NCAR

Impact of resolution and boundary conditions on the cloud simulation over Middle East area

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[2]Israel Institute for Biological Research, Israel

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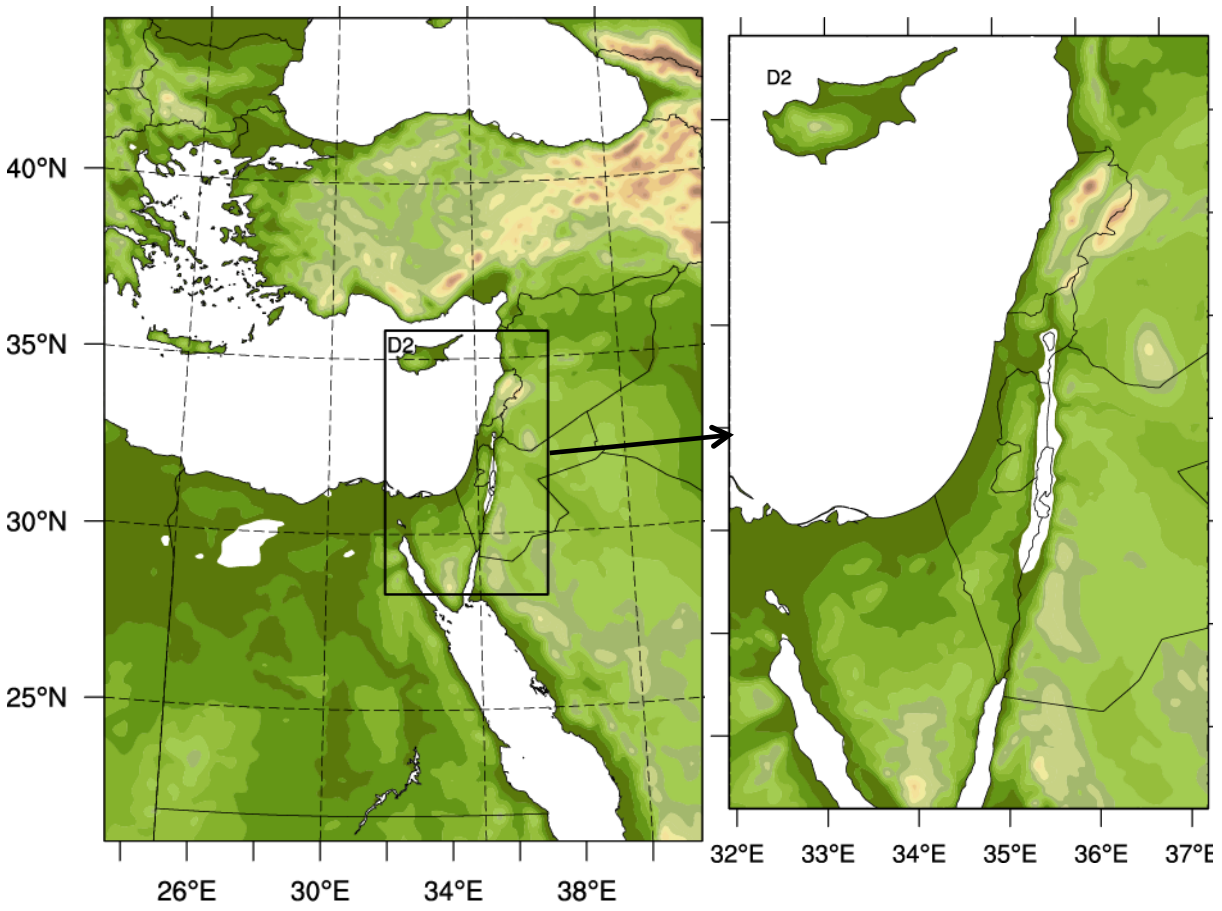
Motivation

- In the last 5 years, NCAR and Israeli AF jointly developed a WRF-based operational forecasting system MAGEN (Model for Advanced GENeration of 4D Weather) over the Eastern Mediterranean region
- This work is focusing on improving the low cloud simulation in the region with integration of the high-resolution ECMWF IFS forecast (as BCs and ICs).

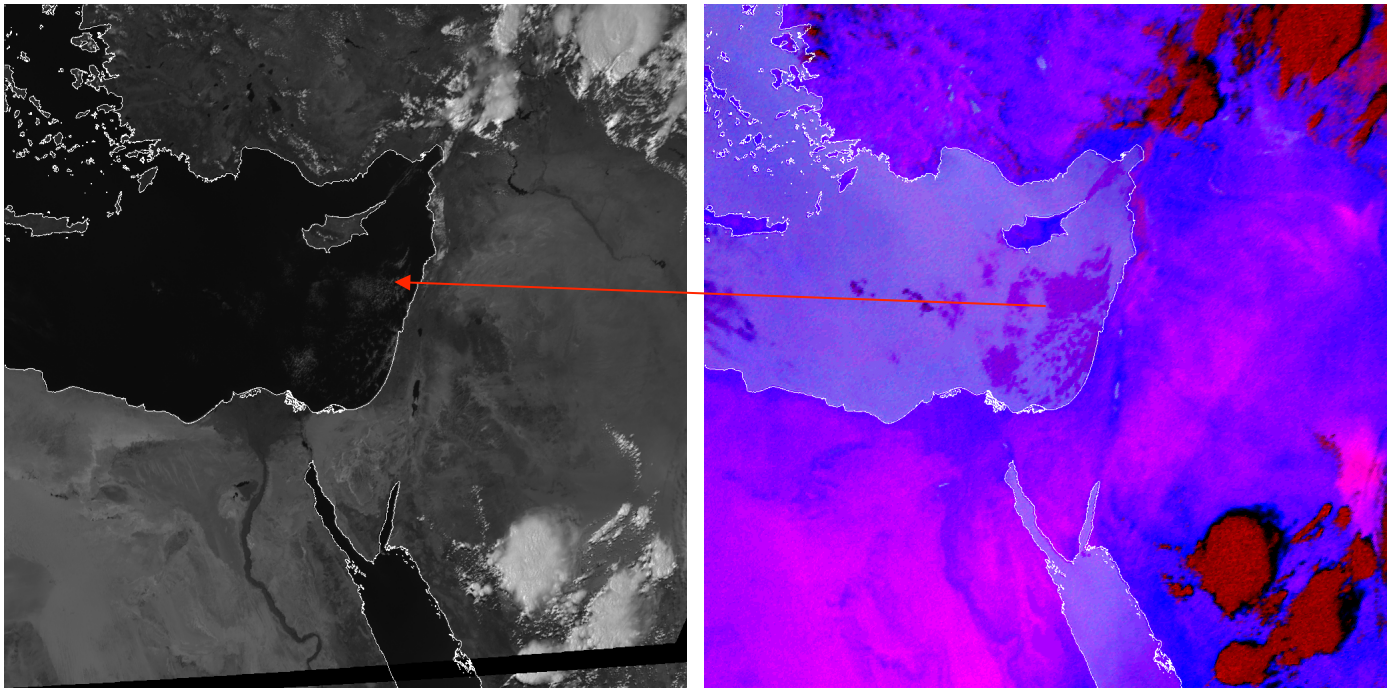
System design and Case Study Period

- A case study focusing on dynamic weather
- Period of interest: from 2016042606 through 2016050100 cycles
- Focus on low clouds close Israel area

