Harokopio University of Athens
Department of Geography

Meteoclima
Atmosphere & Climate Dynamics Group

# The integration of ARGO floats data in numerical weather prediction (NWP)

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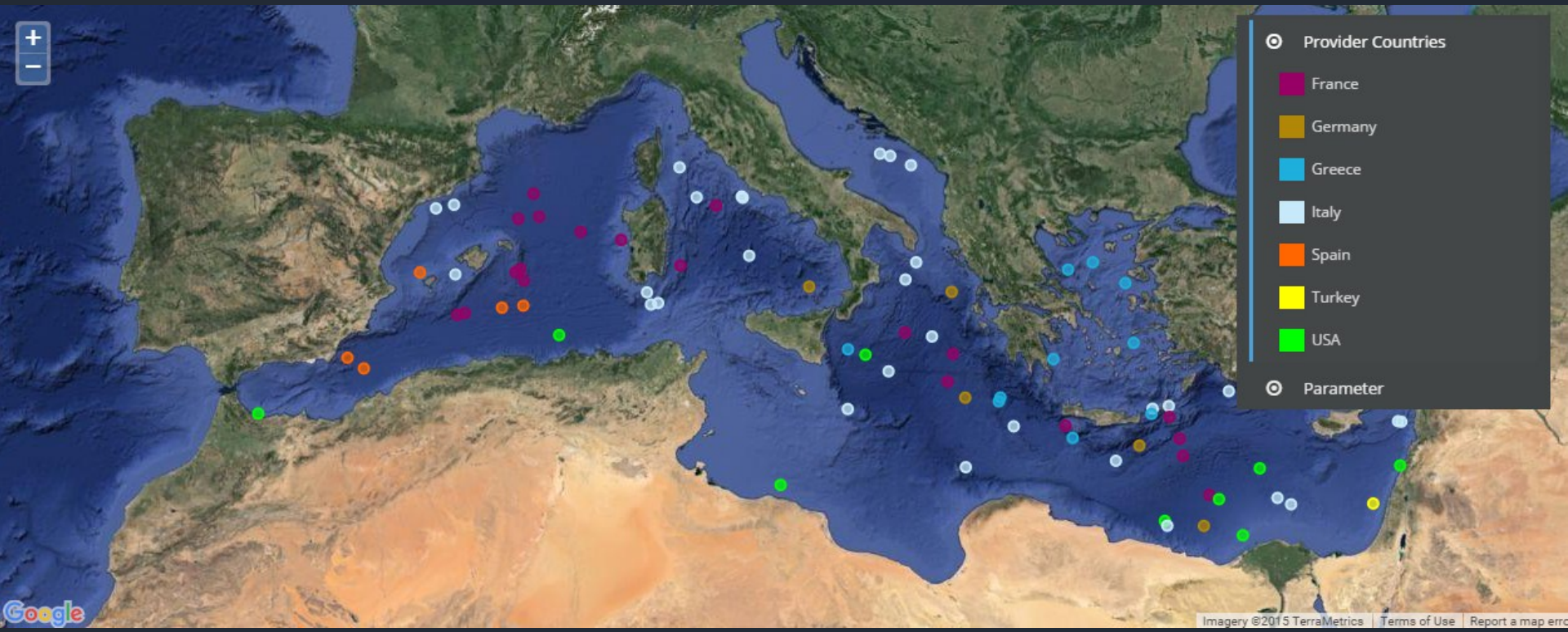
# Current status at Mediterranean Sea



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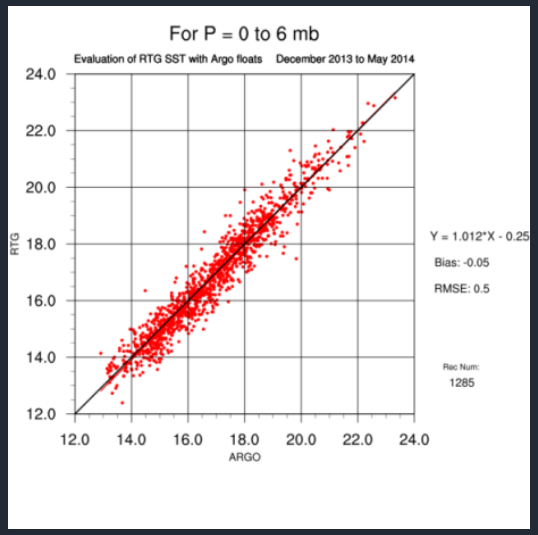
# Tasks

