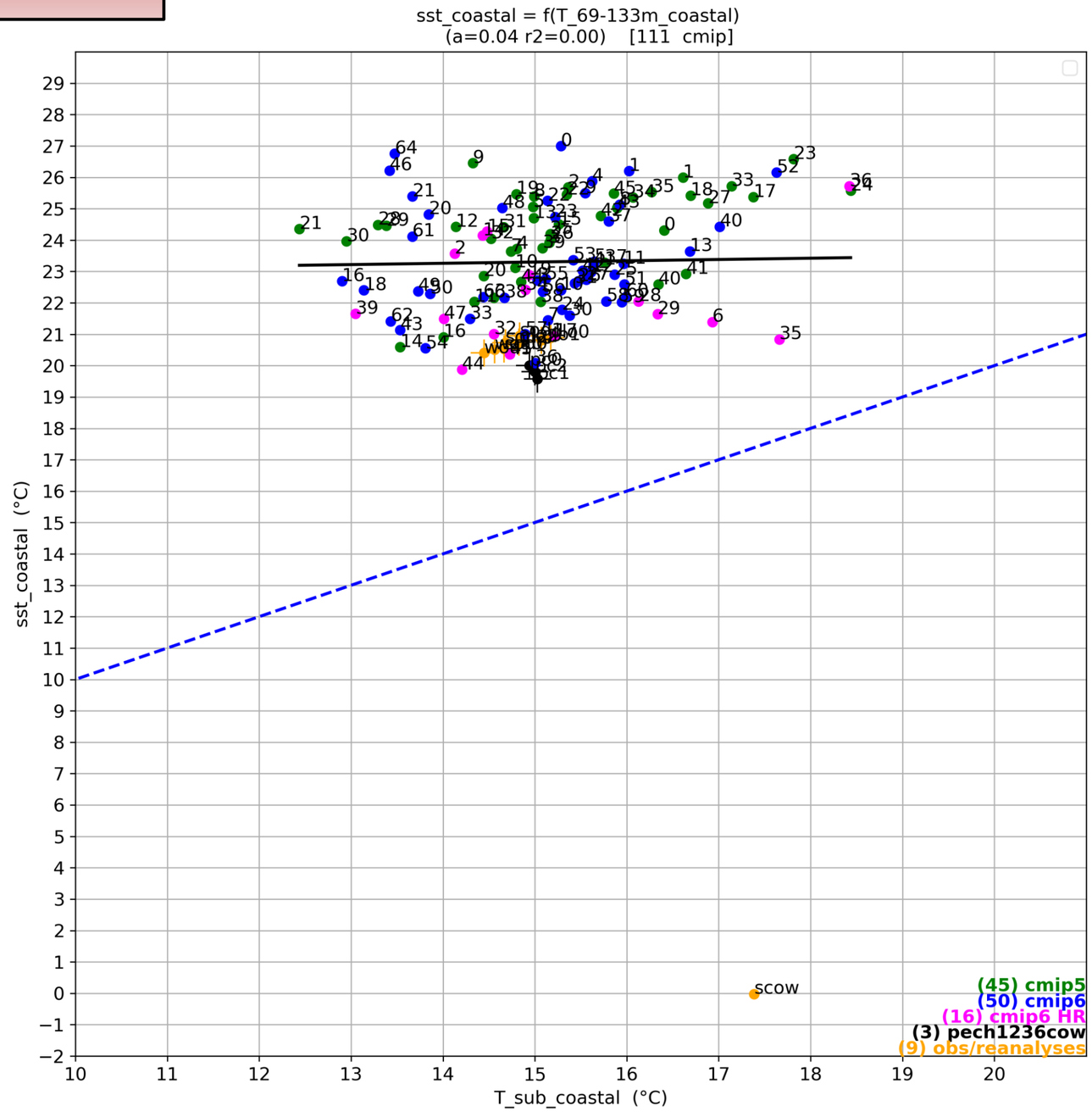
Bug r2

sst coastal = f (T_sub_coastal)



Bug r2

sst coastal = f (T_sub_coastal)



wo=f(tau)

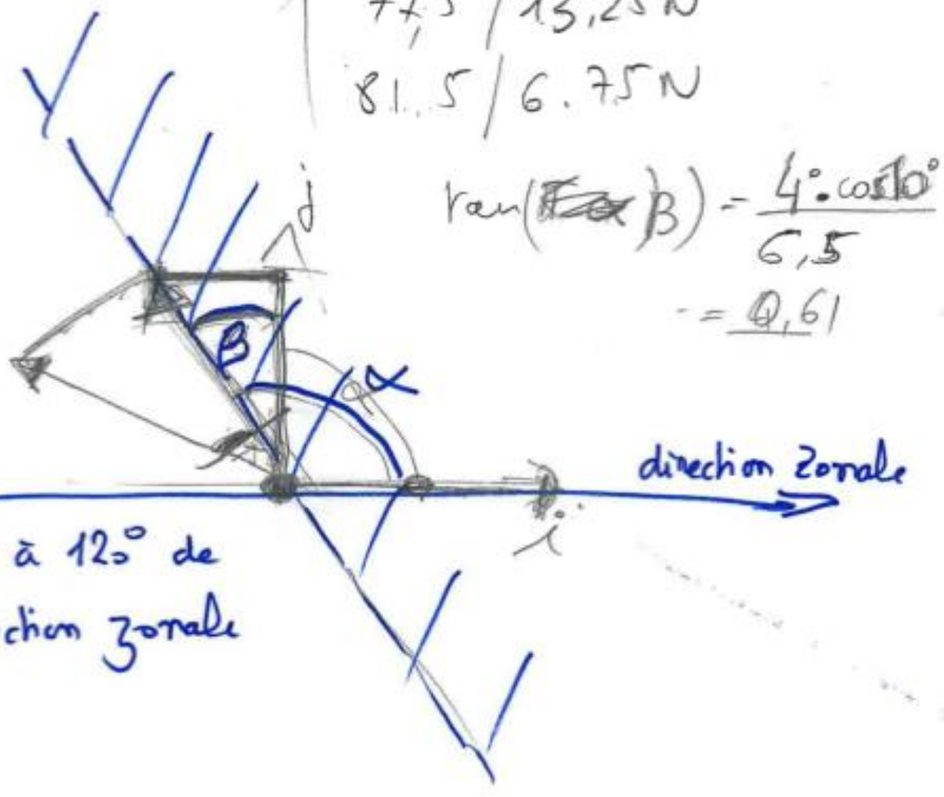
Quantifier le stress de vent => Scatter $Z = f(\omega_0)$

$\underline{\sigma}.\underline{c} = \begin{vmatrix} \sigma_x \\ \sigma_y \end{vmatrix} \cdot \begin{vmatrix} \cos\alpha \\ \sin\alpha \end{vmatrix} \begin{vmatrix} \cos 120 \\ \sin 120 \end{vmatrix}$

77,5 / 13,25 N

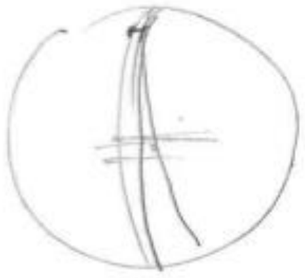
81.5 / 6.75 N

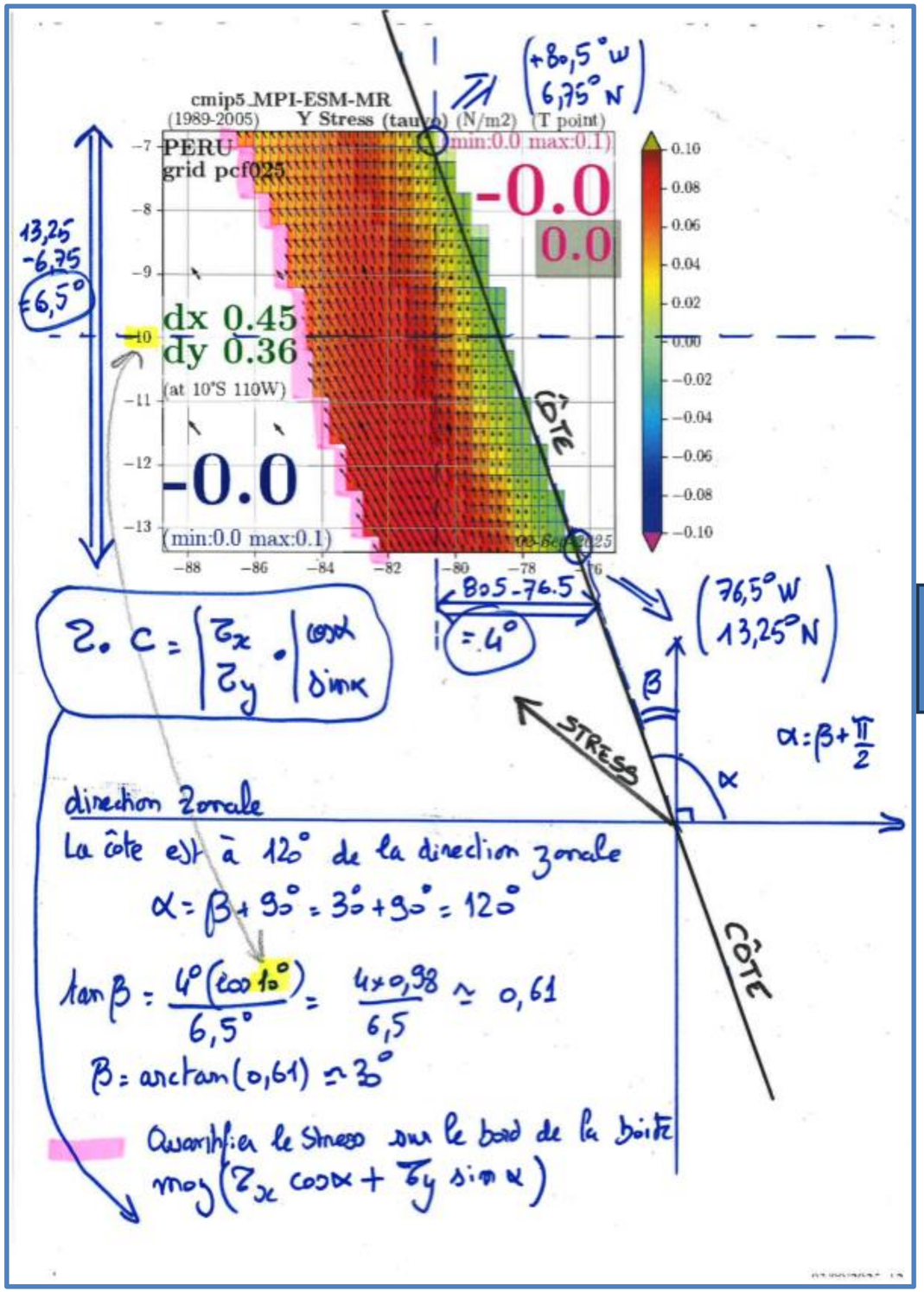
$\rightarrow \sigma_x \cos\alpha + \sigma_y \sin\alpha$