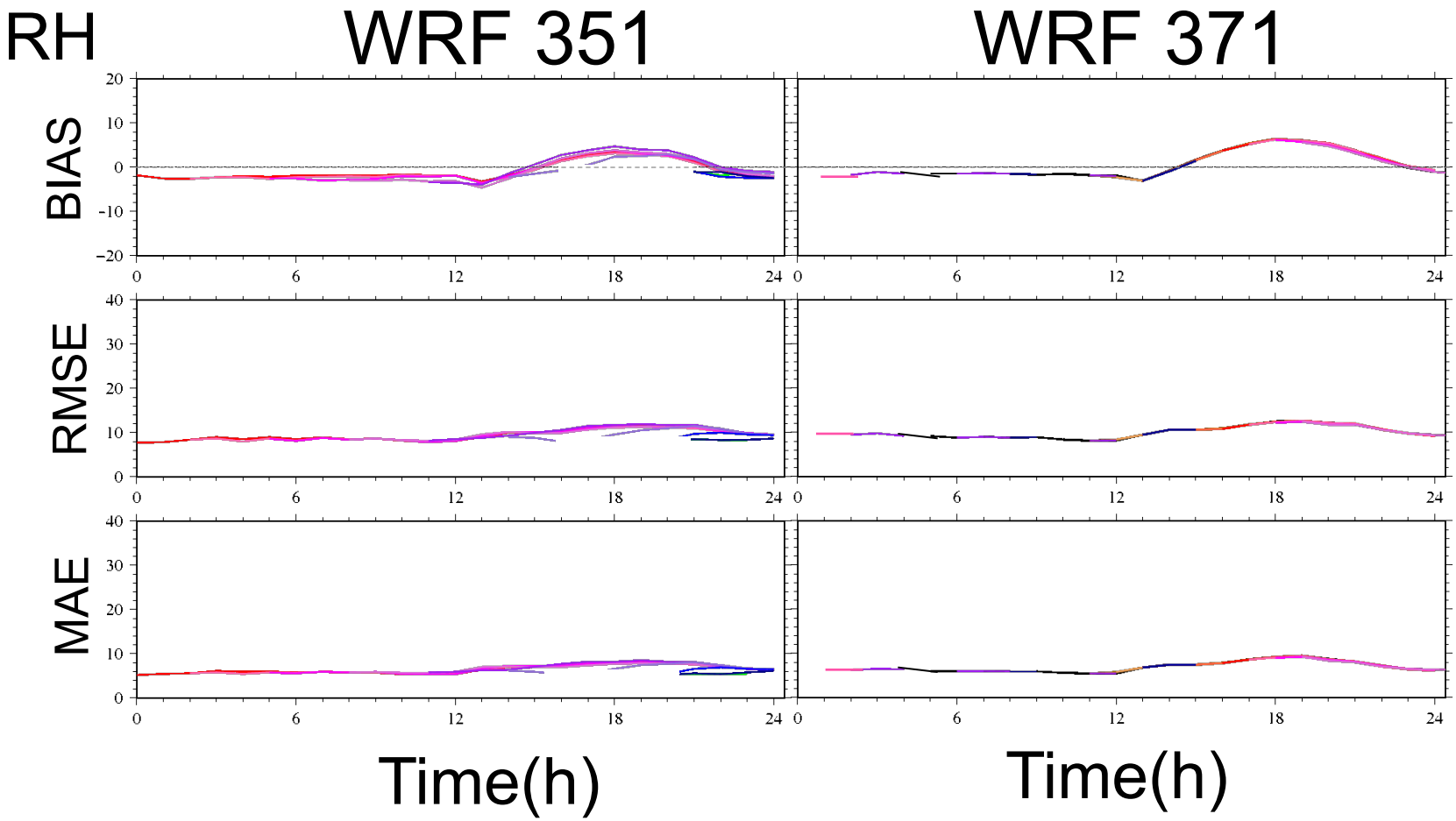


Weather Summary

- April 27, 2016: low clouds developed after 10Z
- April 28, 2016: low clouds developed after 10Z
- April 29, 2016: low clouds developed after 9Z
- May 1, 2016: low clouds developed after 10Z

