

Downscaling methods for the Azores region

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4 downscaling neestings

Level1 – Barotropic – Tide from FES2012

Level2 → Level5 : 3D baroclinic (50 vertical levels)

- **Level2 → Level4**: downscaling in run time
- **Level5** → off line (600s from Level4 solution)

Forcing:

– GFS 0.25 (3-Hourly, GFS 0.25°)

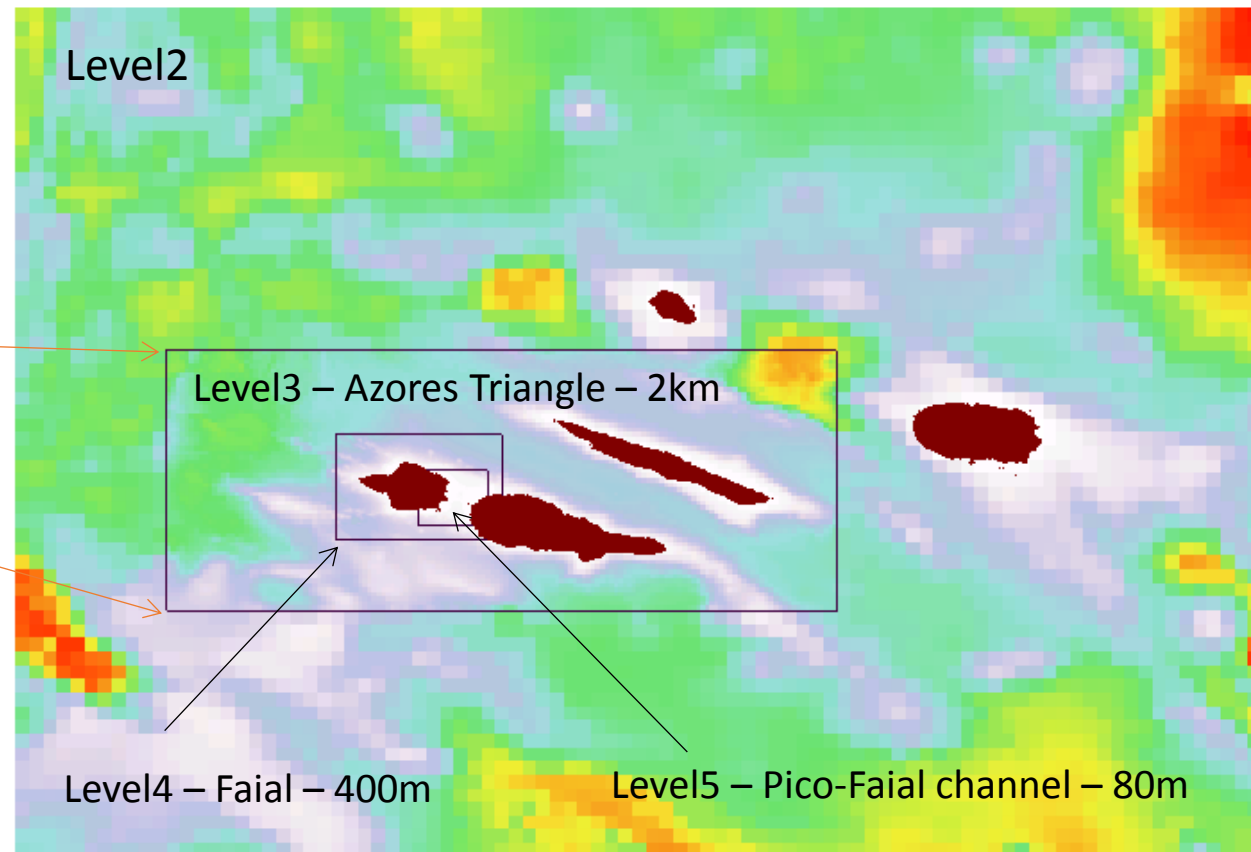
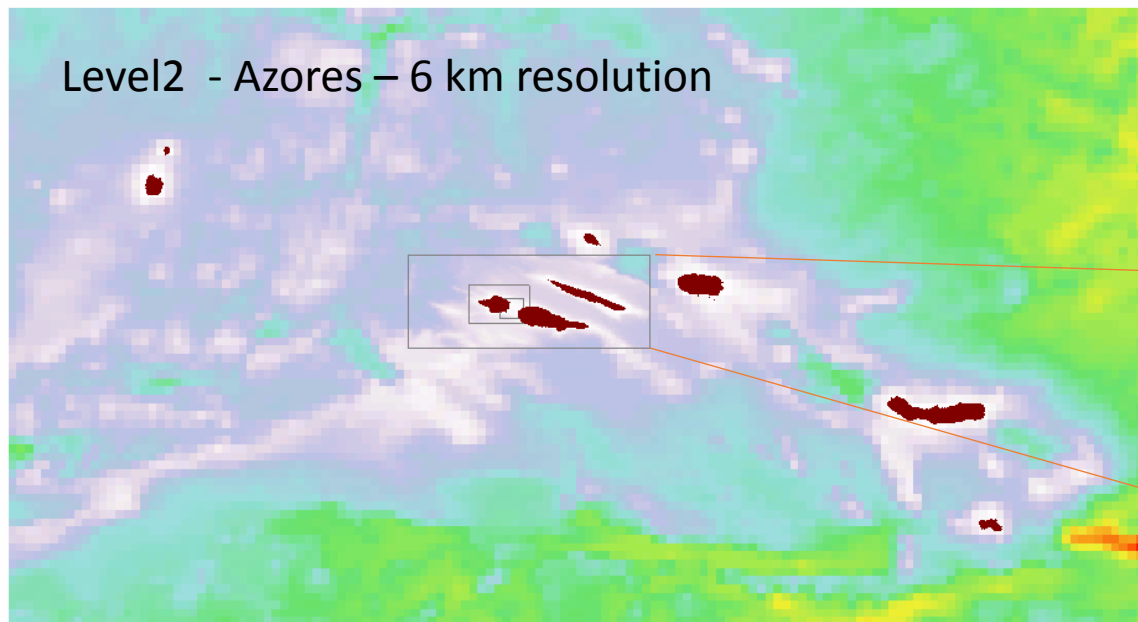
– MERCATOR / CMEMS *global* (GLOBAL_ANALYSIS_FORECAST_PHY_001_024) – 1/12°, daily mean