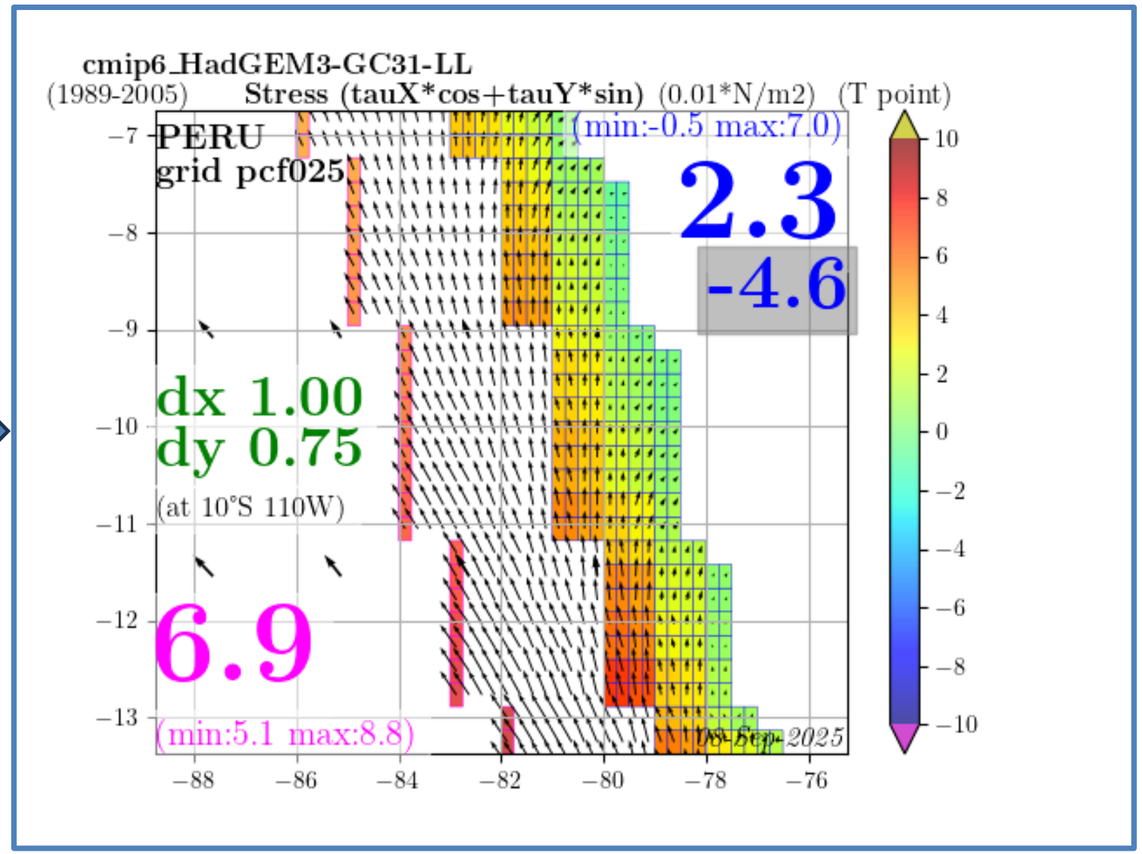


$\tan(\beta) = \frac{4 \cdot \cos 10°}{6,5}$

$= 0,61$

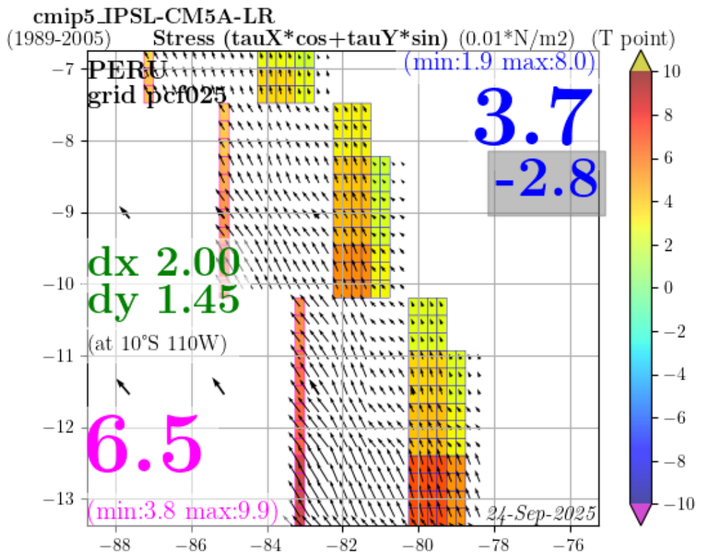



cmip5_MPI-ESM-MR
(1989-2005) Y Stress (tauy) (N/m2) (T point)
PERU
grid pcf025
(min:0.0 max:0.1)
-0.0
0.0
dx 0.45
dy 0.36
(at 10°S 110W)
-0.0
(min:0.0 max:0.1)
(+80,5° W
6,75° N)
(76,5° W
13,25° N)
B05-76.5
=4°
13,25
-6,75
=6,5°
CÔTE
STRESS
β
α
α = β + π/2
direction zonale
La côte est à 120° de la direction zonale
α = β + 90° = 30° + 90° = 120°
tan β = 4°(cos 10°) / 6,5° = 4×0,98 / 6,5 ≃ 0,61
β = arctan(0,61) ≃ 30°
Quantifier le stress sur le bord de la boîte
moy(τx cos α + τy sin α)
2. C = |τx τy| · |cos α sin α|

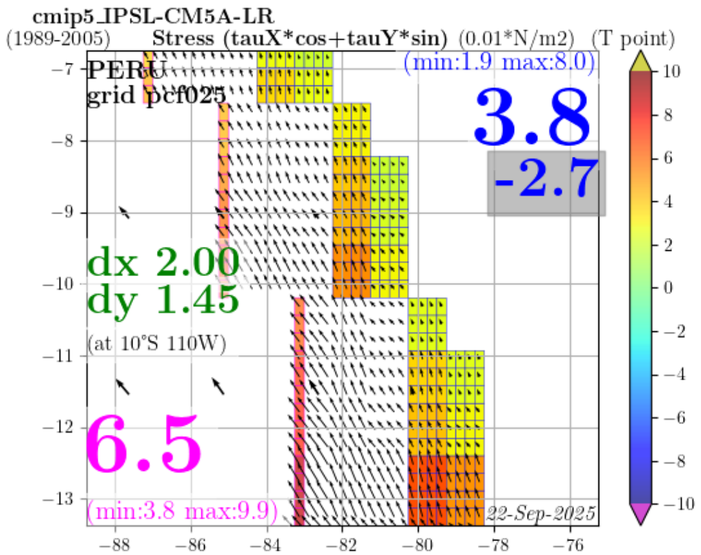

cmip6_HadGEM3-GC31-LL
(1989-2005) Stress (tauX*cos+tauY*sin) (0.01*N/m2) (T point)
PERU
grid pcf025
(min:-0.5 max:7.0)
2.3
-4.6
dx 1.00
dy 0.75
(at 10°S 110W)
6.9
(min:5.1 max:8.8)