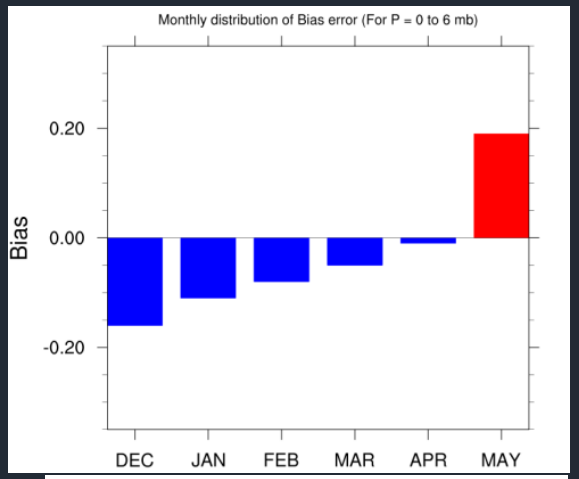
In the framework of the scientific use of ARGO measurements, Harokopio University of Athens (HUA) integrated the data of the ARGO floats in numerical weather prediction (NWP) through the following steps:

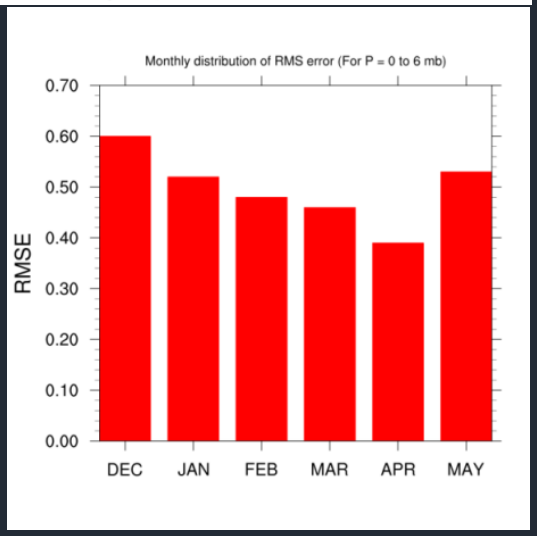
- ☞ Statistical evaluation of the gridded SST data (RTG) having as reference ARGO profiling floats measurements over the Mediterranean Sea.
- ☞ Sensitivity assessment of the NWP on the sea surface temperature (SST).

# Statistical evaluation between Argo and RTG data

- Systematic underestimation of the RTG-SST
- RMS error ~0.5°C
- High correlation between Argo measurements and RTG data