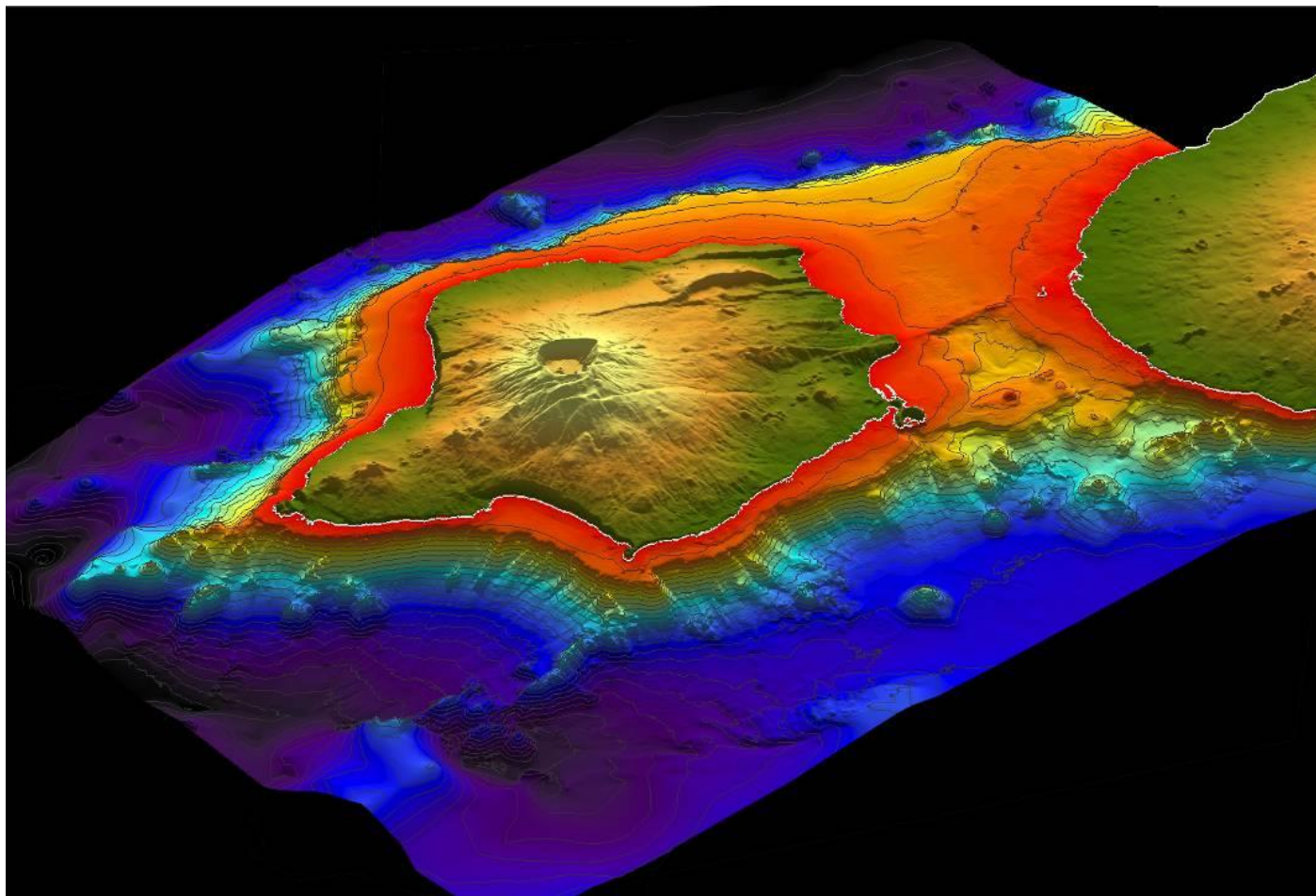
– FES2012

Bathymetry : Emodnet and local source (DOP, University of the Azores)