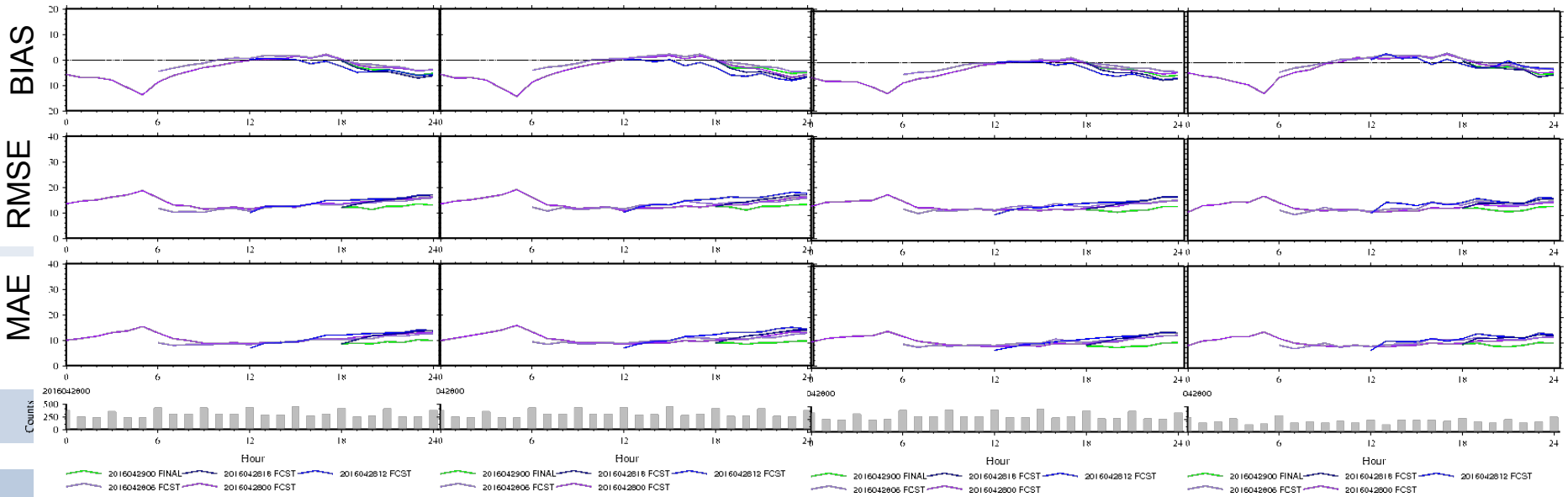


Assess WRF Version Update



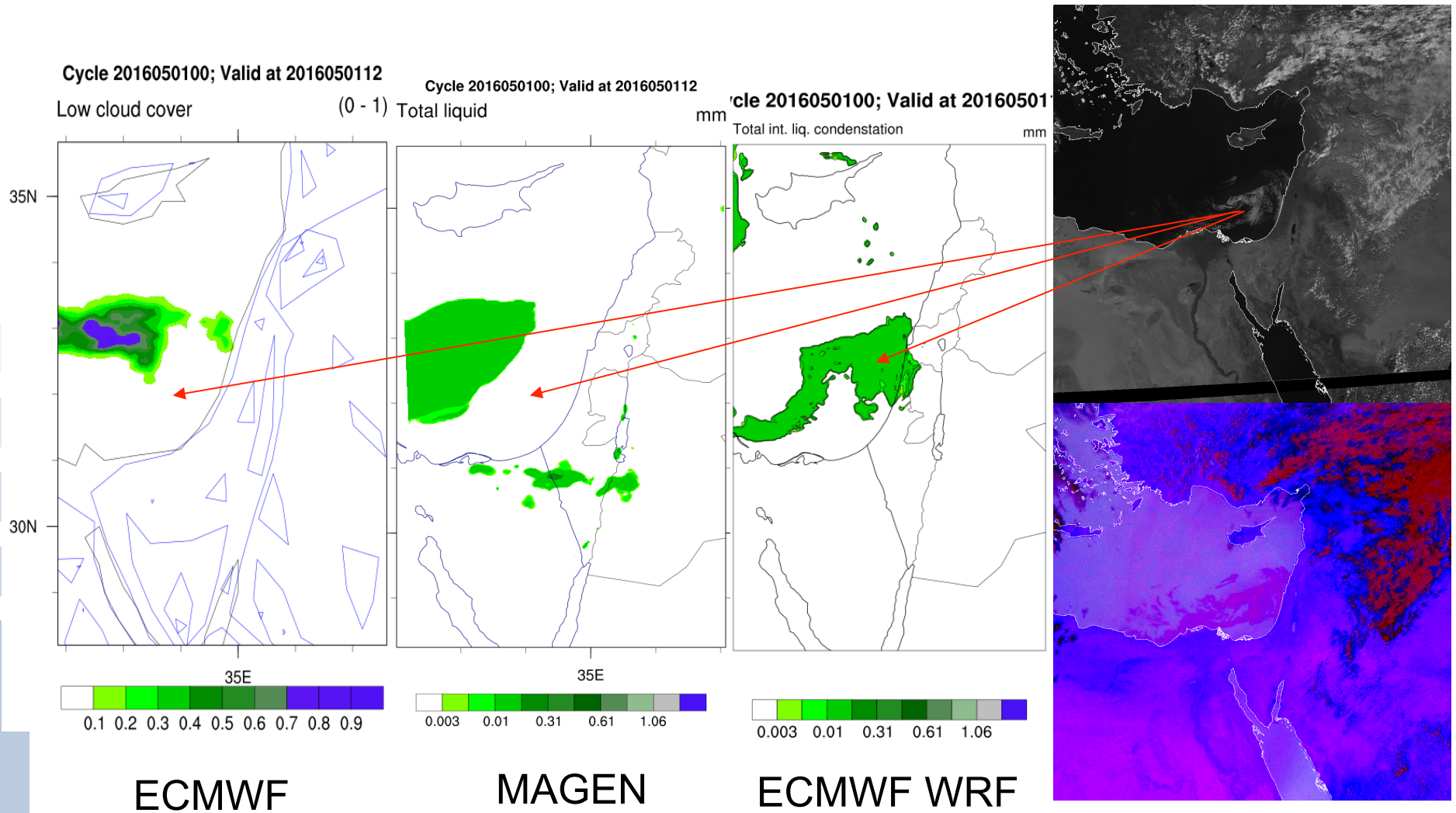
Verification of the surface forecasts driven by different boundary conditions