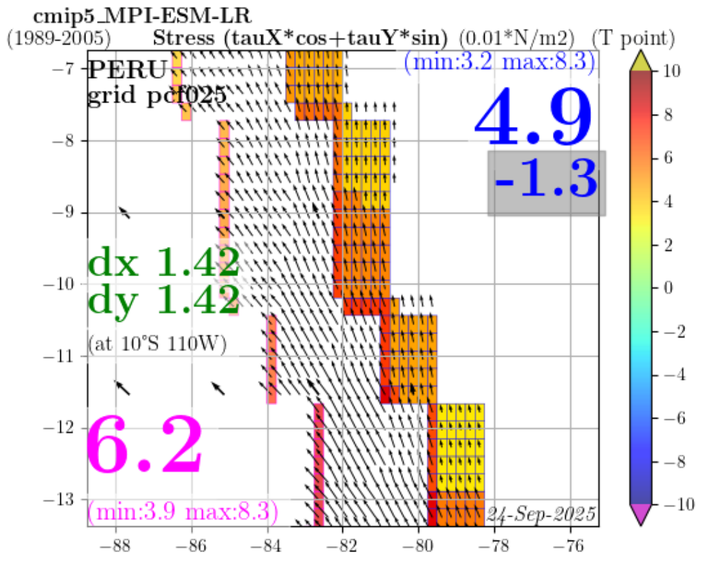
Ajout 6-12 cells

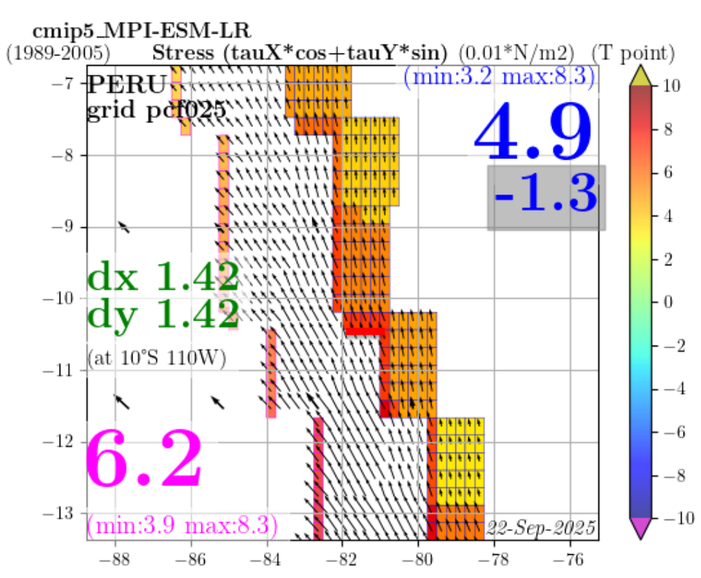
Coastal 6-12 cells



Coastal 1-12 cells

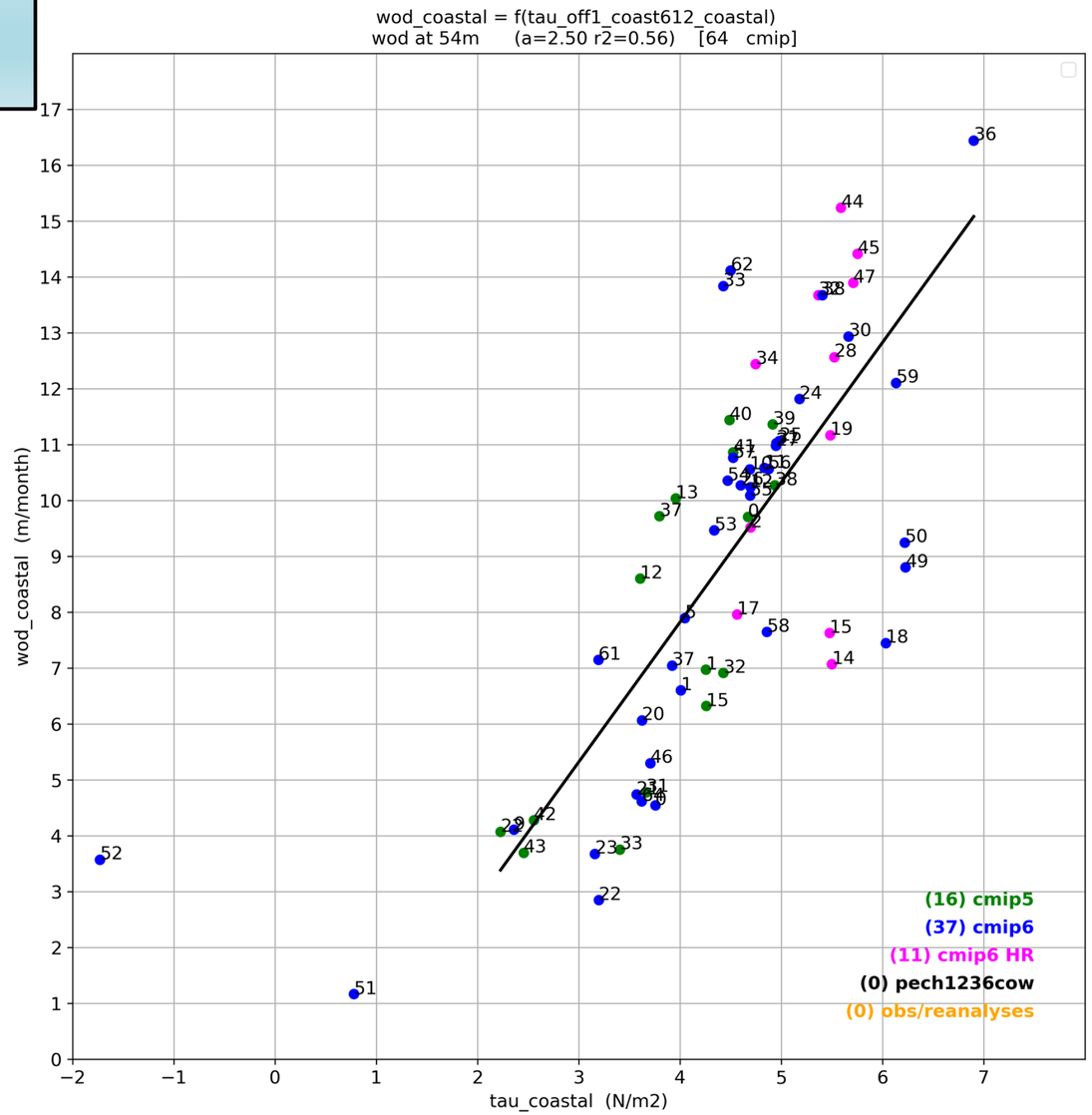




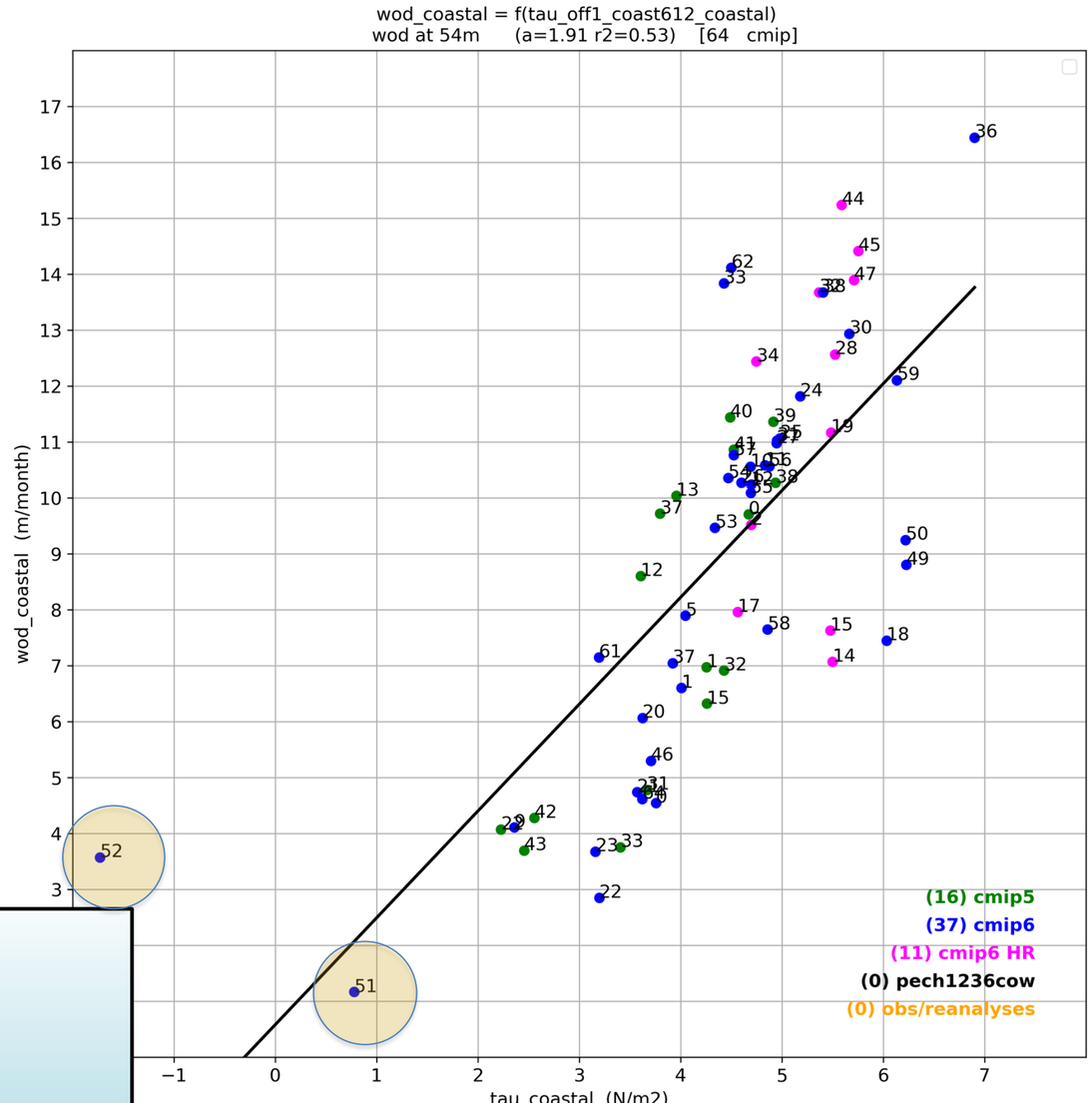


wod+wo= f (tau)

- Pas remis le drop off ni la variation des mailles sur upBas1 et upBas2



wod+wo= f (tau)