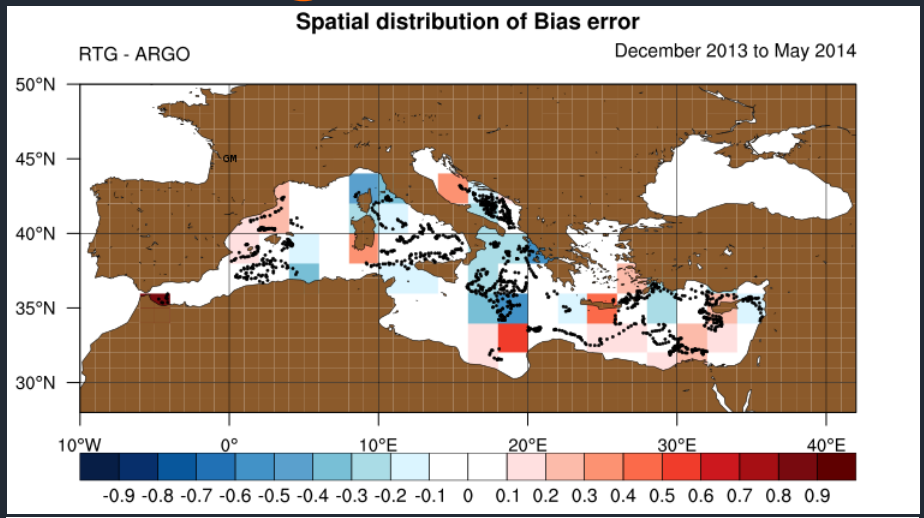



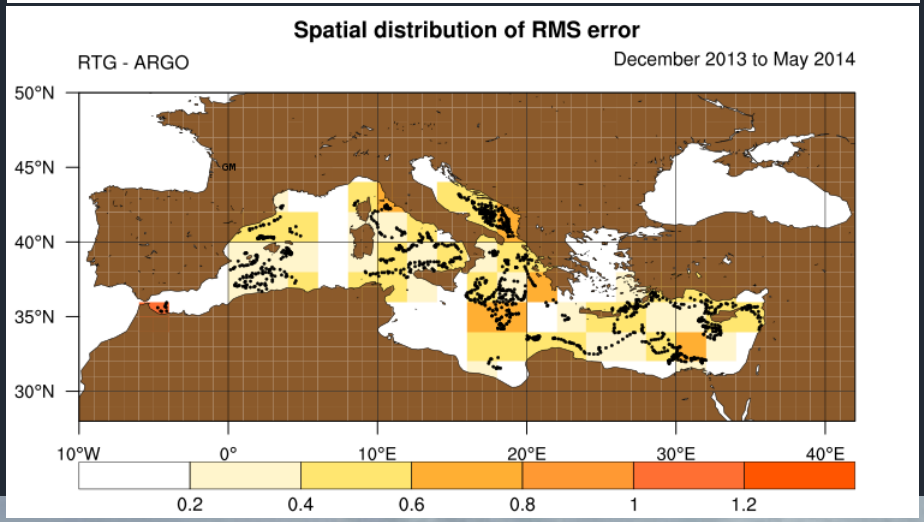




| TOTAL | P = 0 mb | P = 0-2 mb | P = 0-4 mb | P = 0-6 mb |
|---|---|---|---|---|
| Bias error | -0.01 | -0.06 | -0.05 | -0.05 |
| RMS error | 0.49 | 0.51 | 0.50 | 0.50 |
| Records | 308 | 780 | 834 | 1285 |

# Statistical evaluation between Argo and RTG data

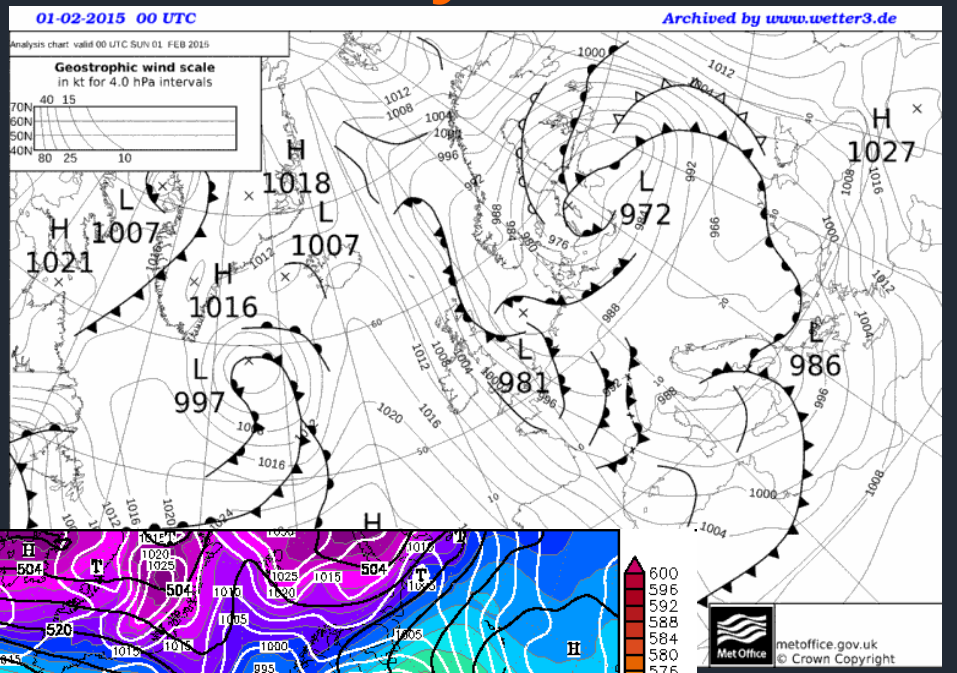
- Systematic underestimation of the RTG-SST over the Central Mediterranean Sea with maximum off the Gulf of Sirte exceeding -0.6°C.
- Eastern Mediterranean Sea contributes with an overall warm bias of +0.4°C .
- Those maxima are also related with maximum RMS errors up to 0.8°C defined over Central and Eastern Mediterranean Sea.