RH

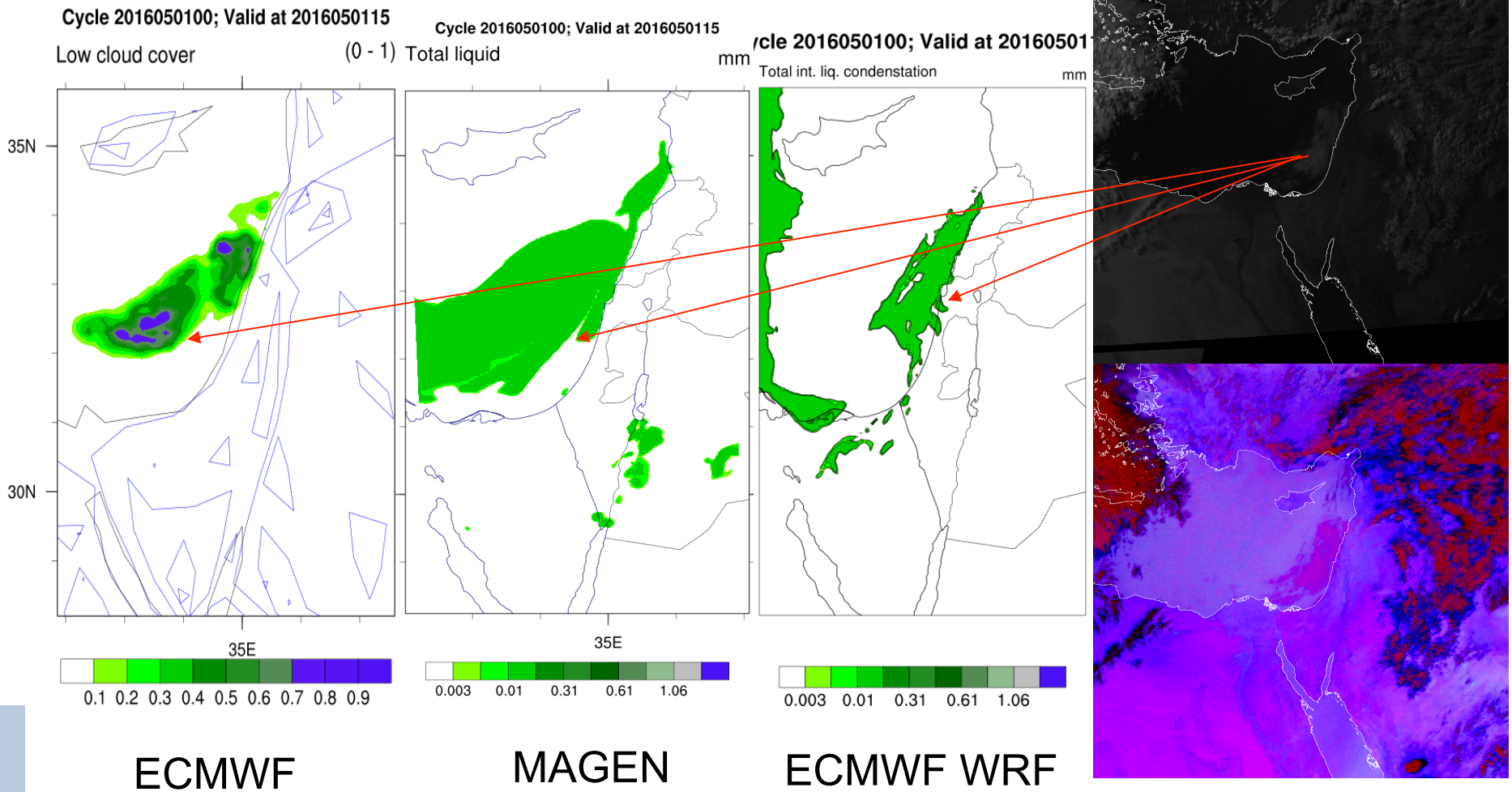


GFS3 GFS4 GFS5 ECMWF

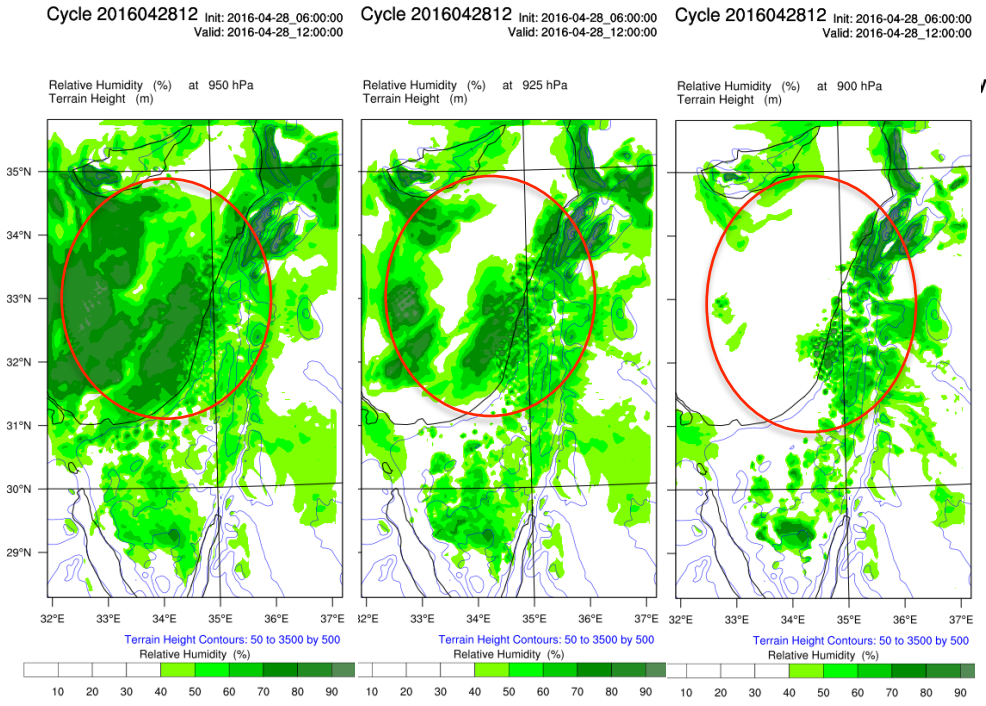
Total liquid and LCC at 2016050112



Total liquid and LCC at 2016050115



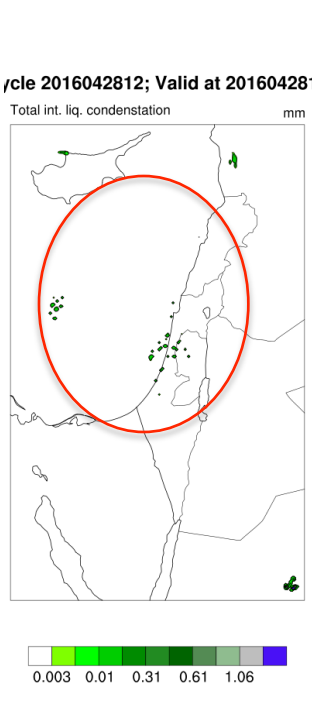
RH VS TLC at 2016042812