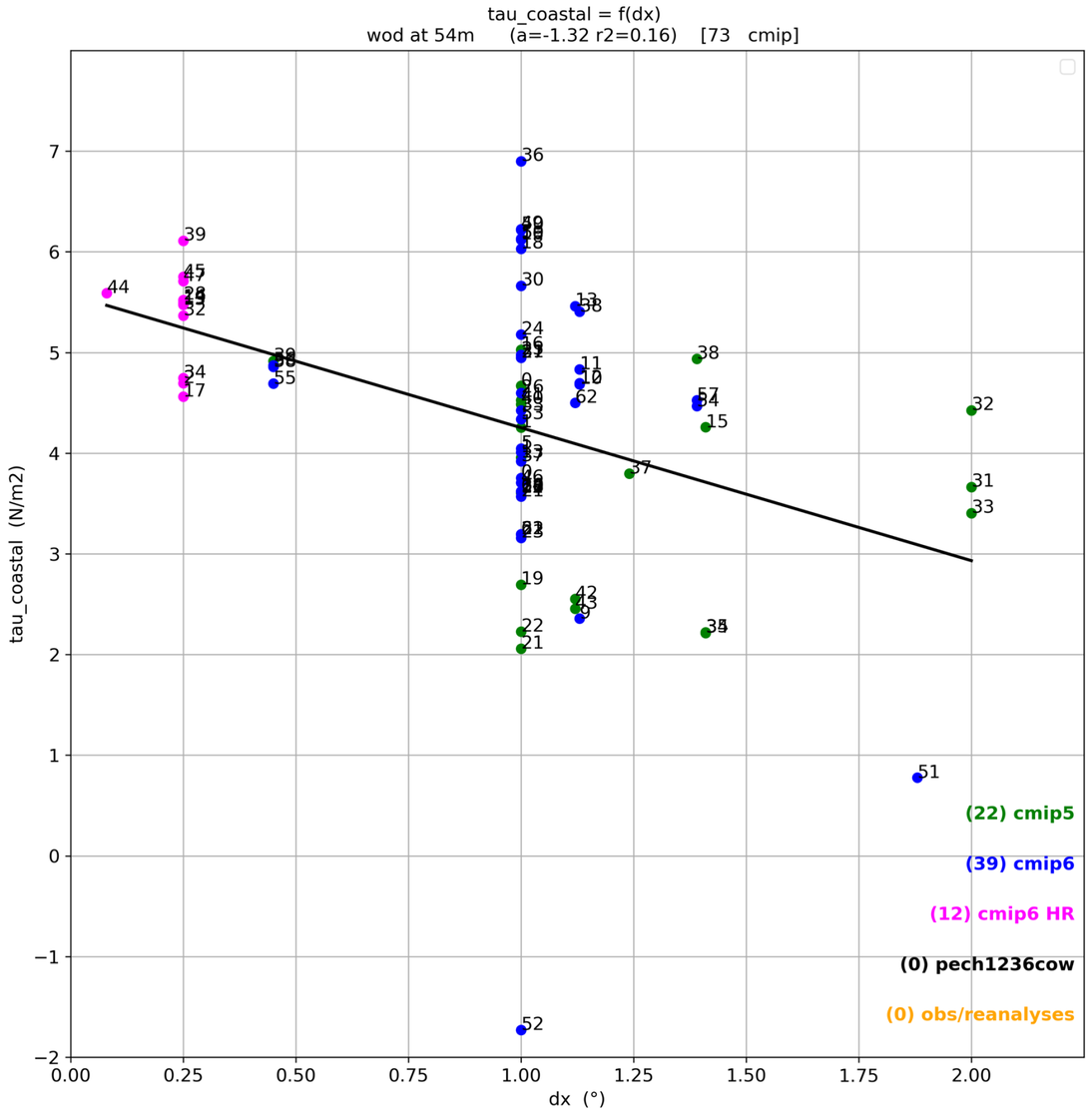


- (id6c52) cmip6_MIROC-ES2L
  - Vent contraire!
- (id6c51) cmip6_MCM-UA-1-0
  - Pas de vent
  - Pas de wo
  - Pas d'EUC

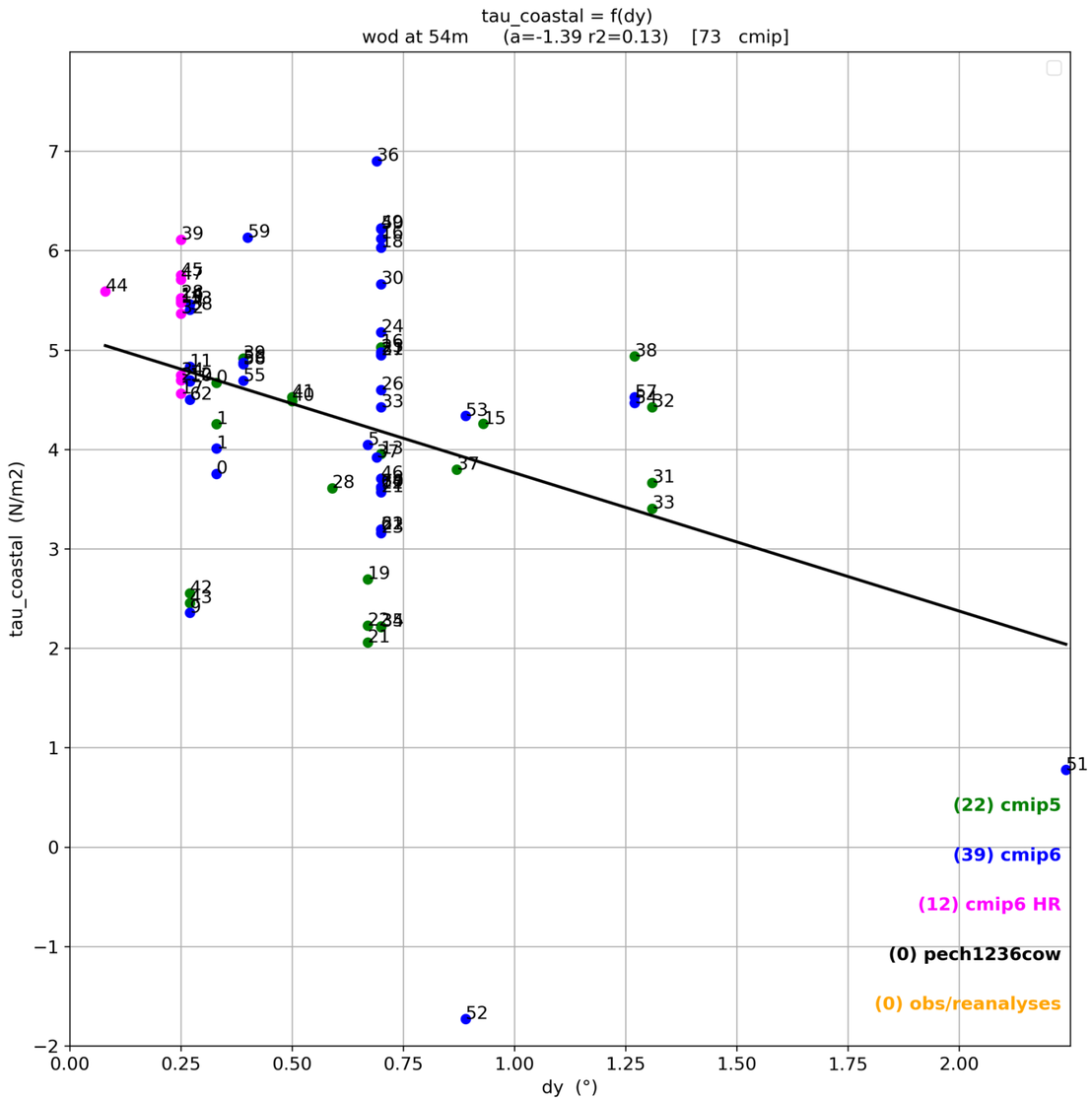
wo=f(dx,dy,dz)

ocean

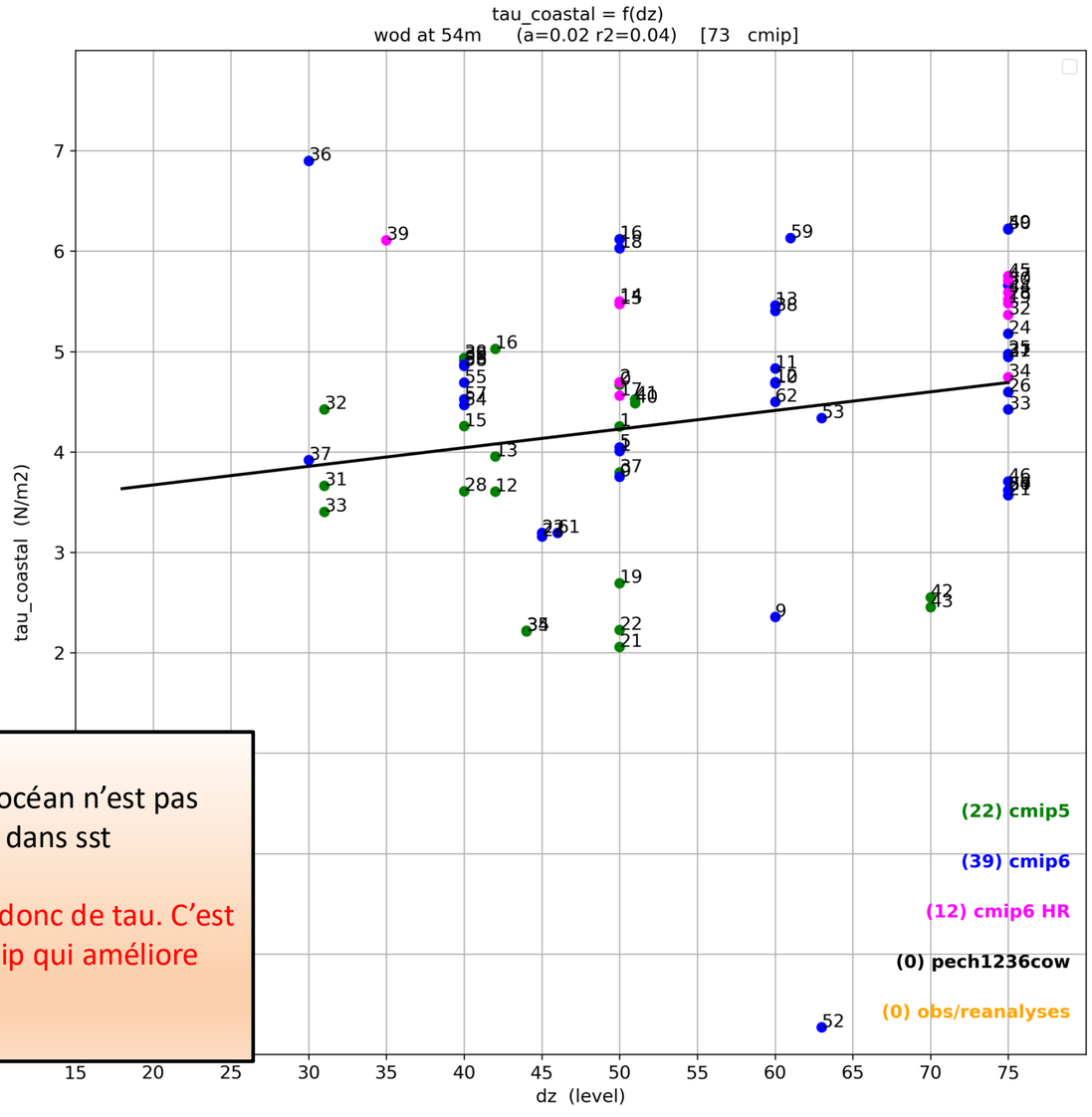
tau= f (dx)


tau_coastal = f(dx)
wod at 54m (a=-1.32 r2=0.16) [73 cmip]
tau_coastal (N/m2)
dx (°)
(22) cmip5
(39) cmip6
(12) cmip6 HR
(0) pech1236cow
(0) obs/reanalyses

tau= f (dy)


tau_coastal = f(dy)
wod at 54m (a=-1.39 r2=0.13) [73 cmip]
tau_coastal (N/m2)
dy (°)
(22) cmip5
(39) cmip6
(12) cmip6 HR
(0) pech1236cow
(0) obs/reanalyses

tau= f (dz)