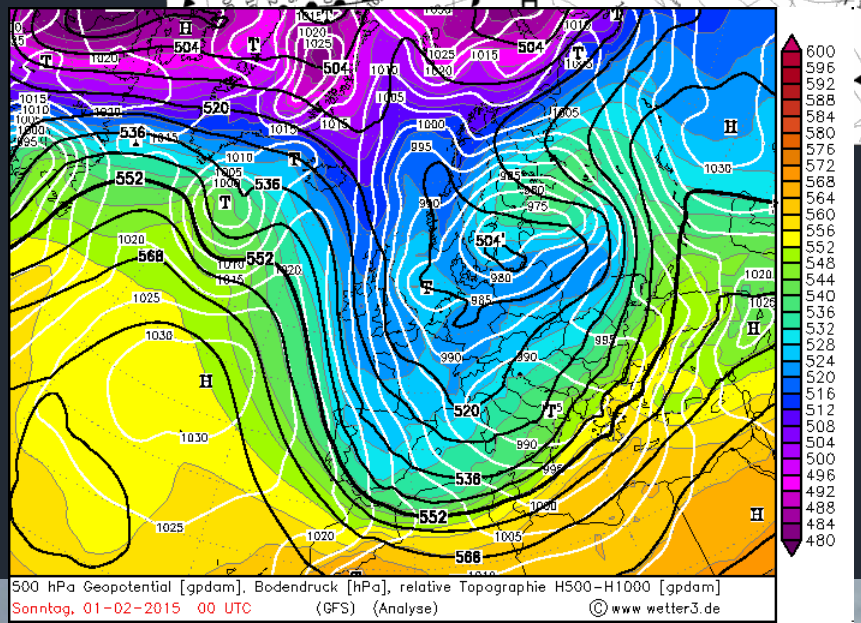


# Case study January 29 - February 3, 2015

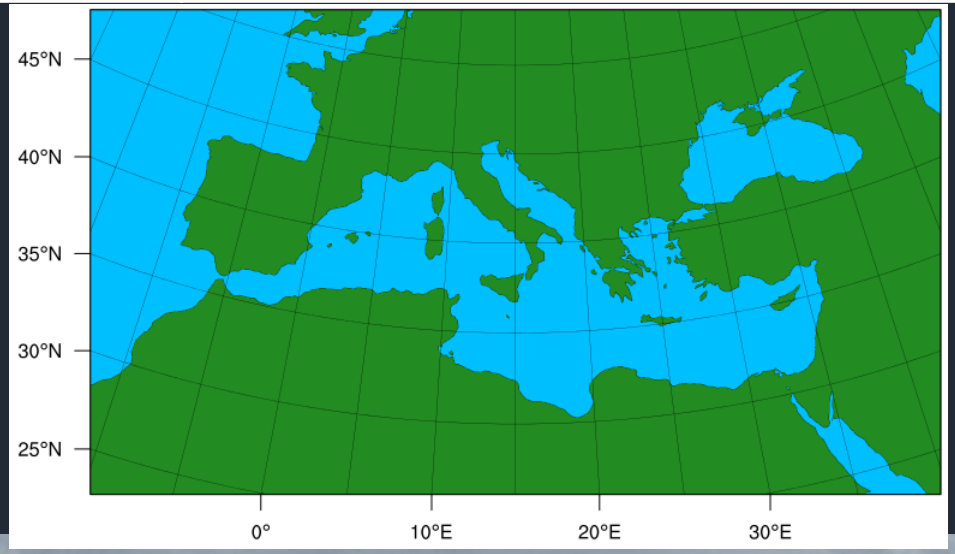
- On January 29, a barometric low developed over central Mediterranean Sea
- The system moved towards Greece and deepened with a rate of 1 Bergeron
- The cyclonic system was stagnant for 3 days, causing extreme storms