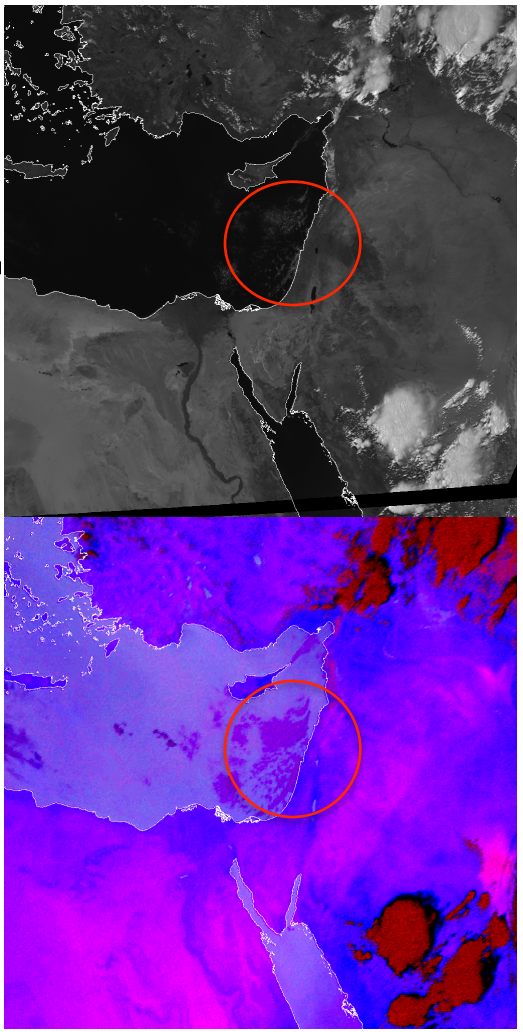
950mb

925mb

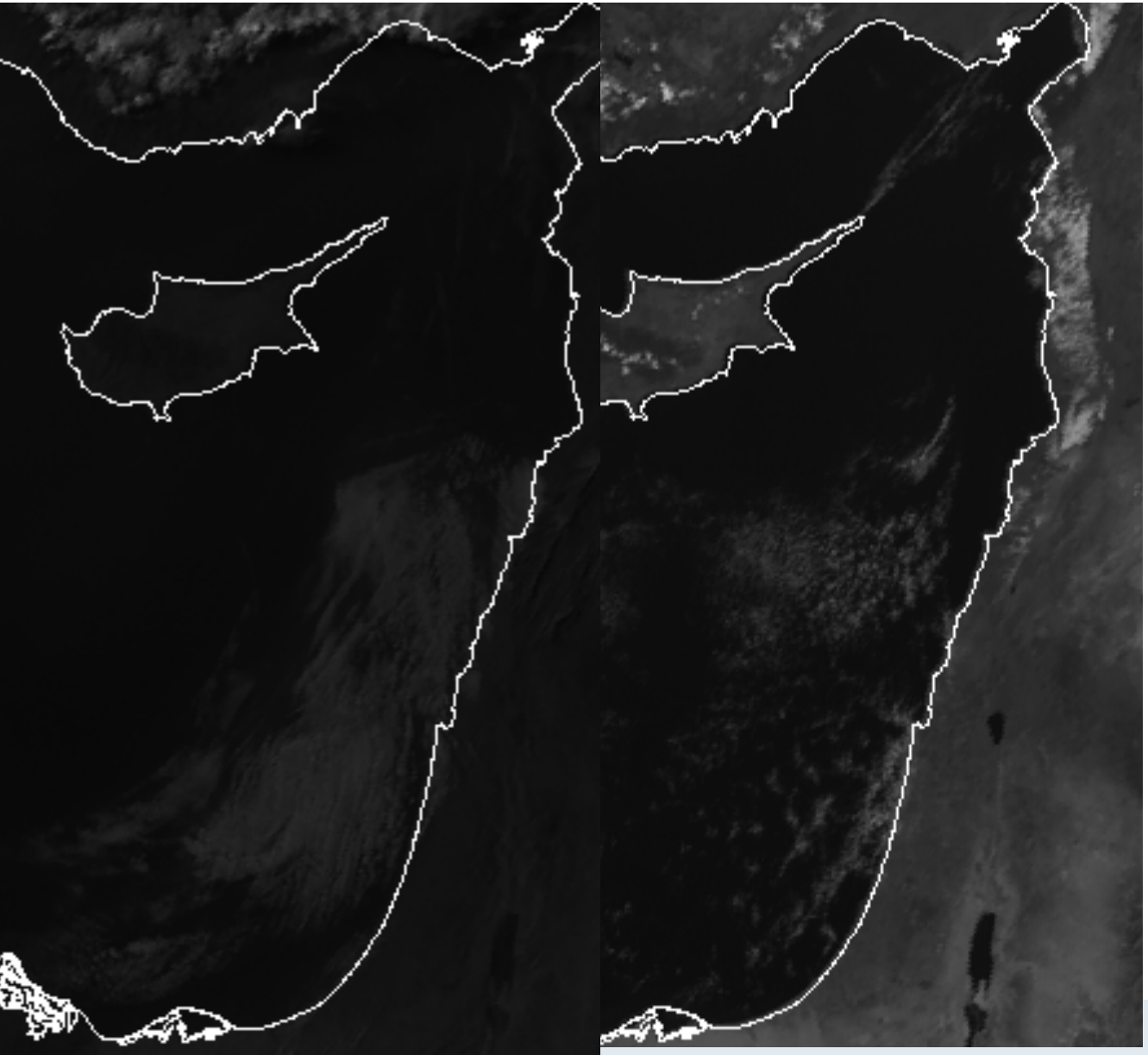
900mb

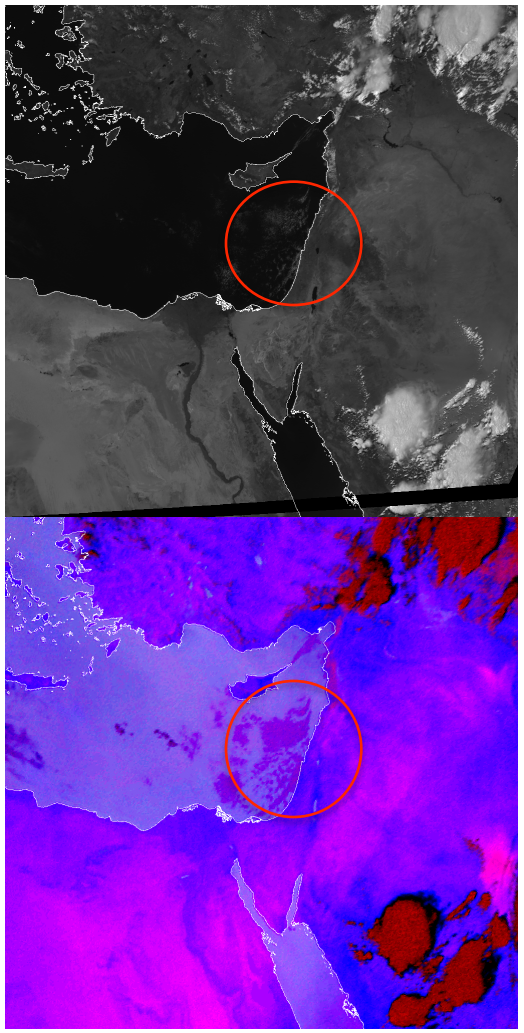


TLC



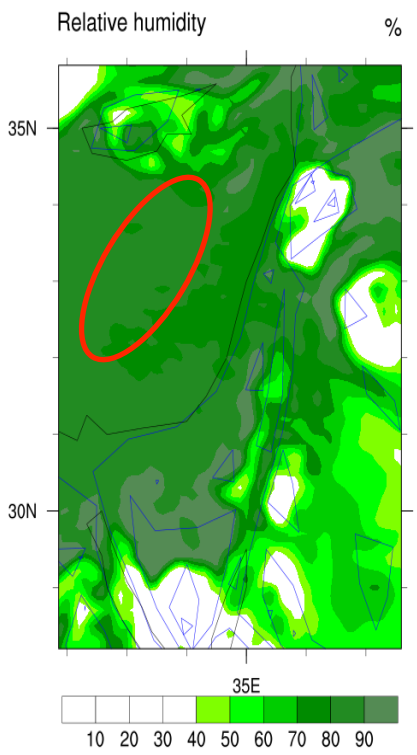
RH VS TLC at 2016042812



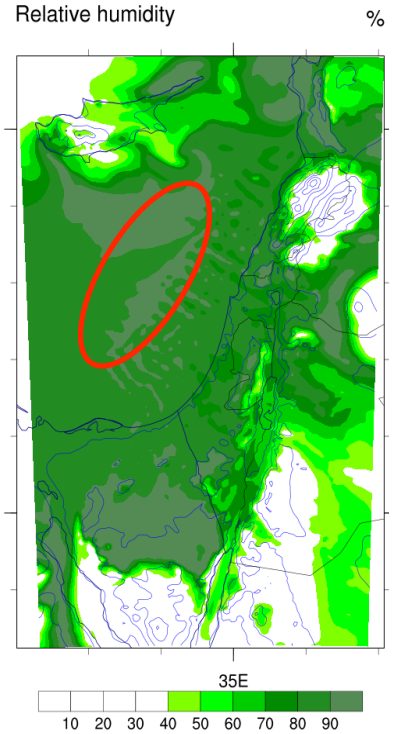


Low clouds revealed in relative humidity