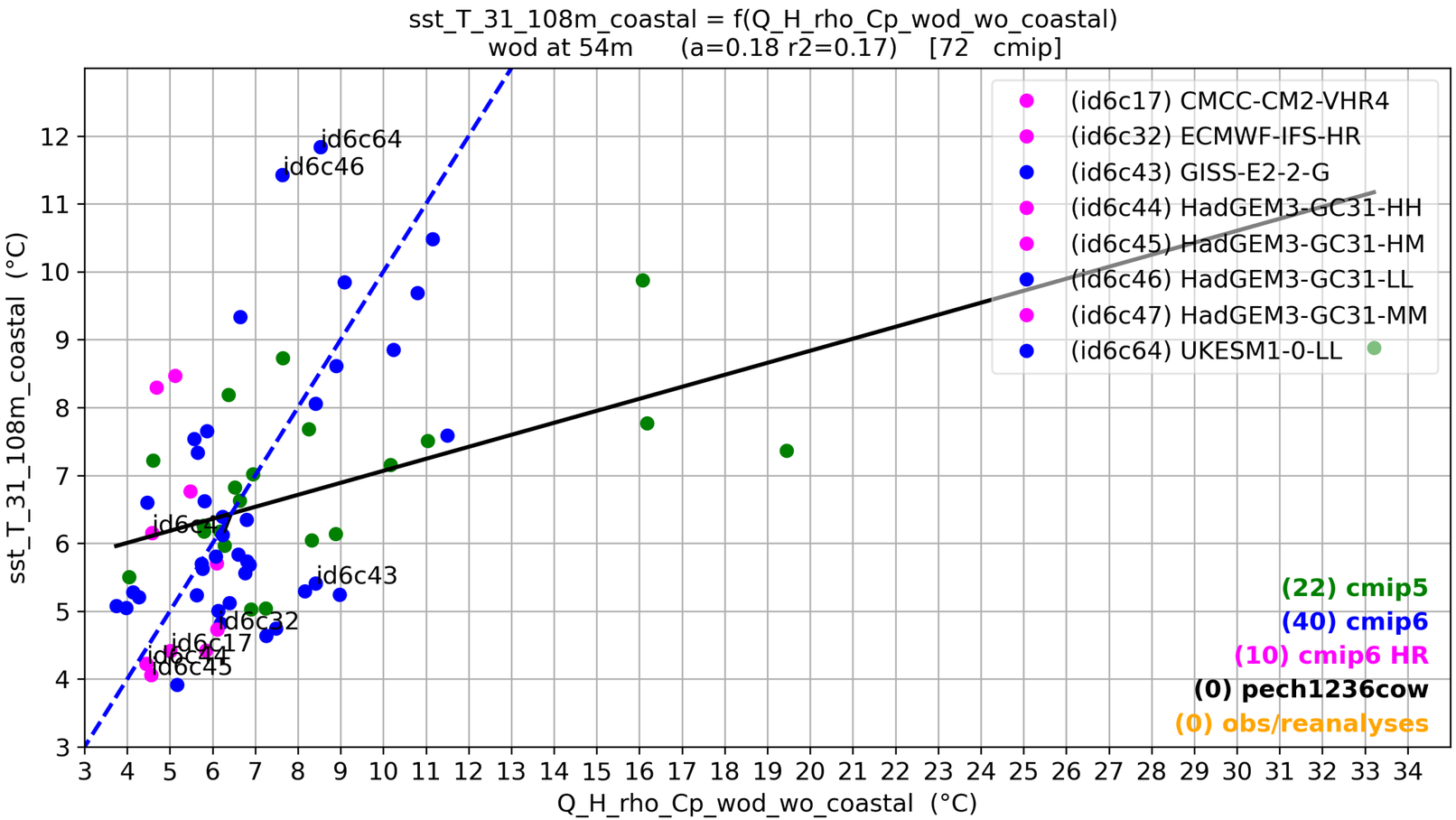


- Peut on conclure que la résolution de l'océan n'est pas déterminante dans tau => dans wod => dans sst
- Mais que la sst dépend bien de wod et donc de tau. C'est donc l'amélioration de tau au fil des cmip qui améliore wo et donc la sst.

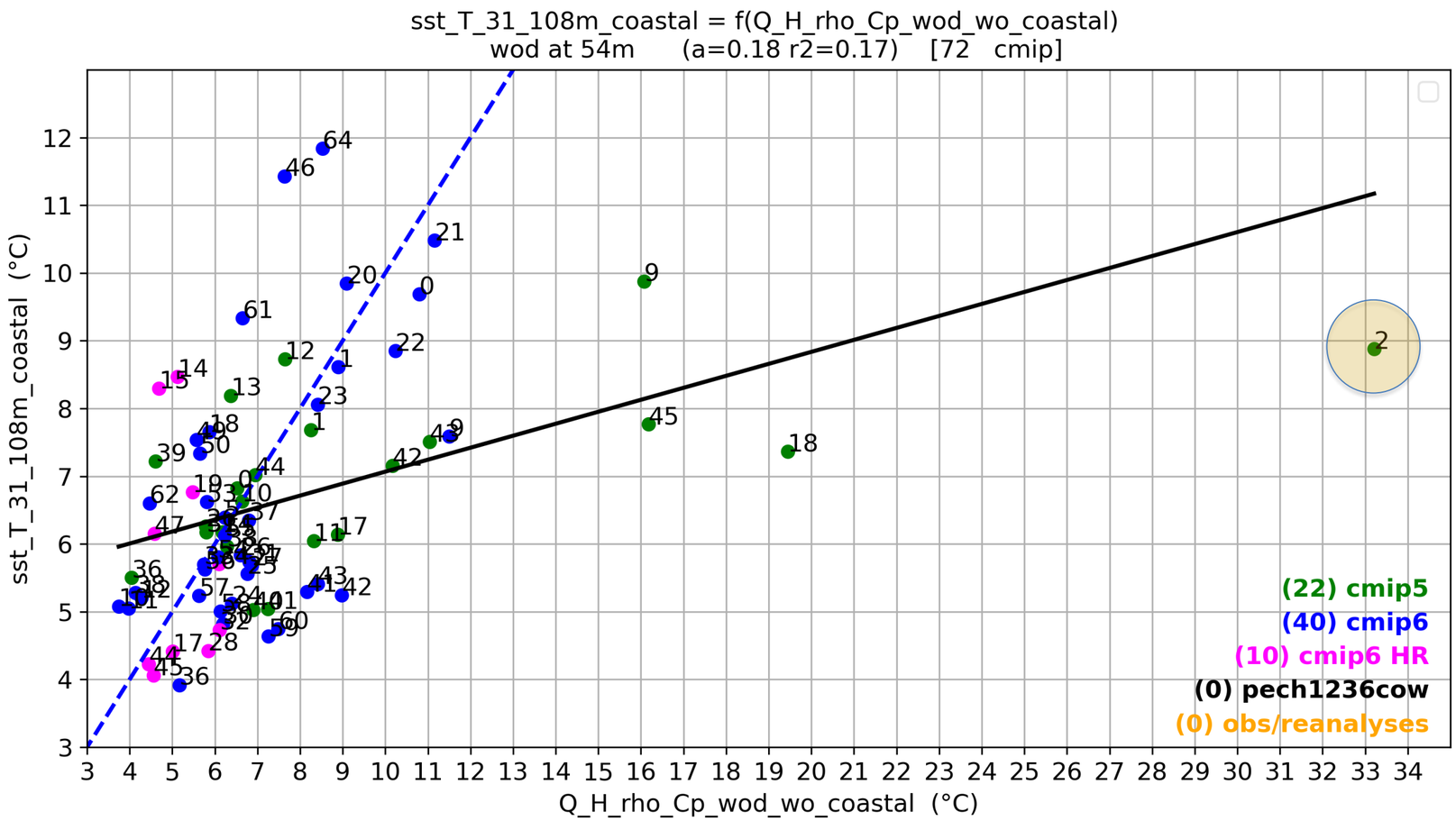
wo=f(dx,dy,dz)
atmosphère

deltaT=f(Q,H,wo)

dT coastal = f (Q_H_wod+wo coastal)