Time period : 1 year, 2017

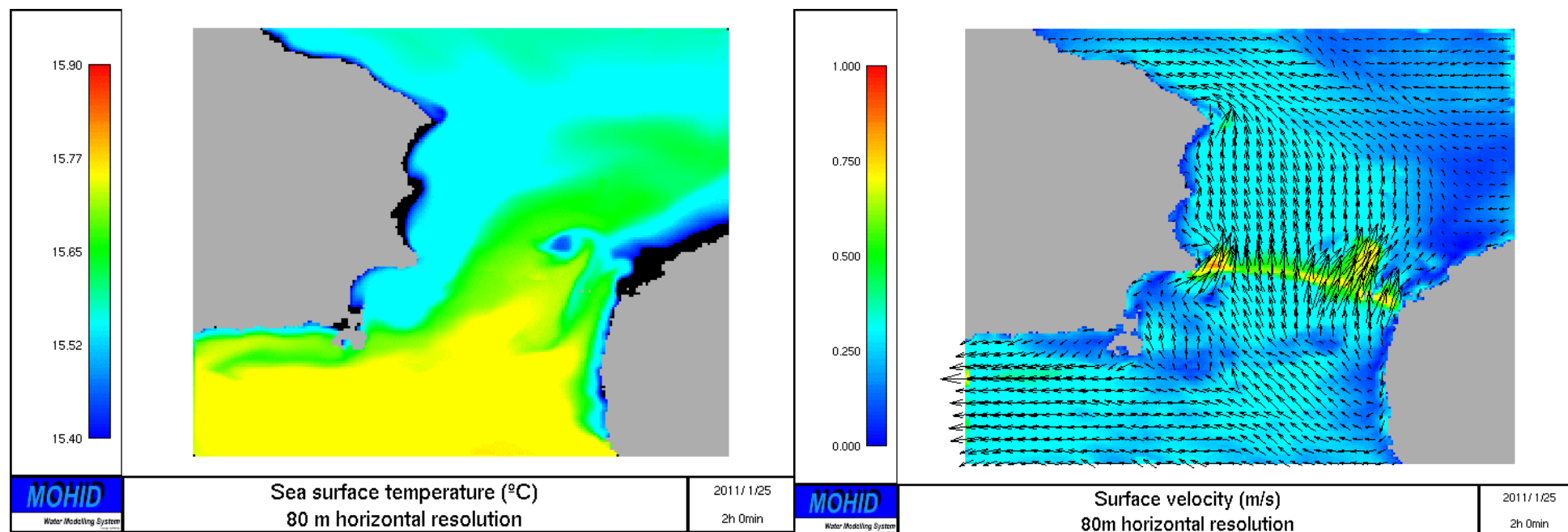








Level 5 – Pico – Faial channel – 80 m resolution





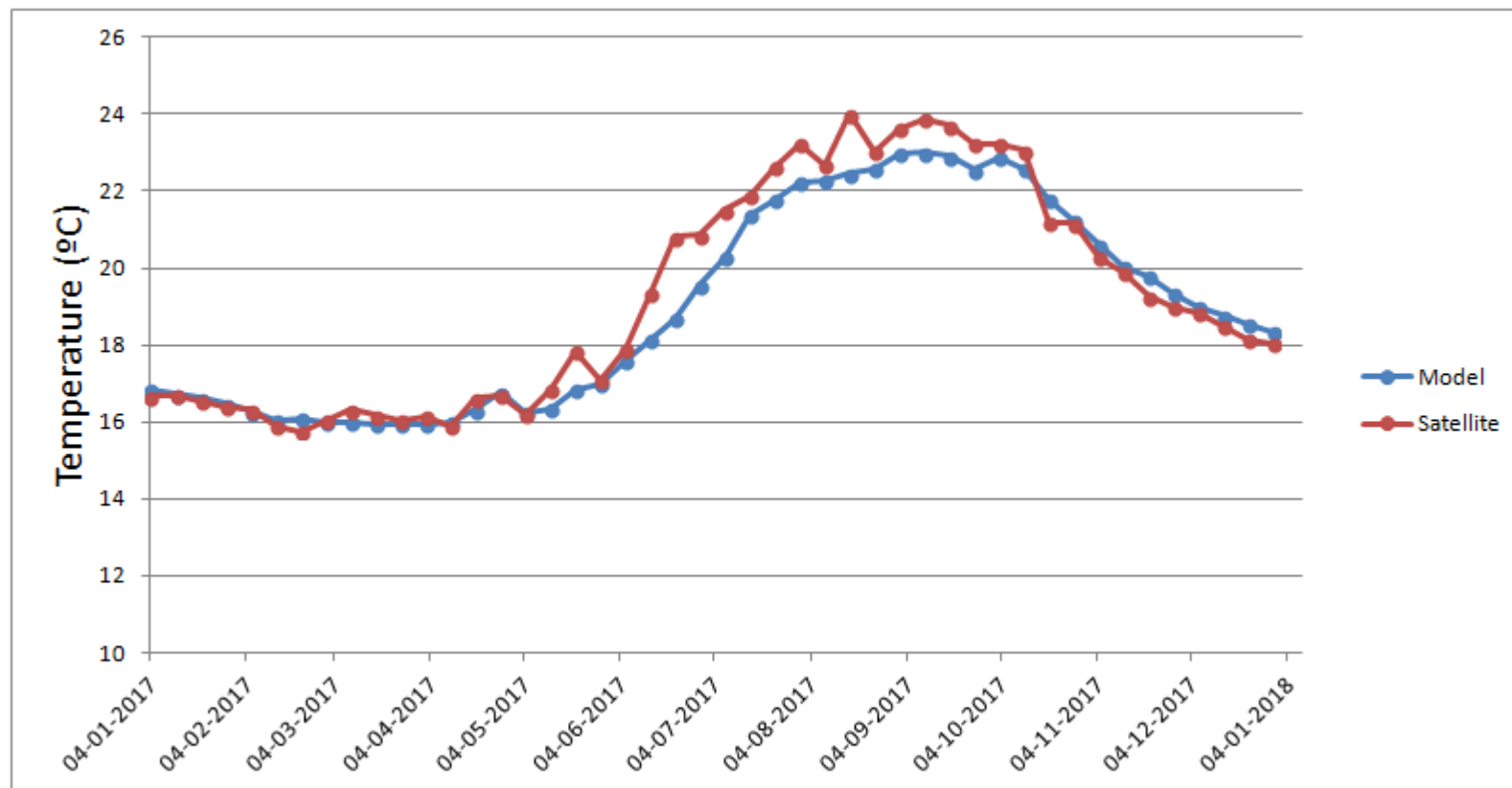
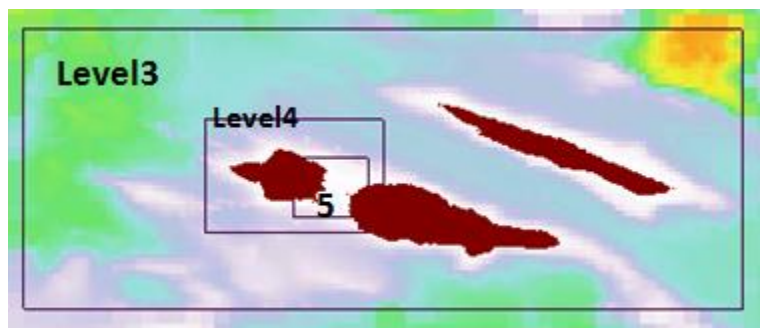
Problems detected in the Azores region (4 open boundaries):

- “Degradation” of MOHID solution in continuous runs, compared with remote and in situ data
- MOHID Solution is colder and is not capable of restoring the OBC imposed at boundaries
- The neestings model’s solutions begins to diverge to much from father’s models (in temperature e salinity)

After several hours talking with Ramiro he sugested making the assimilation of temperature e salinity from MERCATOR/CMEMS for the interior of the model, each 7 days , in Level2

Trying to improve the neestings solutions, I’ve implemented the same methodologie on those submodels and begin to use in the Keyword SPONGE_OUT of assimilation.dat, the same time frequency as the father’s models





“Assimilation” the temperature and salinity

Case studies :

- Detecting the difference of temperature between the remote sensing data and the mohid results for the summer time (last figure, ex) :
- In winter time we have a mixed layer well implemented
- In summer time there is a sazonal termocline, with stratification at the first meters depths
- The satellite only “see” the skyn of the ocean ?
- The mohid first depth is ~1 m
- Could explain these diference...

I’ve decide to use the COARE algorithm in MOHID runs (implemented in MOHID source by João Sobrinho)

So.....one year run (2017) comparing the results for:

- 1 – No assimilation and No COARE (“normal” mode...) (N/assimilation)
- 2 – No assimilation and Coare (N/assimilation_Coare)
- 3 – Assimilation and No COARE (assimilation)
- 4 – Assimilation and Coare (assimilation_Coare)





Assimilation_3.dat

```
<beginproperty>
NAME                : temperature
UNITS                : °C
DIMENSION            : 3D
OUTPUT_HDF           : 1

<<begin_field>>
DEFAULTVALUE         : 17.
TYPE_ZUV             : z
<<end_field>>

<<begin_coef>>
DEFAULTVALUE         : 604800
TYPE_ZUV             : z
FILE_IN_TIME         : NONE
REMAIN_CONSTANT      : 1
INITIALIZATION_METHOD : SPONGE
SPONGE_OUT           : 120
<<end_coef>>
<endproperty>

!*****

<beginproperty>
NAME                : salinity
UNITS                : ‰
DIMENSION            : 3D
OUTPUT_HDF           : 1

<<begin_field>>
DEFAULTVALUE         : 36
TYPE_ZUV             : z
<<end_field>>

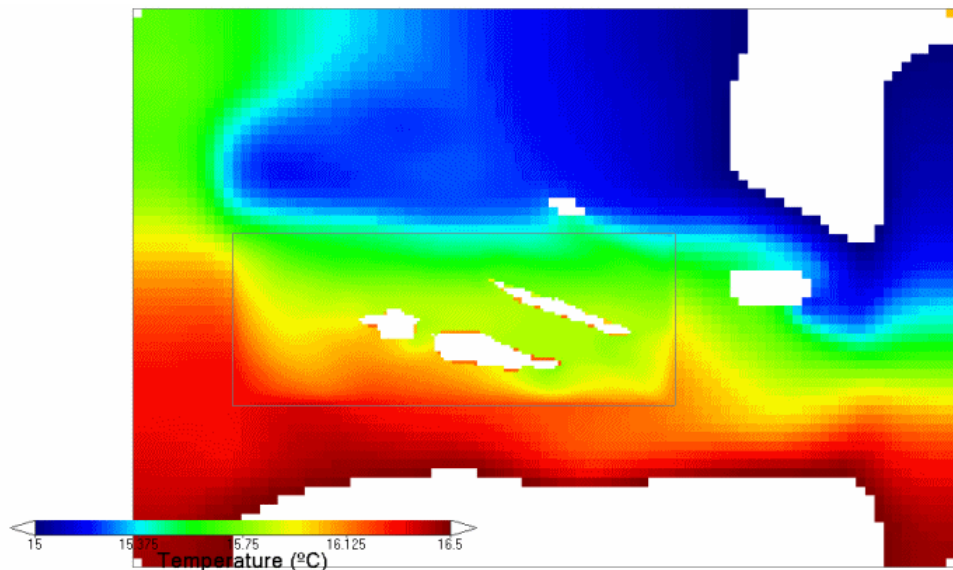
<<begin_coef>>
DEFAULTVALUE         : 604800
TYPE_ZUV             : z
FILE_IN_TIME         : NONE
REMAIN_CONSTANT      : 1
INITIALIZATION_METHOD : SPONGE
SPONGE_OUT           : 120
<<end_coef>>
```

= 7 days (temperature e salinity only)