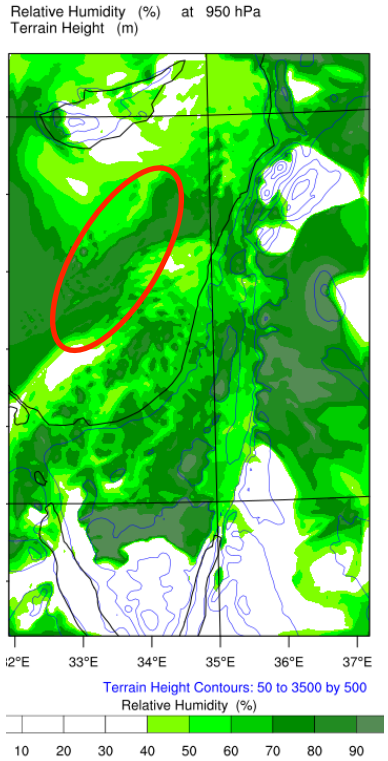
RH valid at 2016042803 for 950mb



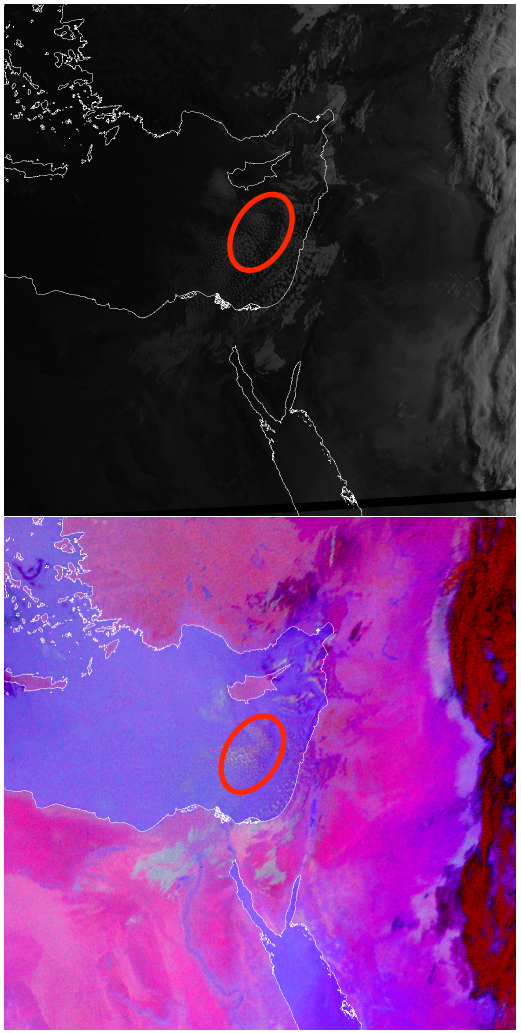
ECMWF



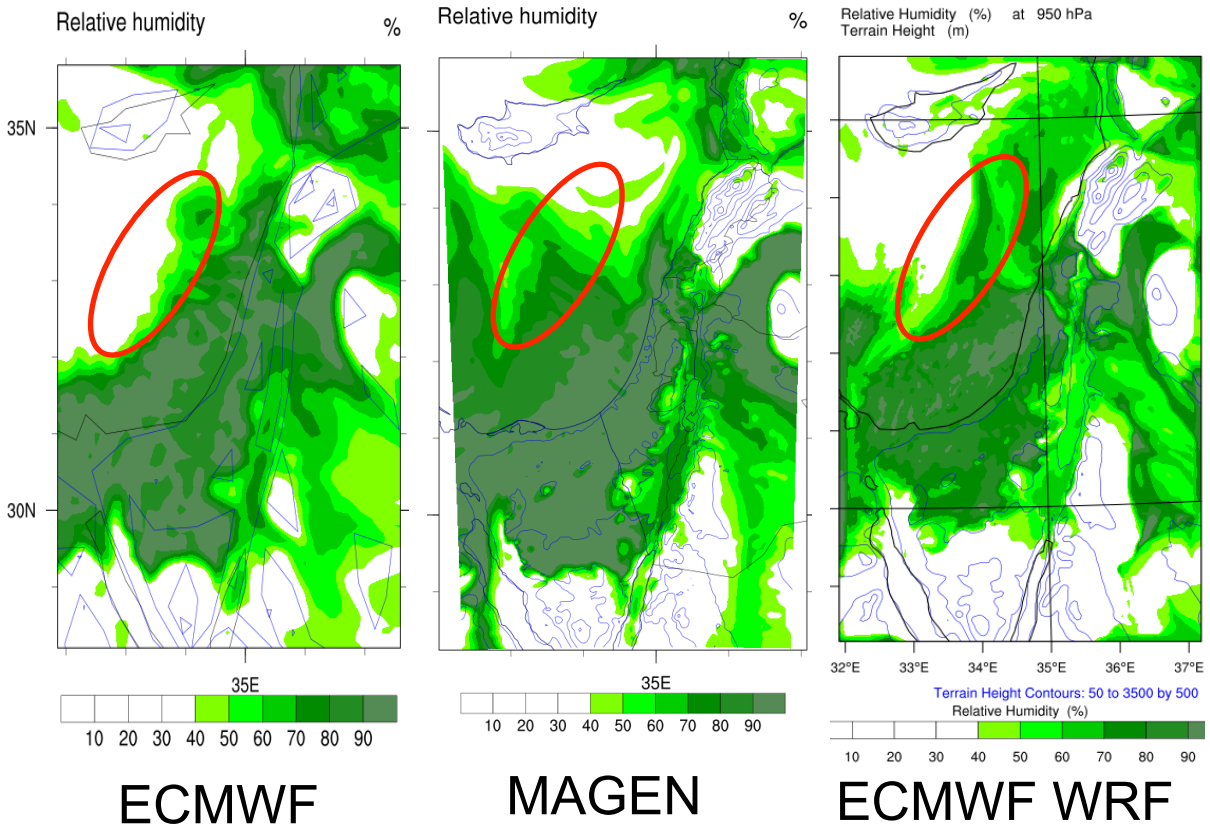
MAGEN



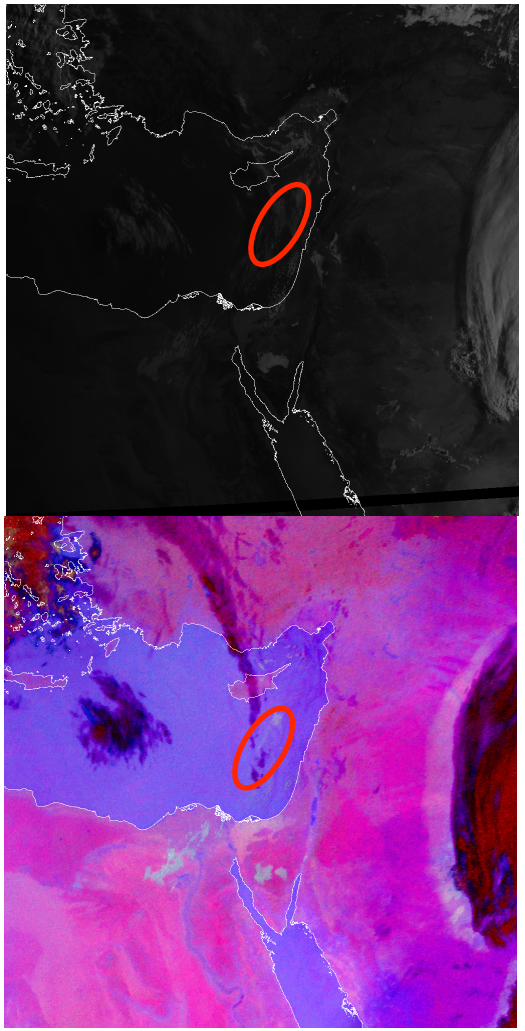
ECMWF WRF



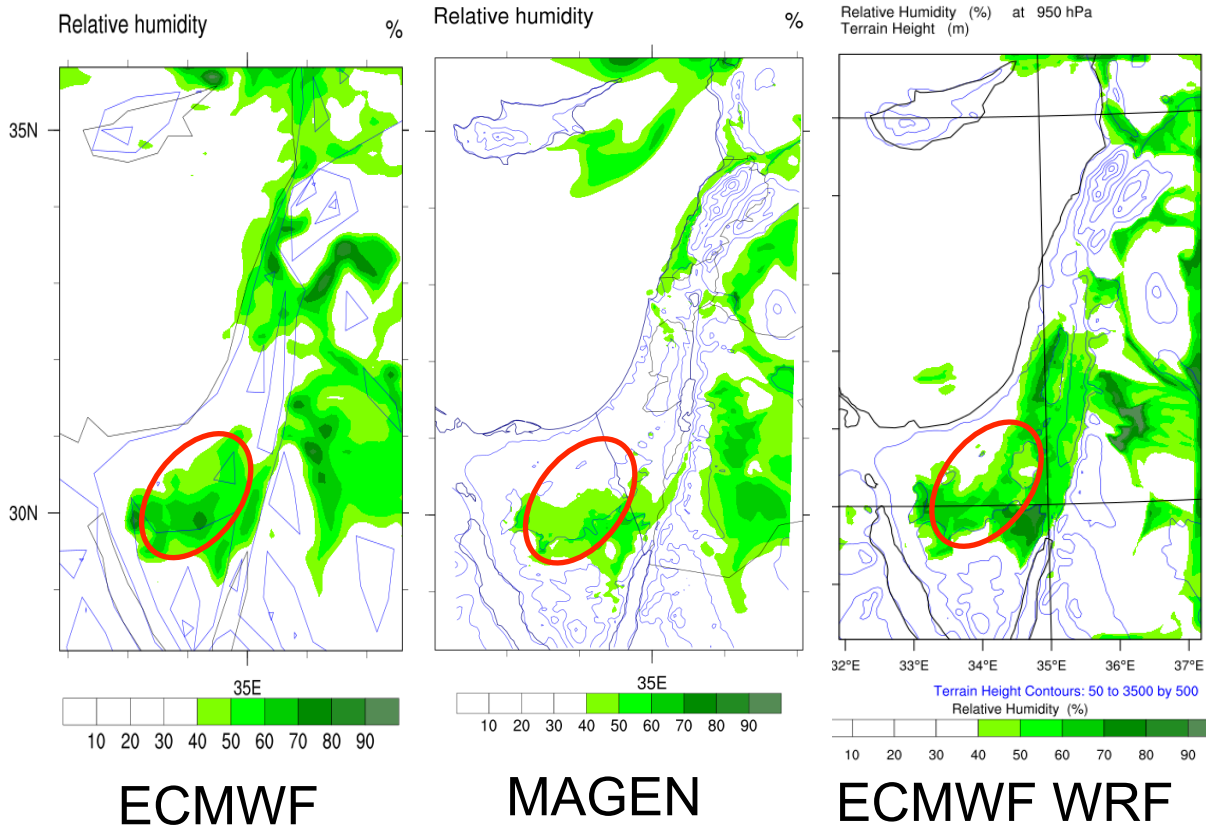