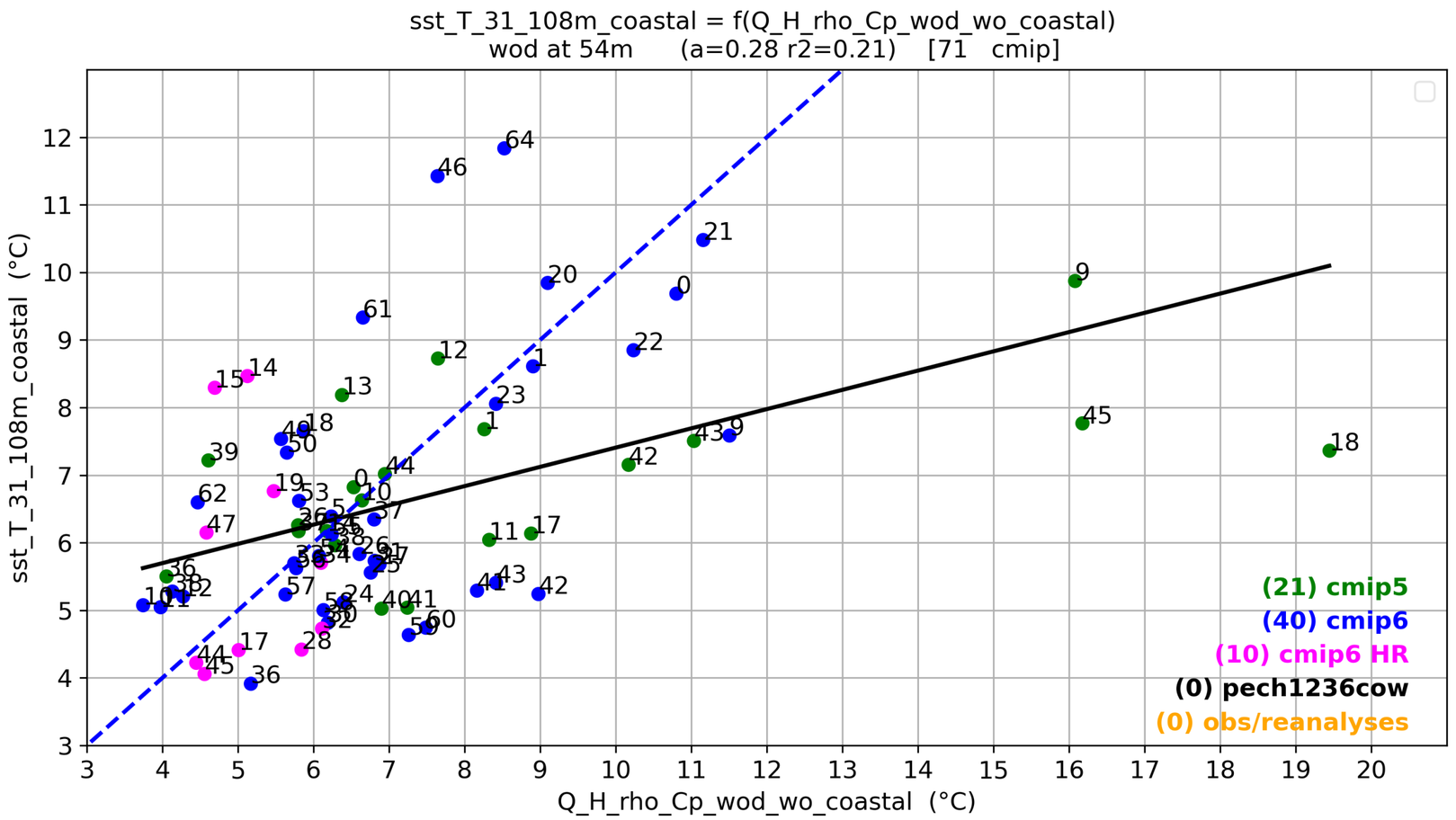


dT coastal = f (Q_H_wod+wo coastal)

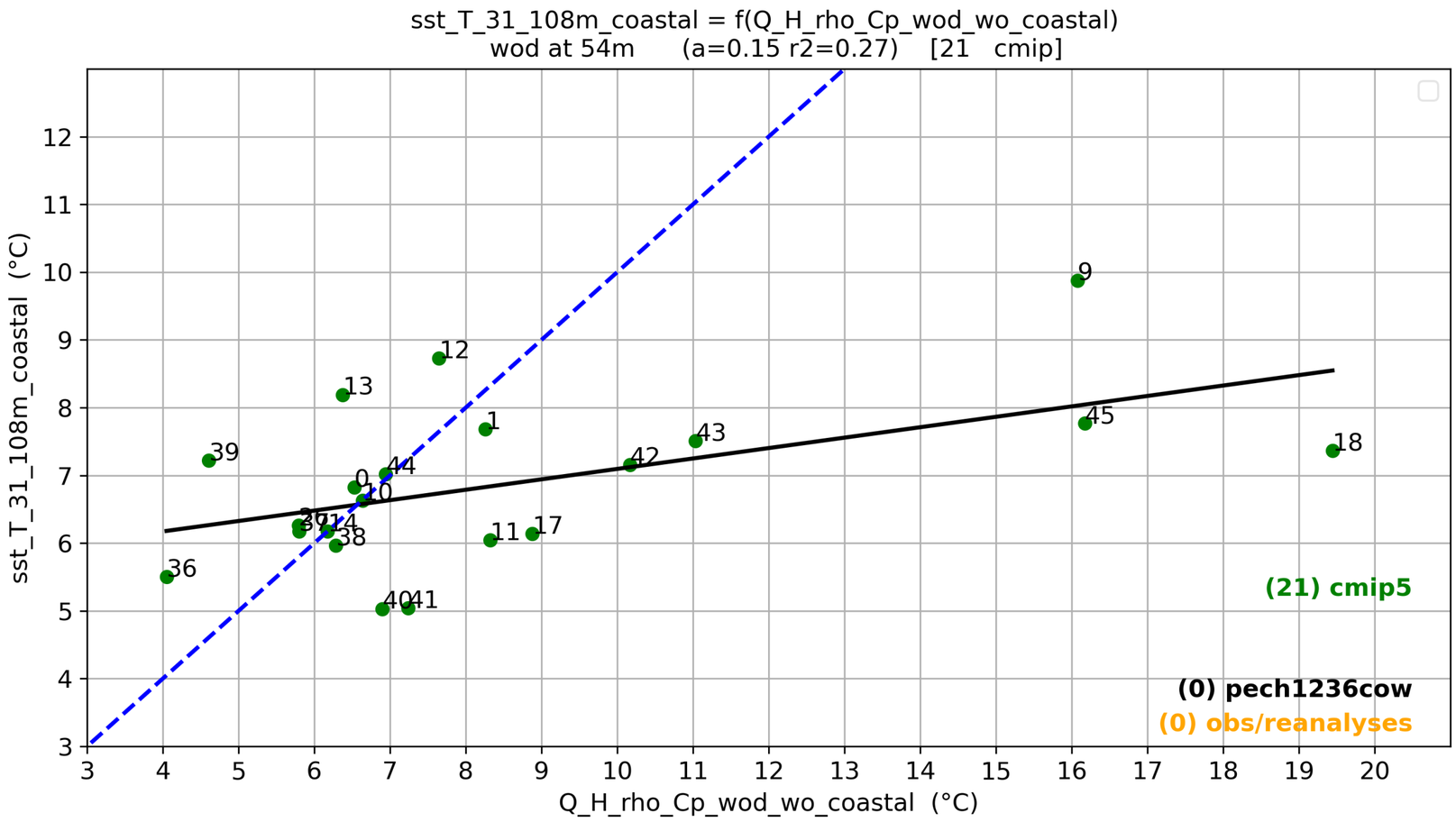


- (id5c2) cmip5_BNU-ESM
  - wo vraiment douteux… et les autres champs aussi
- Manque pech12 hfdsO (existe mais en sigma)
- Manque glorys hfdsO (voir la clim mercator ou demander à Steph sur la grille native!)

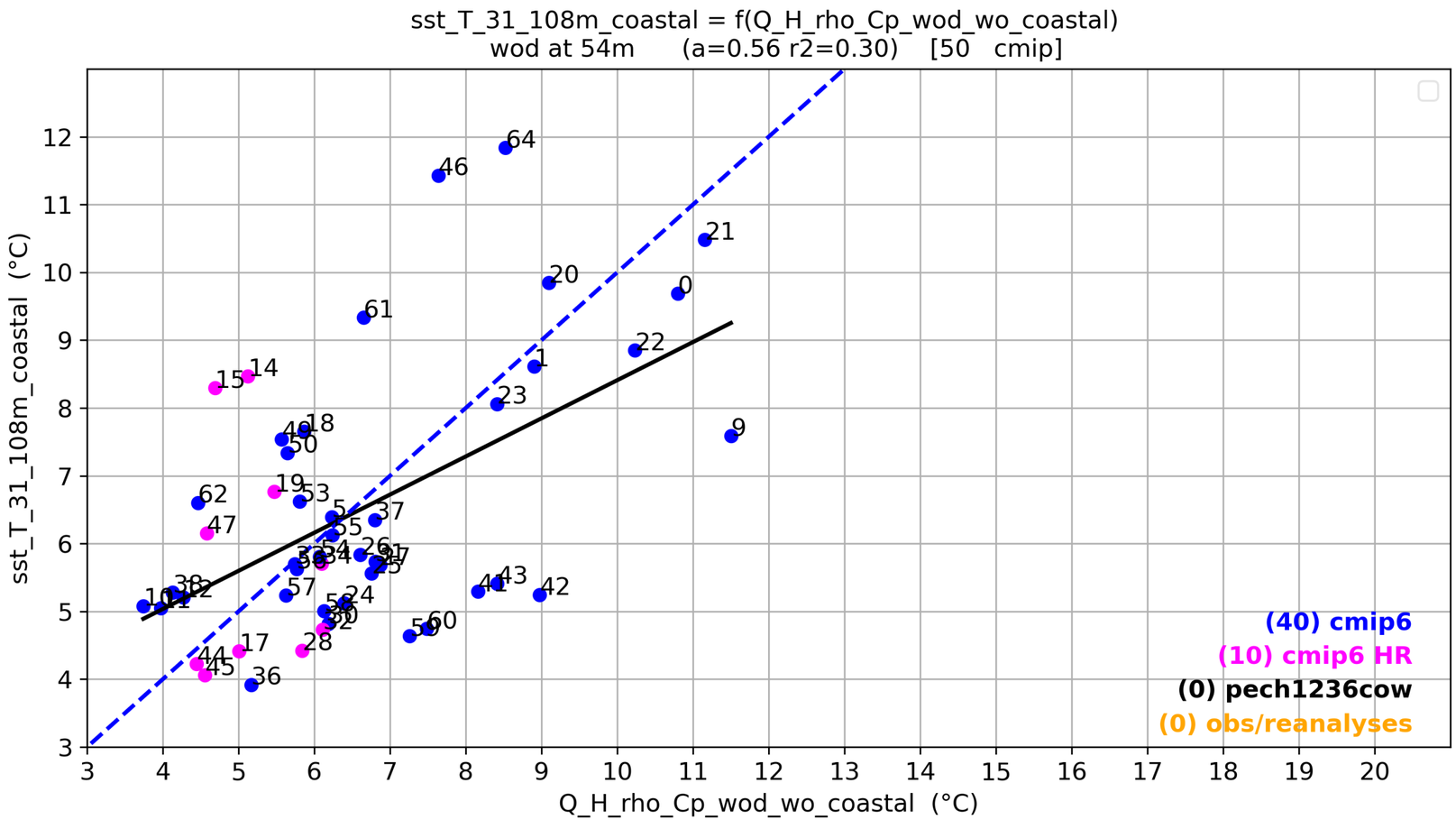
Sans cmip5_BNU-ESM : dT coastal = f (Q_H_wod+wo coastal)