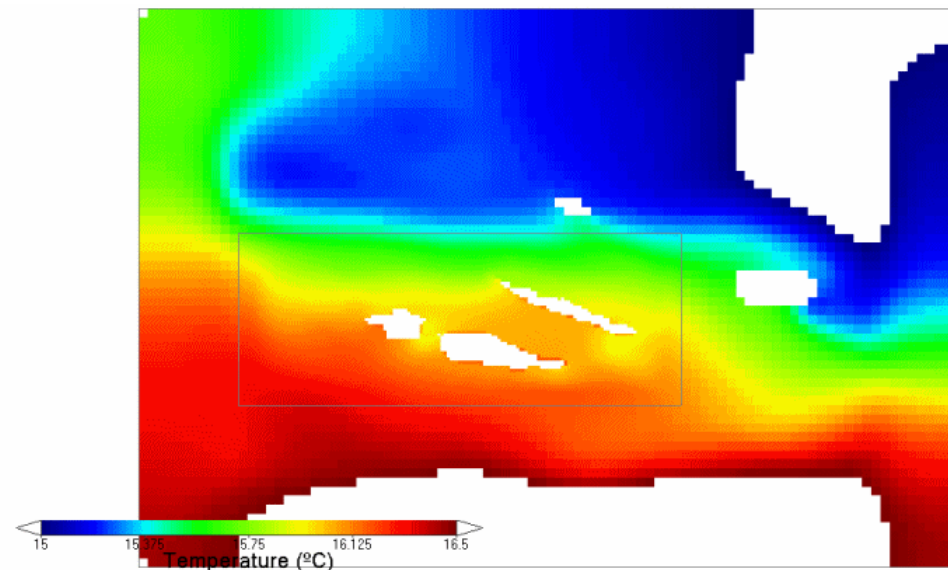
Same procedure for all neestings levels
(see next figure)



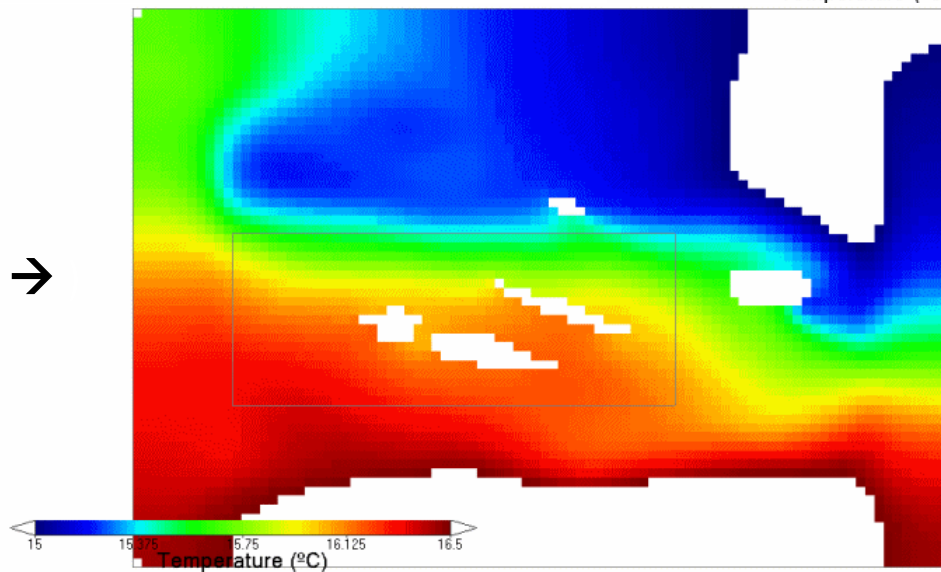
Level2 (assimilation) + Level3 (N/assimilation)



Level2(assimilation)+ Level3(assimilation)



Level2(assimilation) →



One day animation after 3 months runing...