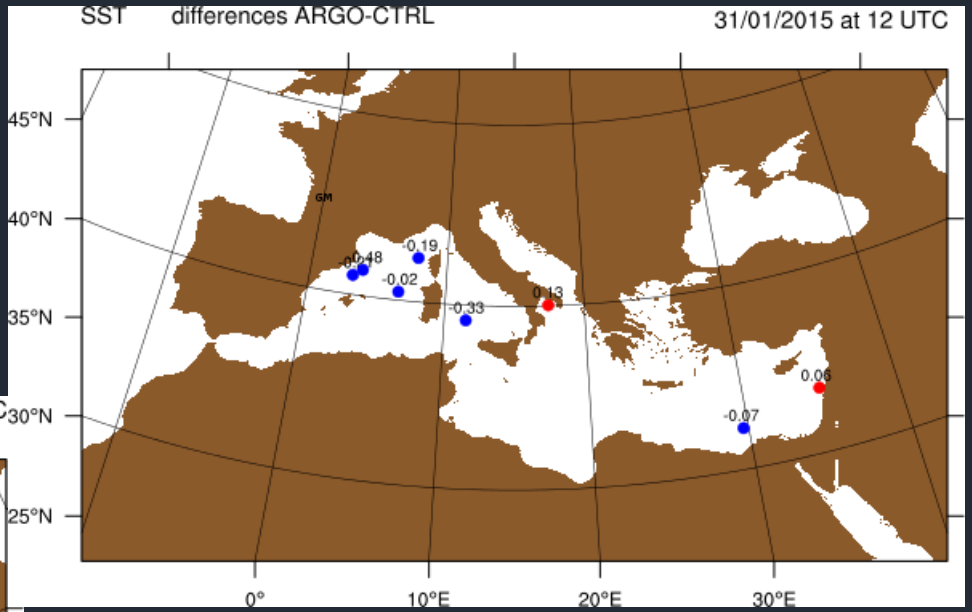
# Model set up for CTRL and ARGO simulations

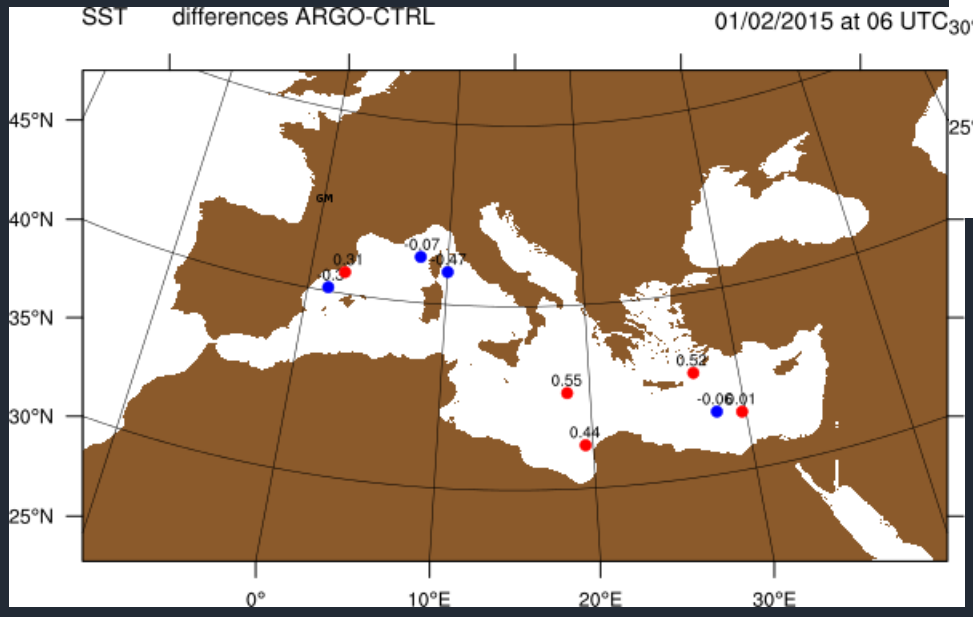
| | |
|---|---|
| **Model** | WRF-ARW V3.6 (Skamarock et al., 2008) |
| **Horizontal resolution (# grid points)** | 10kmx10km (#516x294), timestep 60'' |
| **Vertical resolution** | 38 sigma-pressure levels up to 50hPa |
| **Initial conditions** | GFS-NCEP (0.5°x0.5°) 00:00UTC analysis |
| **SST conditions** | Initial SST from 1/12x1/12 deg RTG data. Update every 6 hours for both simulations |
| **Argo SST assimilation** | In ARGO simulation, Argo temperature assimilation every 6 hours with the method of the nearest neighbor interpolation |



# Comparison of ARGO and model SSTs

- Differences between ARGO and CTRL SSTs in the range of [-0.58,+0.55]