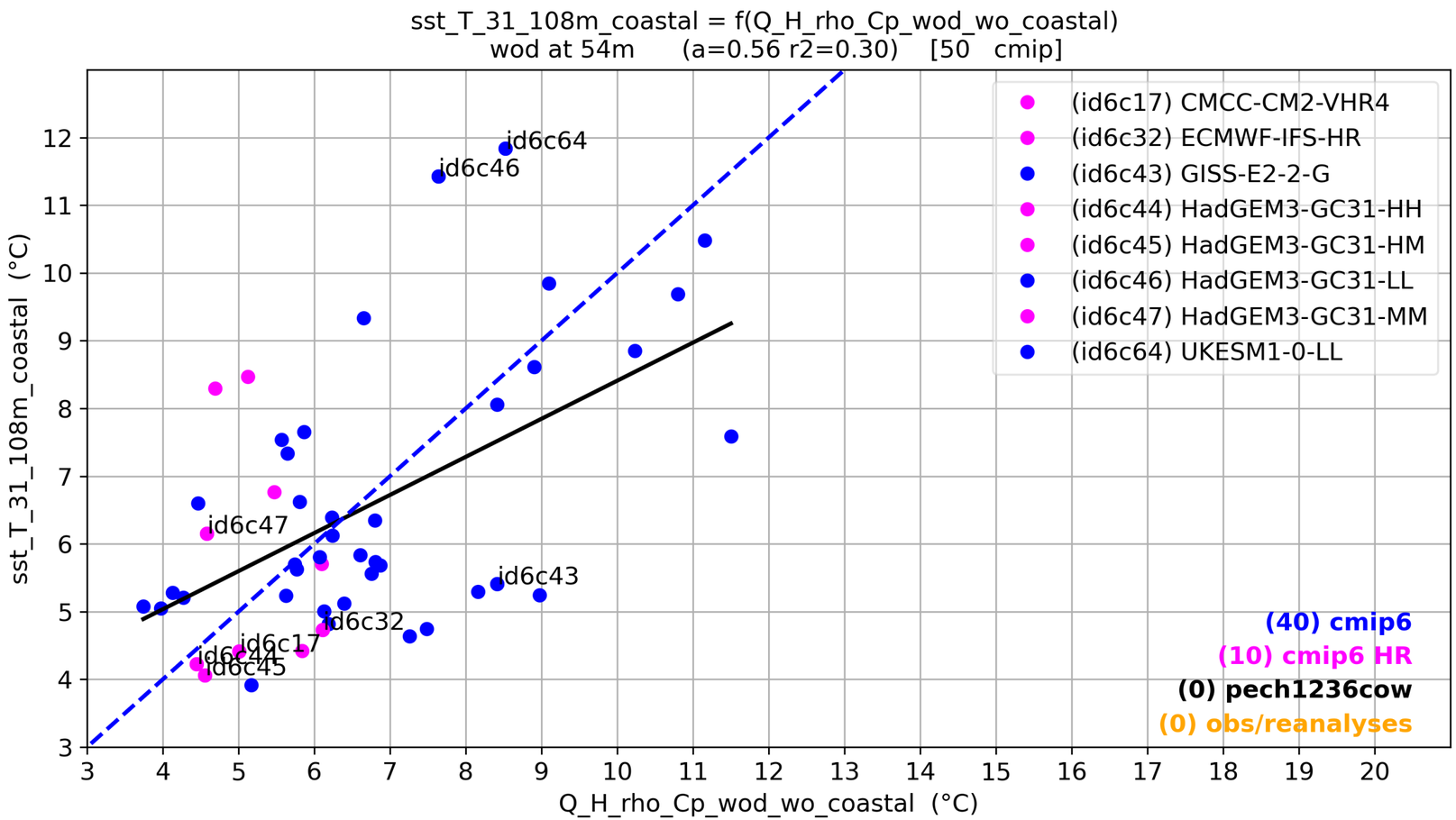
cmip5: dT coastal = f (Q_H_wod+wo coastal)



cmip6: dT coastal = f (Q_H_wod+wo coastal)



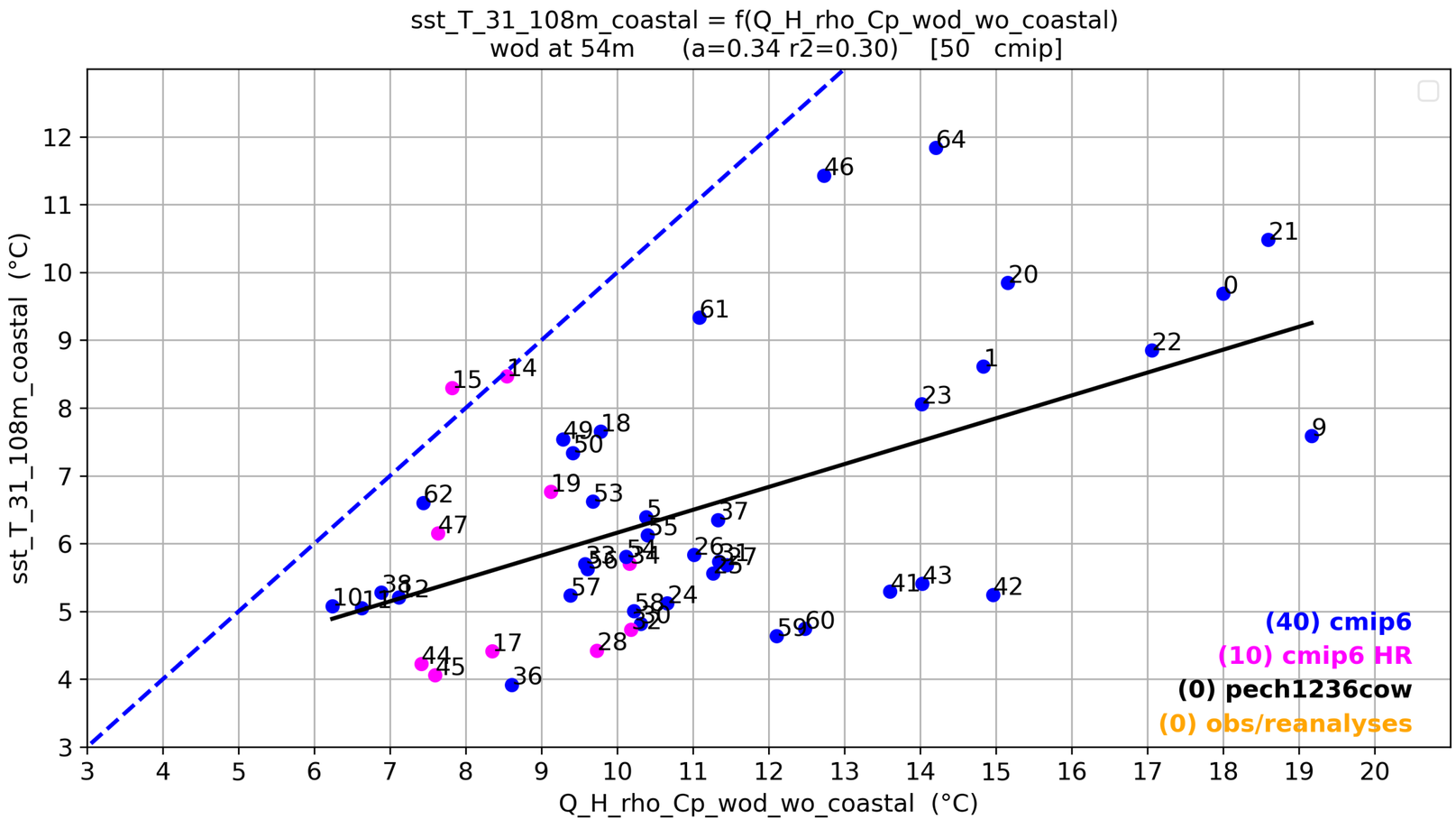
cmip6: dT coastal = f (Q_H_wod+wo coastal)



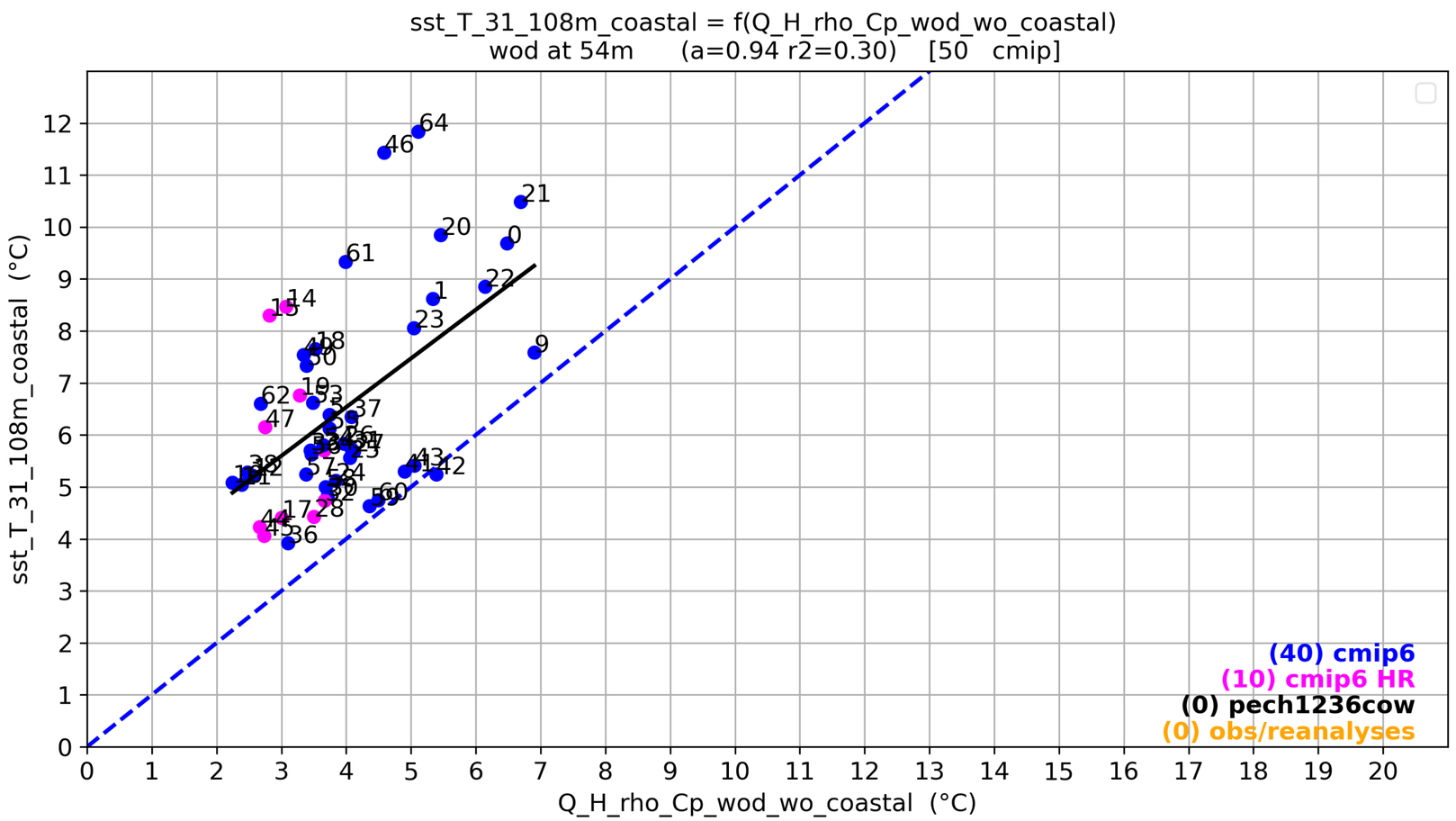
- Sur deltaT = f [QHrhoCpwod] pourquoi dun côté ou l'autre de la droite 1 poir 1 ou pourquoi a distance?
- Corrélé à delta T ou à Tsub? Ordre 2
- Je peux afficher facilement sur chaque point, wo, Tsub… pour une premire estimation qualitative