Assimilation_3.dat

```
<<begin_field>>
DEFAULTVALUE      : 0
TYPE_ZUV          : z
<<end_field>>

<<begin_coef>>
DEFAULTVALUE      : 1e9
TYPE_ZUV          : v
FILE_IN_TIME      : NONE
REMAIN_CONSTANT   : 1
INITIALIZATION_METHOD : SPONGE
SPONGE_OUT        : 60
<<end_coef>>
<endproperty>

!*****

<beginproperty>
NAME              : temperature
UNITS             : °C
DIMENSION         : 3D
OUTPUT_HDF        : 1

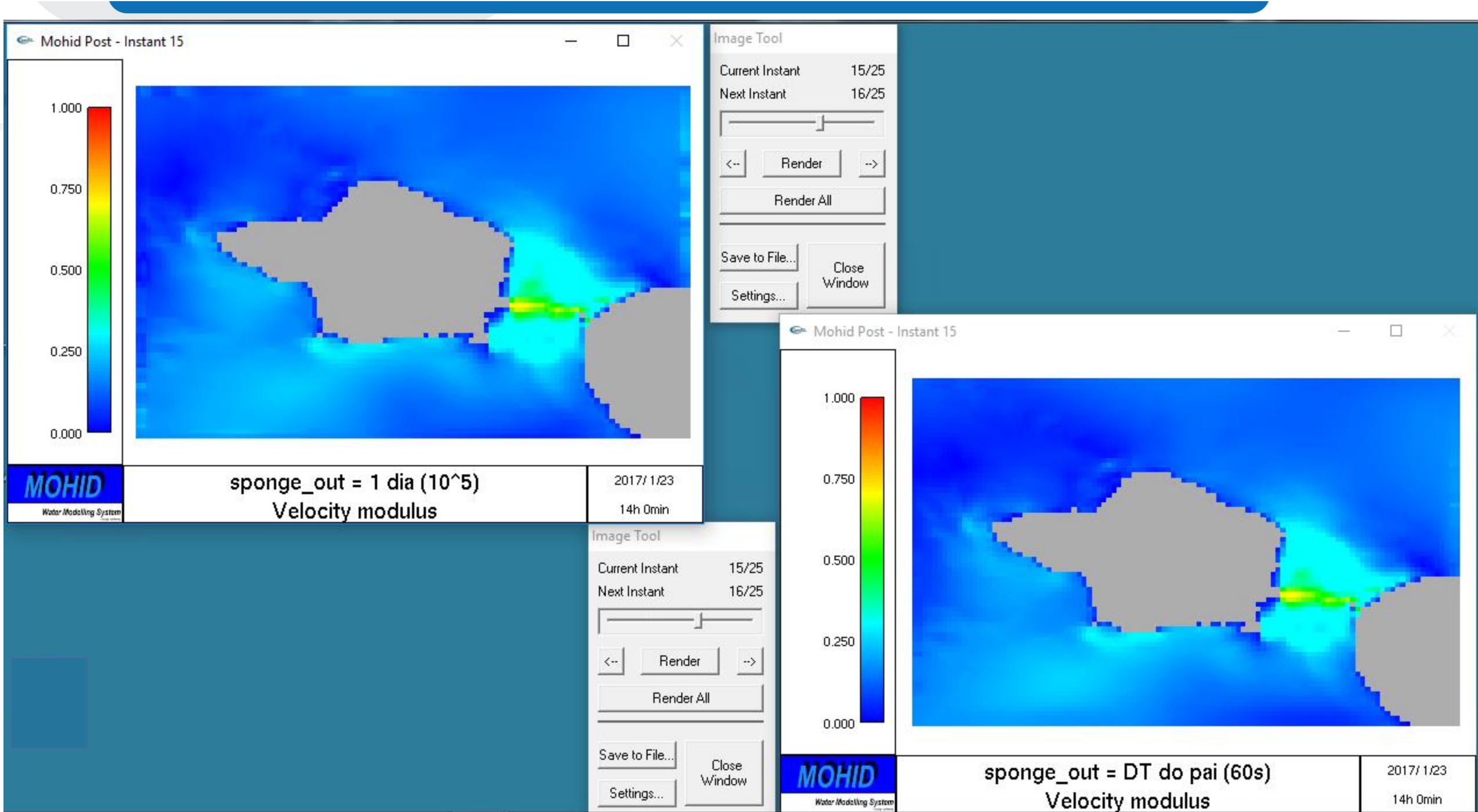
!COLD_RELAX_PERIOD : 432000

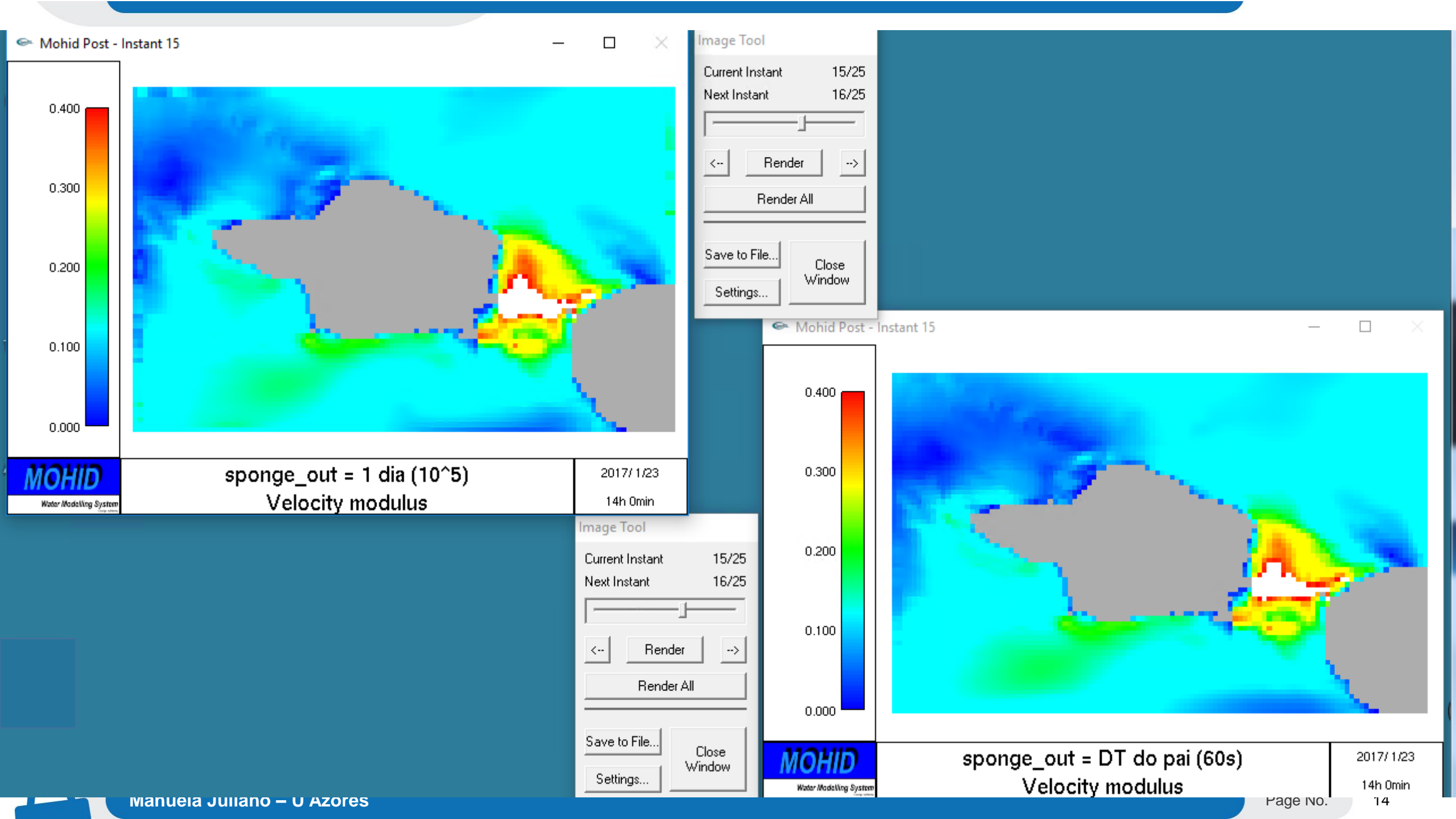
<<begin_field>>
DEFAULTVALUE      : 17.
TYPE_ZUV          : z
<<end_field>>

<<begin_coef>>
DEFAULTVALUE      : 604800
TYPE_ZUV          : z
FILE_IN_TIME      : NONE
REMAIN_CONSTANT   : 1
INITIALIZATION_METHOD : SPONGE
SPONGE_OUT        : 60
<<end_coef>>
<endproperty>
```

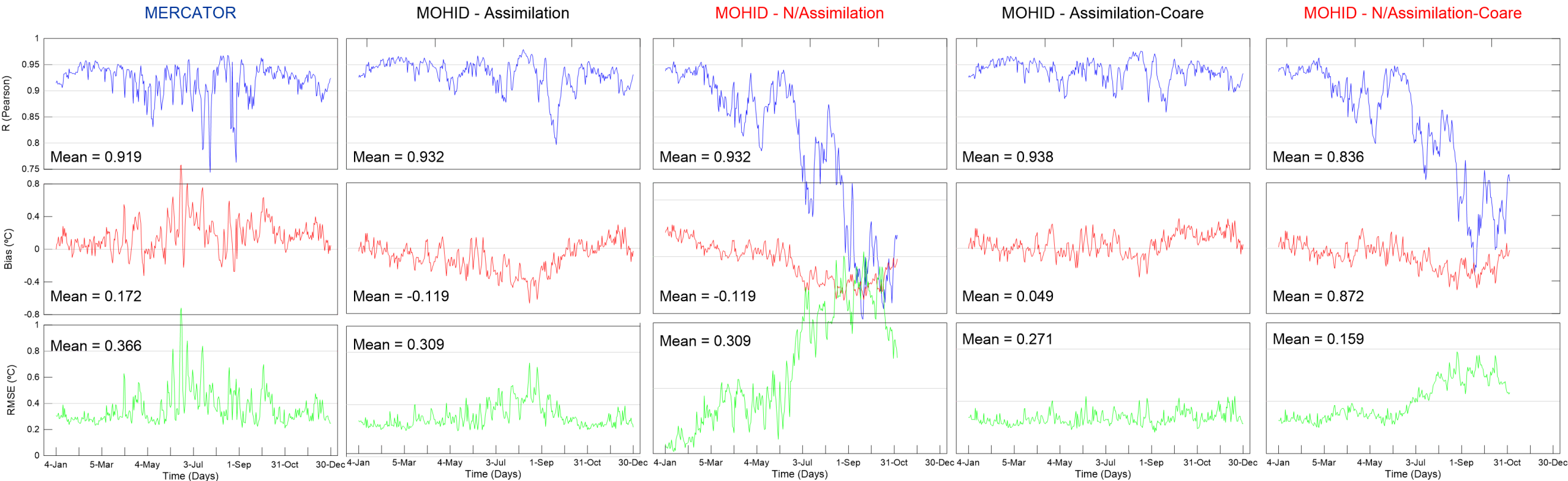
**SPONGE_OUT = DT father model
(all properties)**