RH at 2016042903 for 950mb



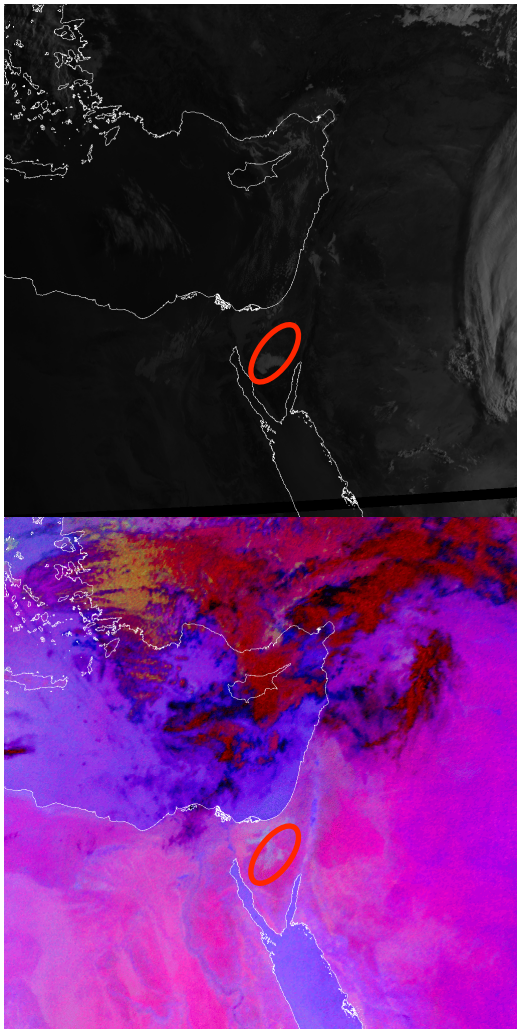
ECMWF MAGEN ECMWF WRF



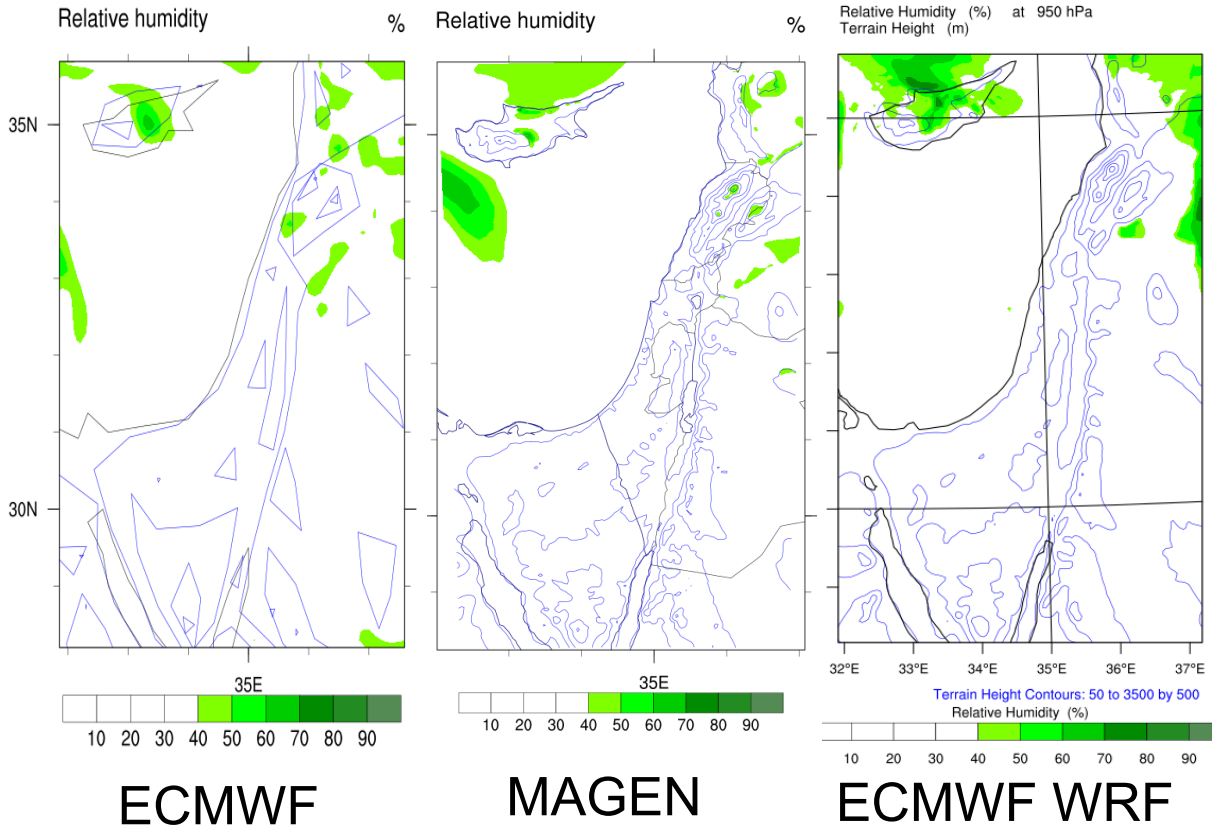
RH at 2016043003 for 950mb



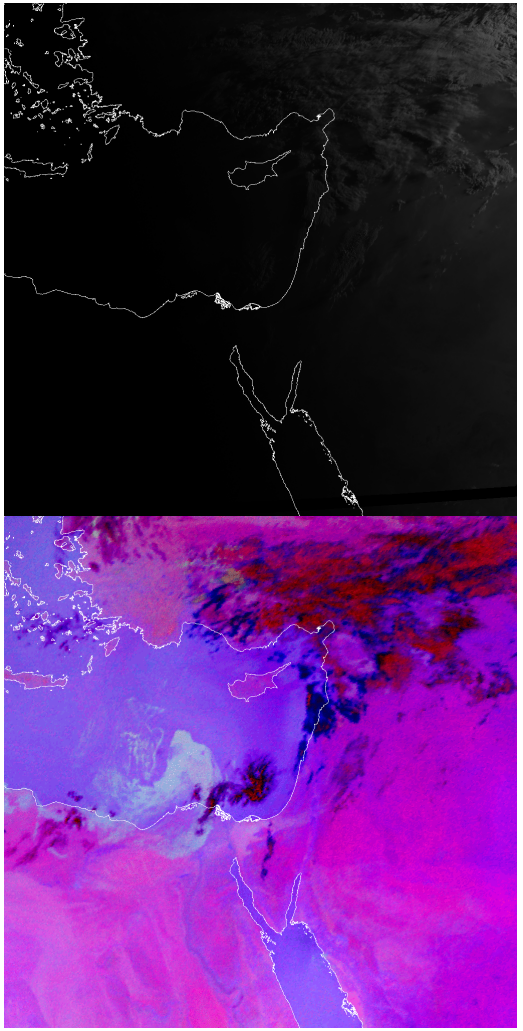
ECMWF MAGEN ECMWF WRF



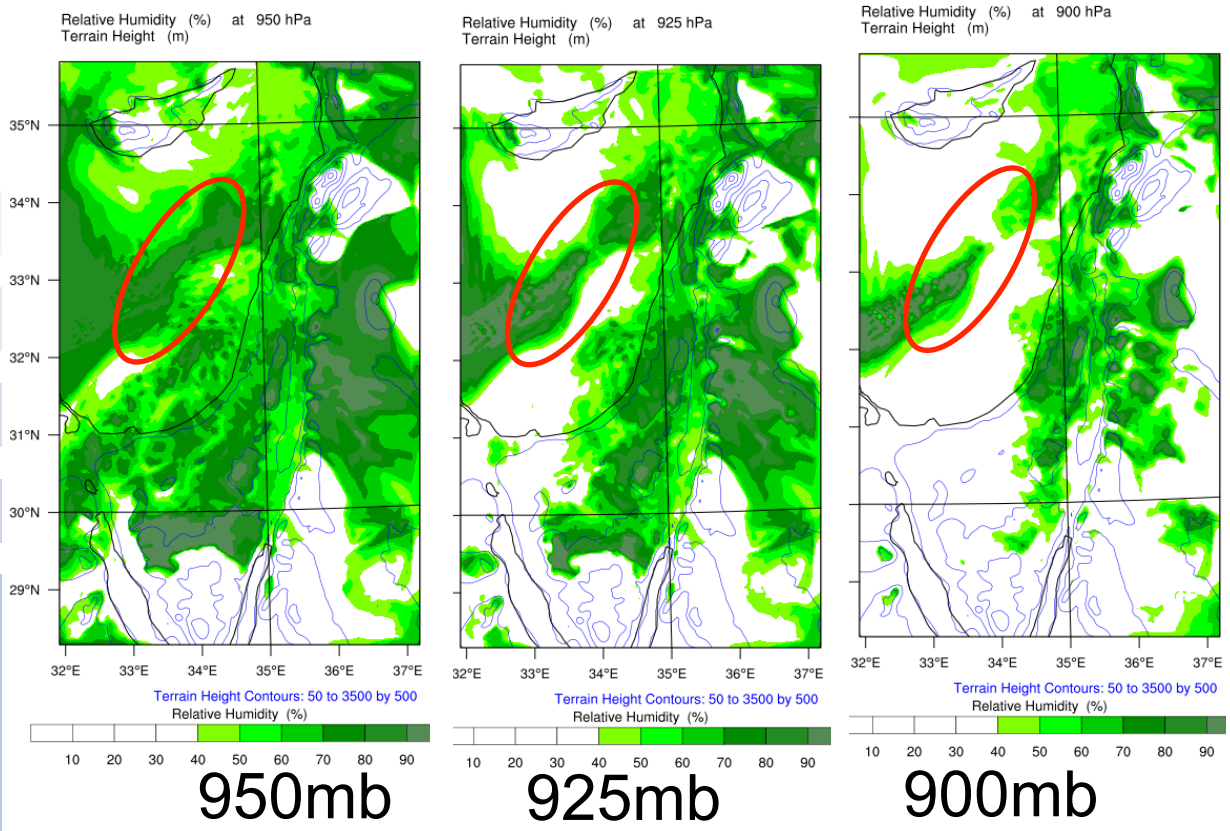