Influence H/h

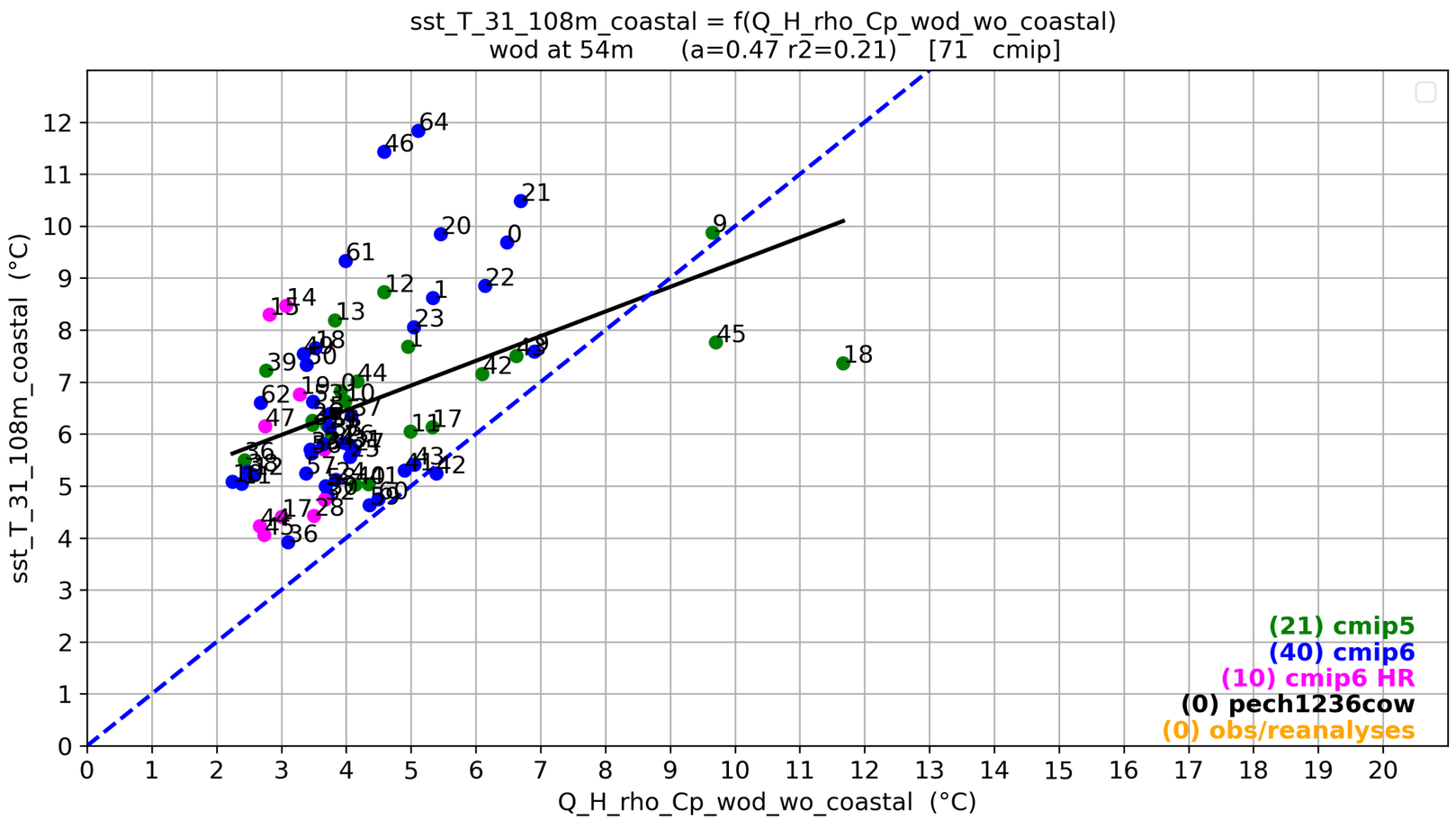
Cmip6 & H/h = 50/30: sst coastal = f (wod+wo coastal)



Cmip6 & H/h = 30/50: sst coastal = f (wod+wo coastal)



Cmip6 & H/h = 30/50: sst coastal = f (wod+wo coastal)



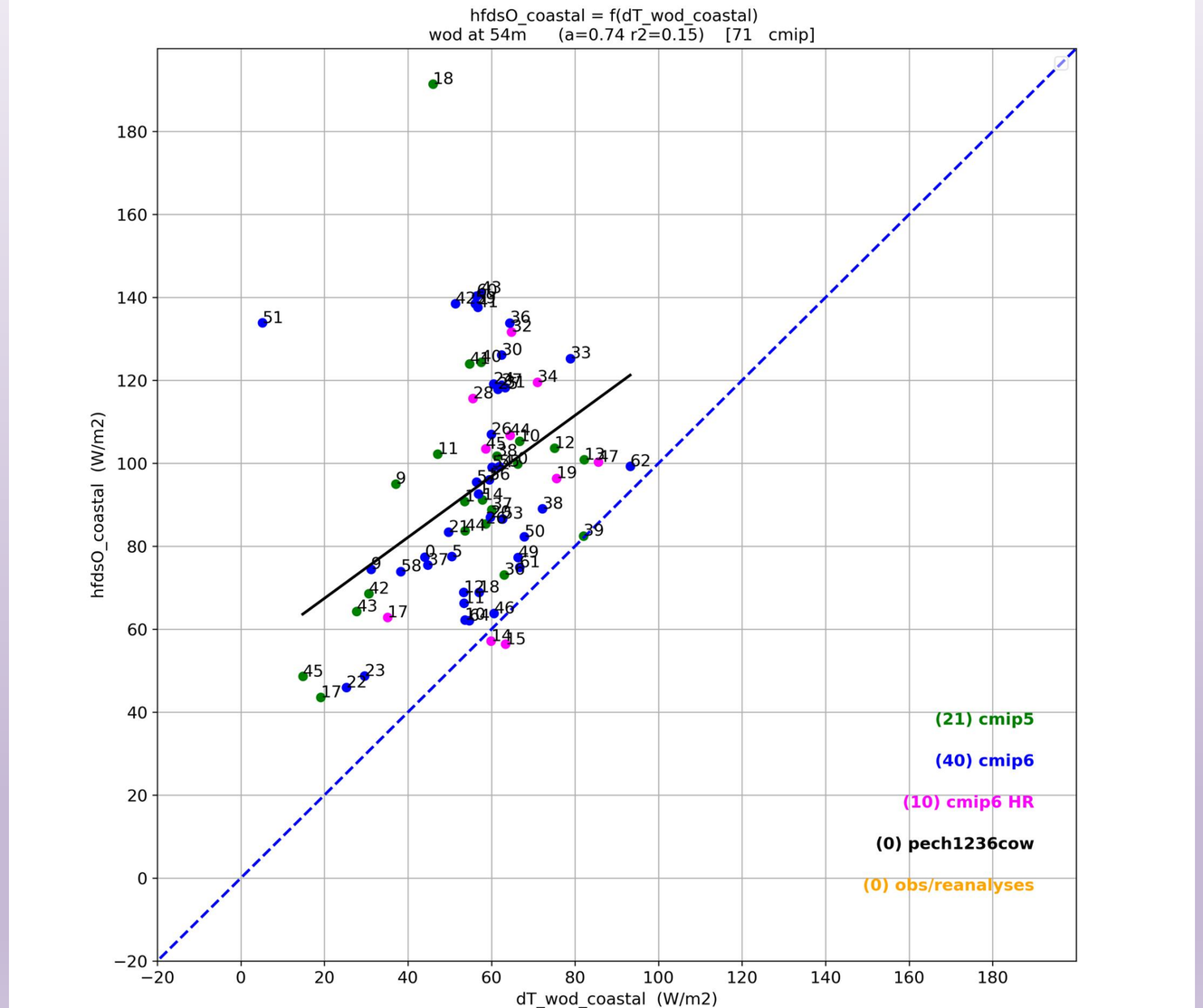
hfdsO=f(dT*wod)

hfdsO = f [(sst - T31-108m)*wod à ~ -45m)]

- **Proxy de ce qui arrive comme chaleur à la base de la MLD (-20m)**

- **SST correspond à peu près à T à la base de la MLD à -20m**
- **T31-108m correspond à une température à 70m**
- **On a donc un deltaT entre 70m et 20m = 50m**
- **On prend donc un wod au milieu de cette couche => à -45m (on prend le niveau -54m)**

hfdsO= f (dT * wod+wo coastal)



hfdsO= f (dT * wod+wo coastal)