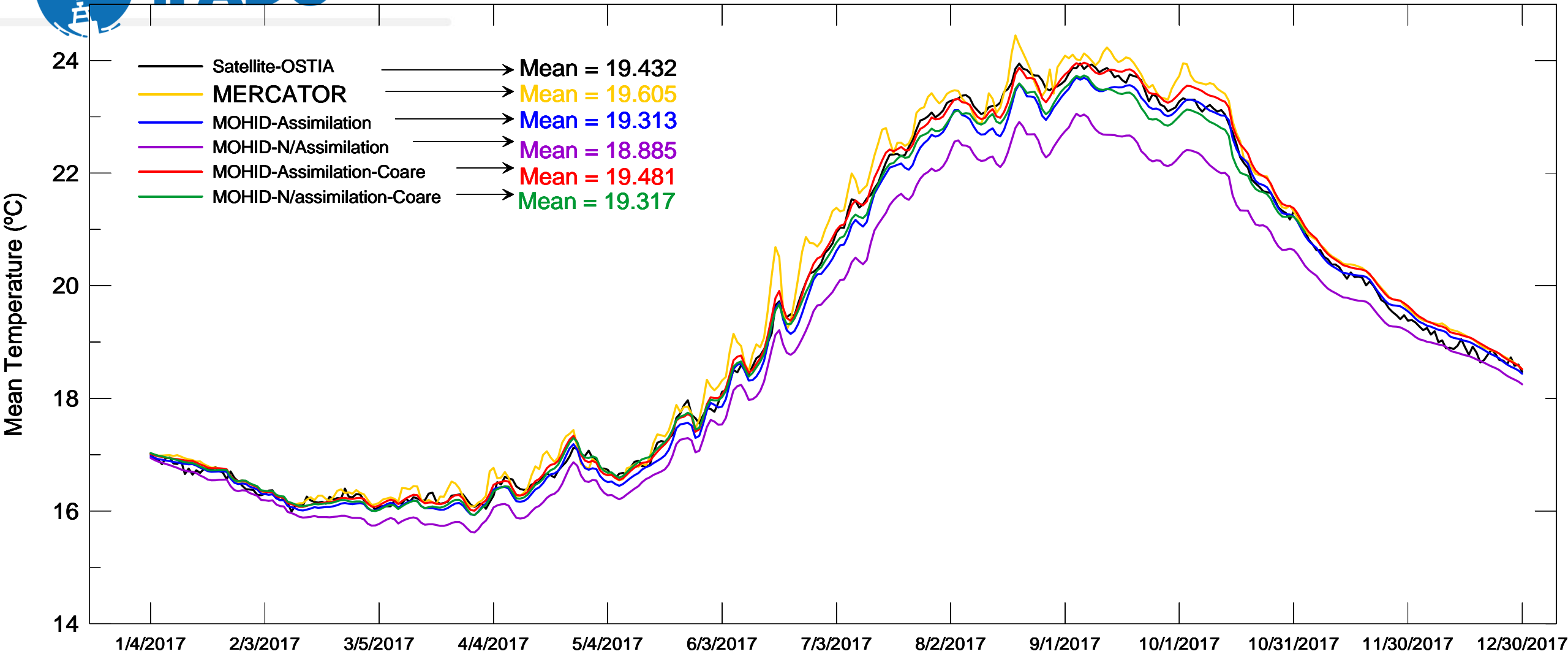
Reduces the noise at boundary and interior