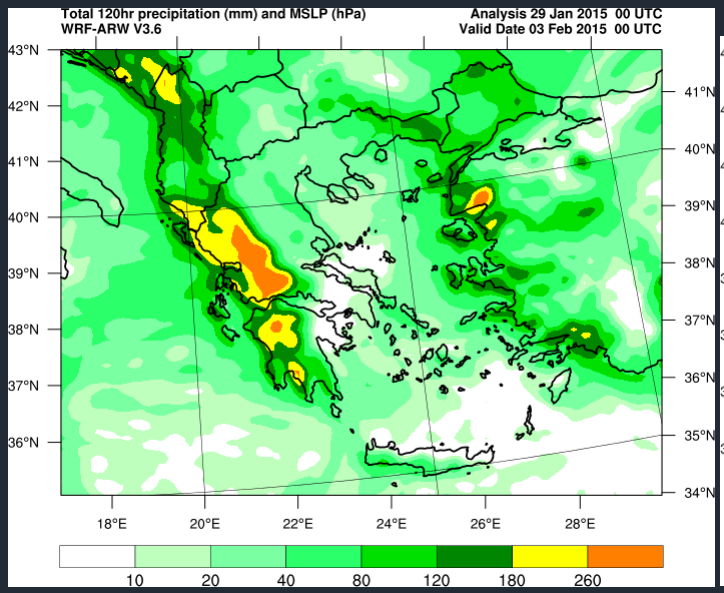


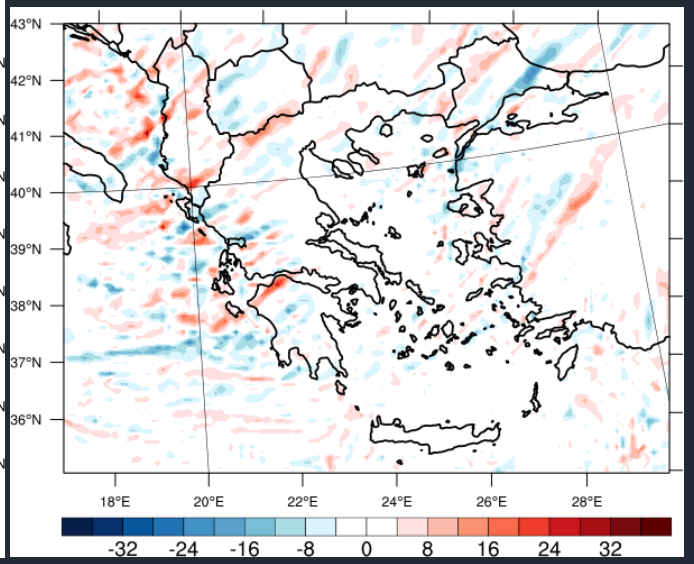

- Underestimation for ARGO over Western Mediterranean
- Overestimation over Eastern Mediterranean

# The response of the precipitation

- The maximum differences are mainly located around the areas of the precipitation peaks forming positive and negative bands of precipitation