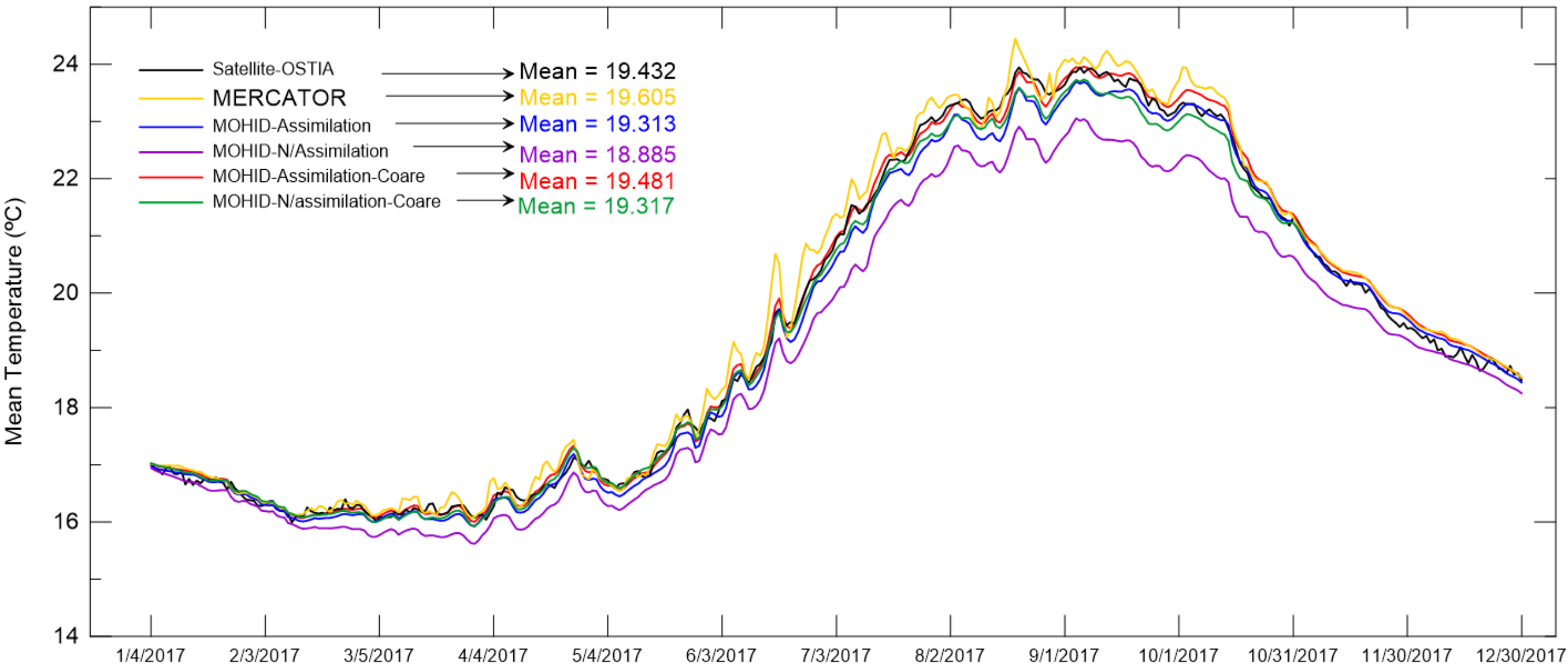


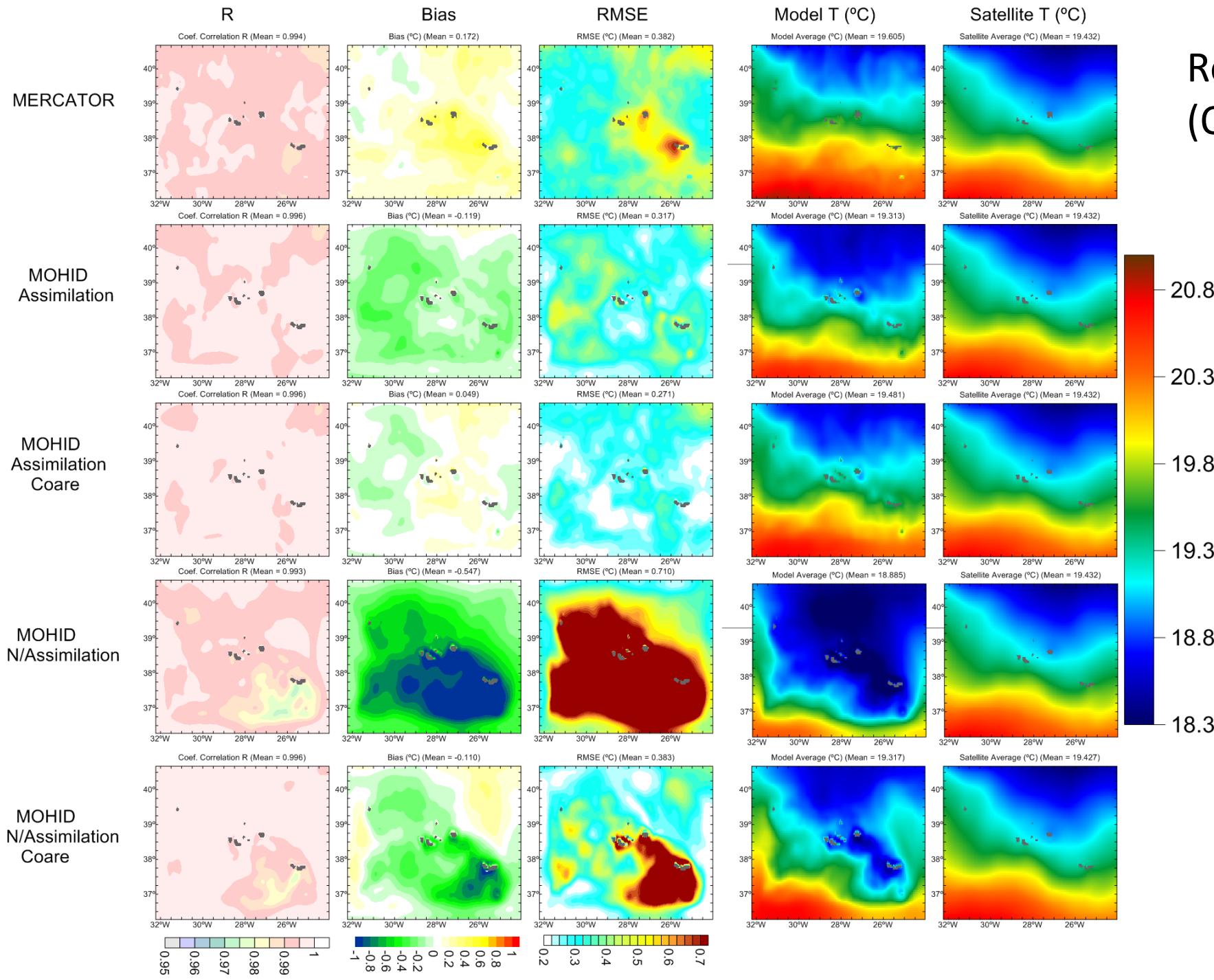


Remote sensing validation (OSTIA ~5km resolution)









Remote sensing validation
(OSTIA ~5km resolution)

Best solution

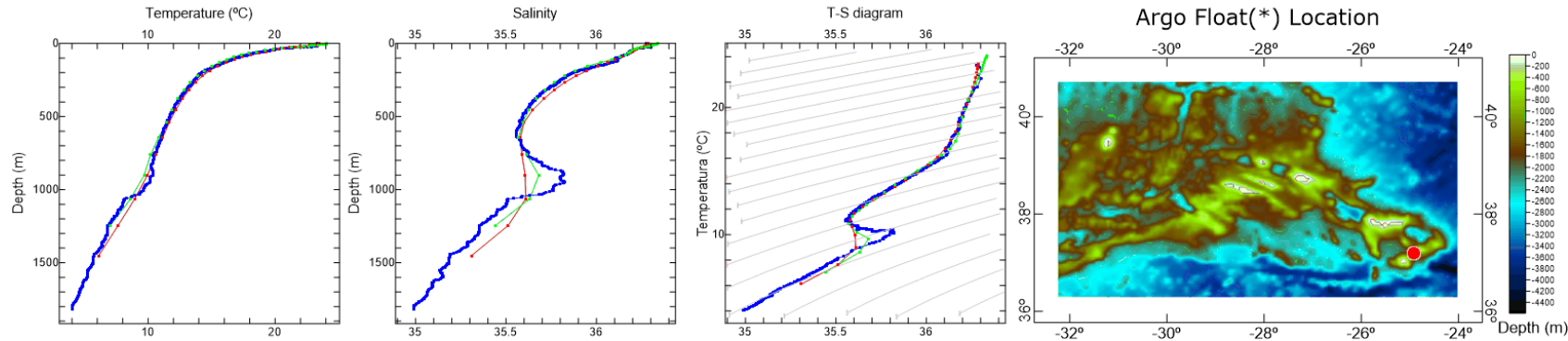


iFADO

ARGO Validation

ARGO
MOHID
MERCATOR

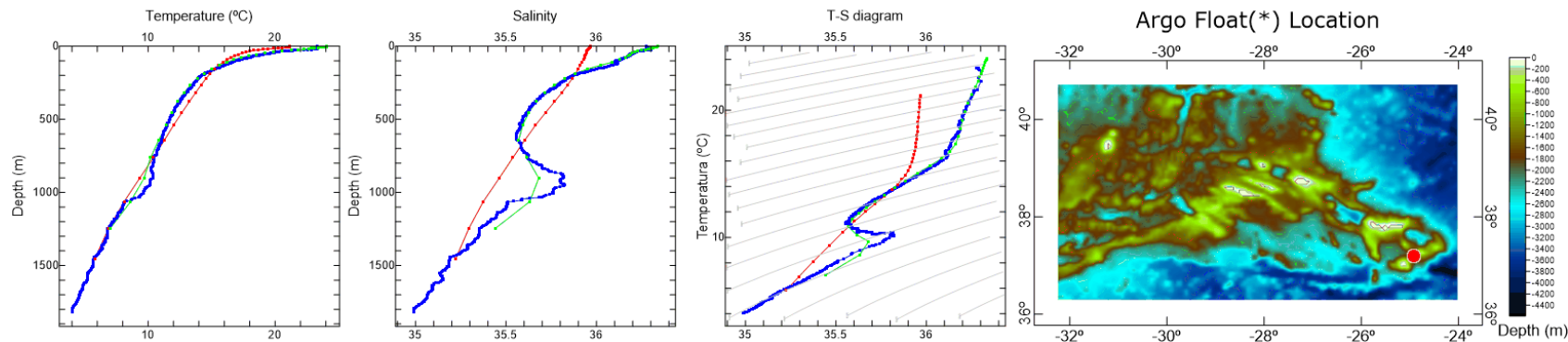
Time: 29-Jul-2017 9:34
Location: 37.193°N, 24.915°W
Id: 4901421 Cycle No. 78(R)



ARGO
MOHID
MERCATOR

Time: 29-Jul-2017 9:34
Location: 37.193°N, 24.915°W
Id: 4901421 Cycle No. 78(R)

Assimilation-COARE



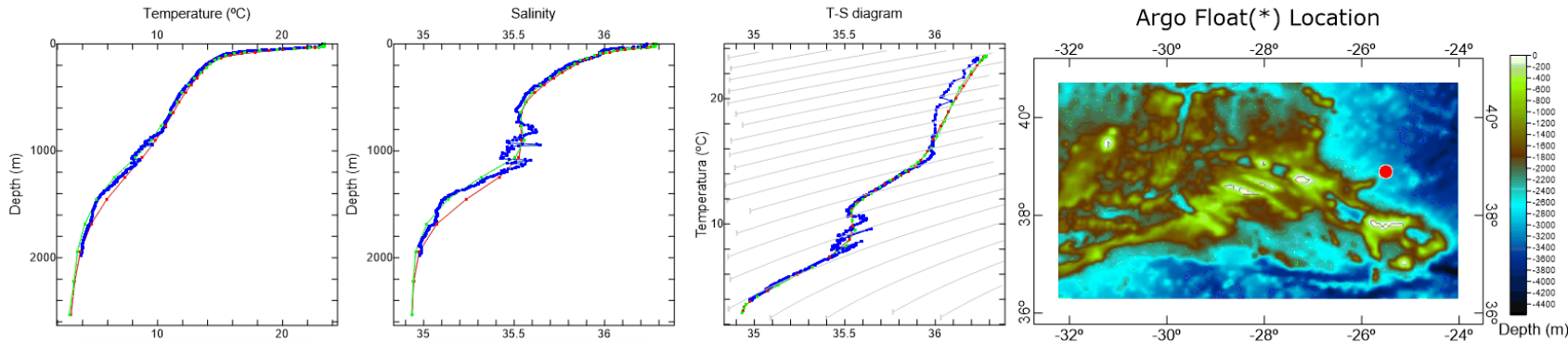


iFADO

ARGO Validation

ARGO 
MOHID 
MERCATOR 

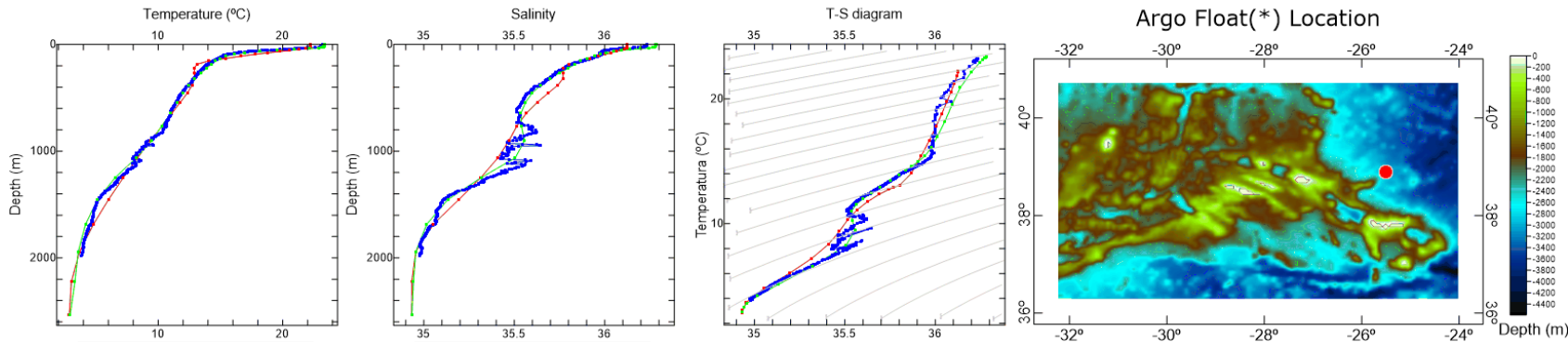
Time: 4-Oct-2017 17:35
Location: 38.889°N , 25.502°W
Id: 3901944 Cycle No. 2(R)



Assimilation-COARE

ARGO 
MOHID 
MERCATOR 

Time: 4-Oct-2017 17:35
Location: 38.889°N , 25.502°W
Id: 3901944 Cycle No. 2(R)



N/Assimilation

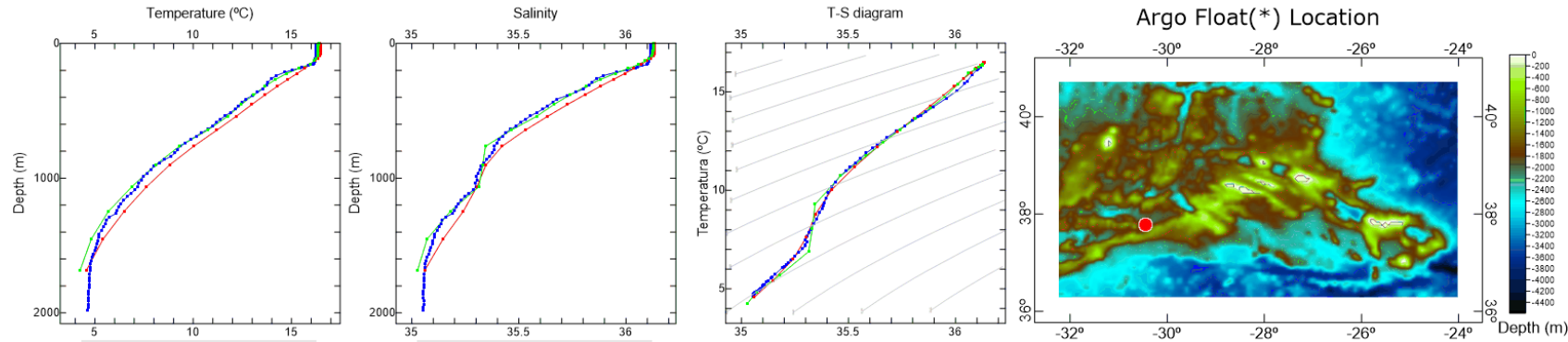


iFADO

ARGO Validation

ARGO
MOHID
MERCATOR

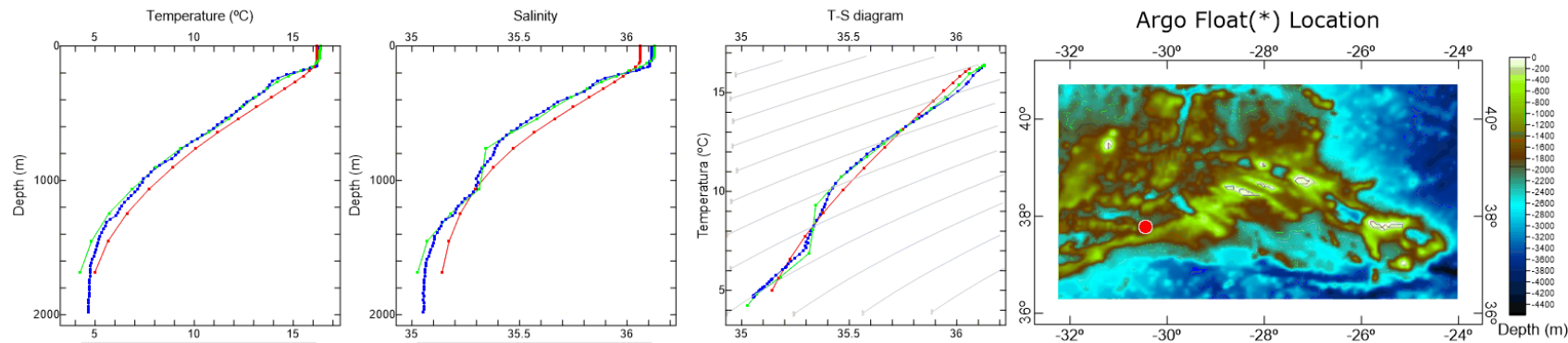
Time: 2-Mar-2017 23:27
Location: 37.782°N, 30.439°W
Id: 6900972 Cycle No. 171(D)



ARGO
MOHID
MERCATOR

Time: 2-Mar-2017 23:27
Location: 37.782°N, 30.439°W
Id: 6900972 Cycle No. 171(D)

Assimilation-COARE



N/Assimilation



- **Increase the time series, at least for 3 years (going already...)**
- **Validate with other sources of data (buoys, etc) (very important !)**
- **Increase de vertical resolution in the first meters and AM depths?**
- **....????.....**
- **I have a lot of work To do....**

Thank you !!