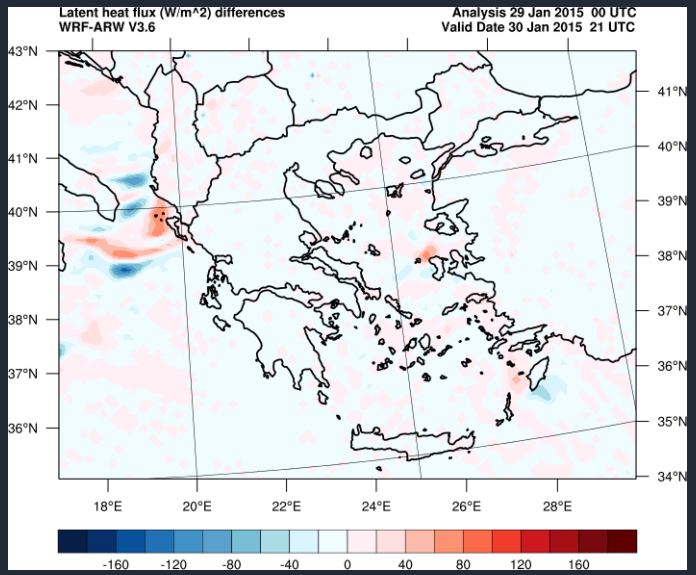

ARGO-CTRL

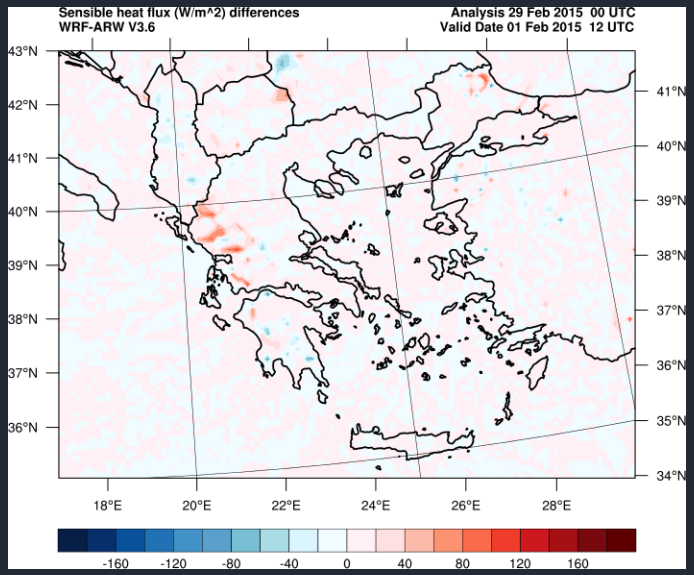



- ARGO temperatures assimilation produced a faster propagation of the system

# The response of the heat fluxes

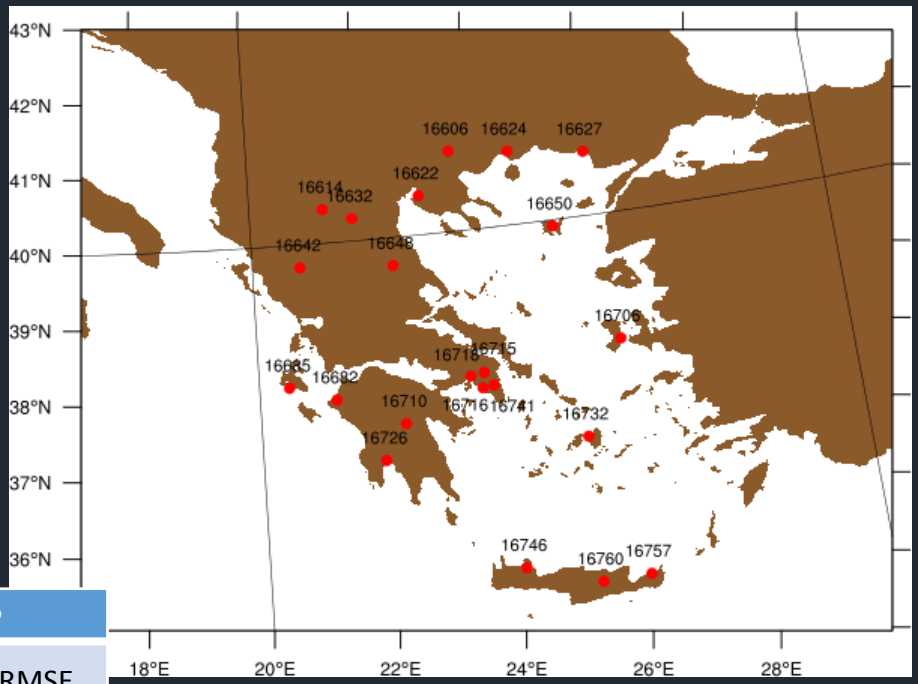
- ARGO temperatures assimilation produced a faster propagation of the system due to the changes in the spatial distribution of the latent and sensible heat fluxes



# Statistical evaluation against observational data

- The basic scores of the continuous variables are almost identical indicating a slight impact of the ARGO temperature assimilation on the atmospheric conditions over land




| | Wind speed | | Air temperature | | MSLP | |
|---|---|---|---|---|---|---|
| | Bias | RMSE | Bias | RMSE | Bias | RMSE |
| CTRL | 0.59 | 1.83 | -1.11 | 1.96 | -0.52 | 1.39 |
| ARGO | 0.60 | 1.83 | -1.10 | 1.95 | -0.51 | 1.39 |

# Statistical evaluation of both simulations against observational data

- Both simulations overestimate the precipitation more prominent for the medium and higher thresholds with better BS scores for the run with the assimilated ARGO measurements
- Overall, the ARGO temperatures assimilation offers an up to **5%** improvement in the precipitation scores for the entire rainfall thresholds