RH at 2016050103 for 950mb

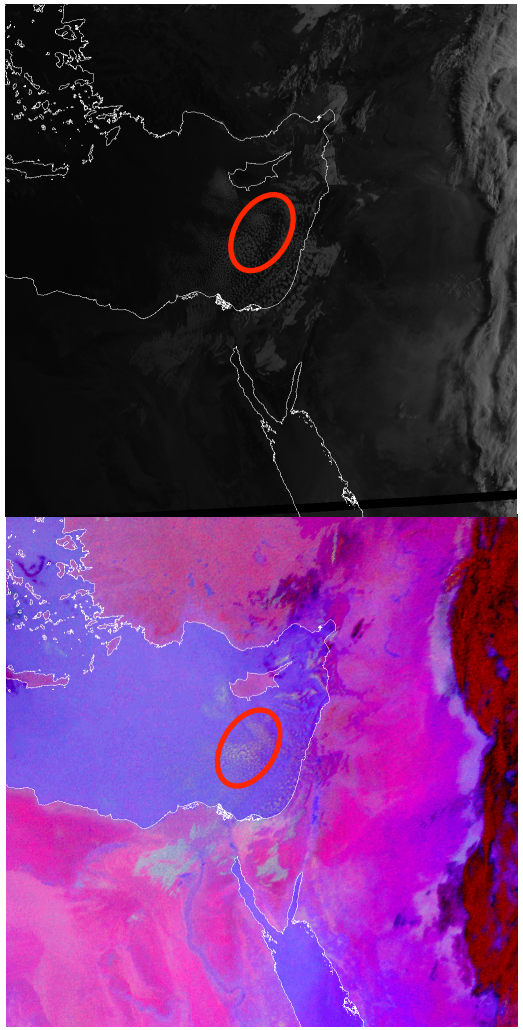


ECMWF MAGEN ECMWF WRF

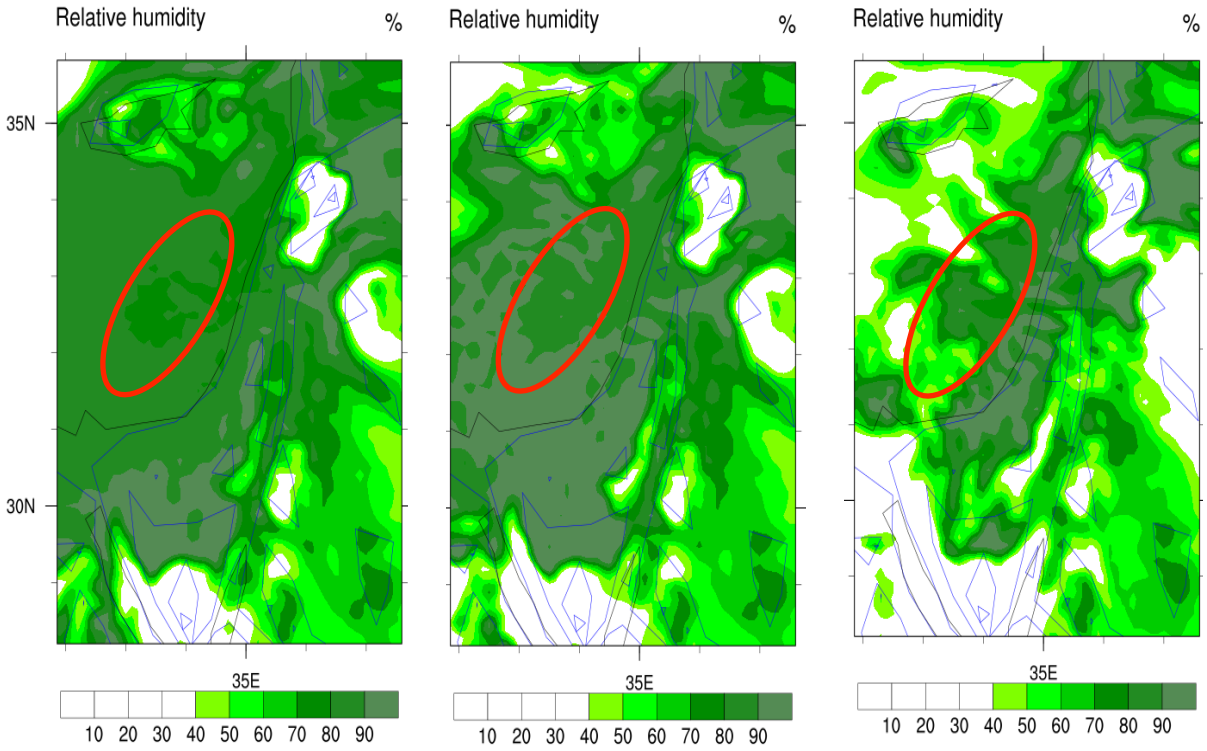


ECMWF WRF at 2016042803

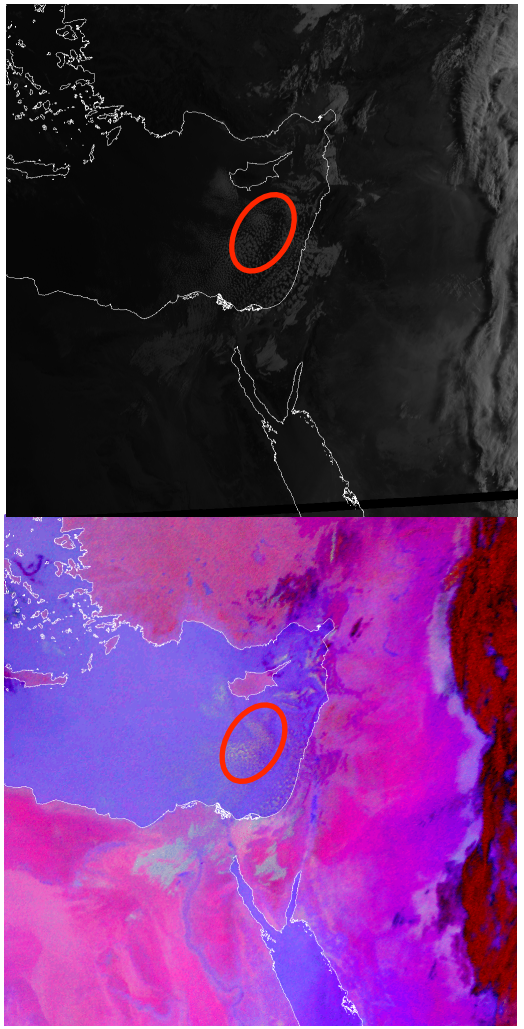




ECMWF at 2016042803



950mb 925mb 900mb



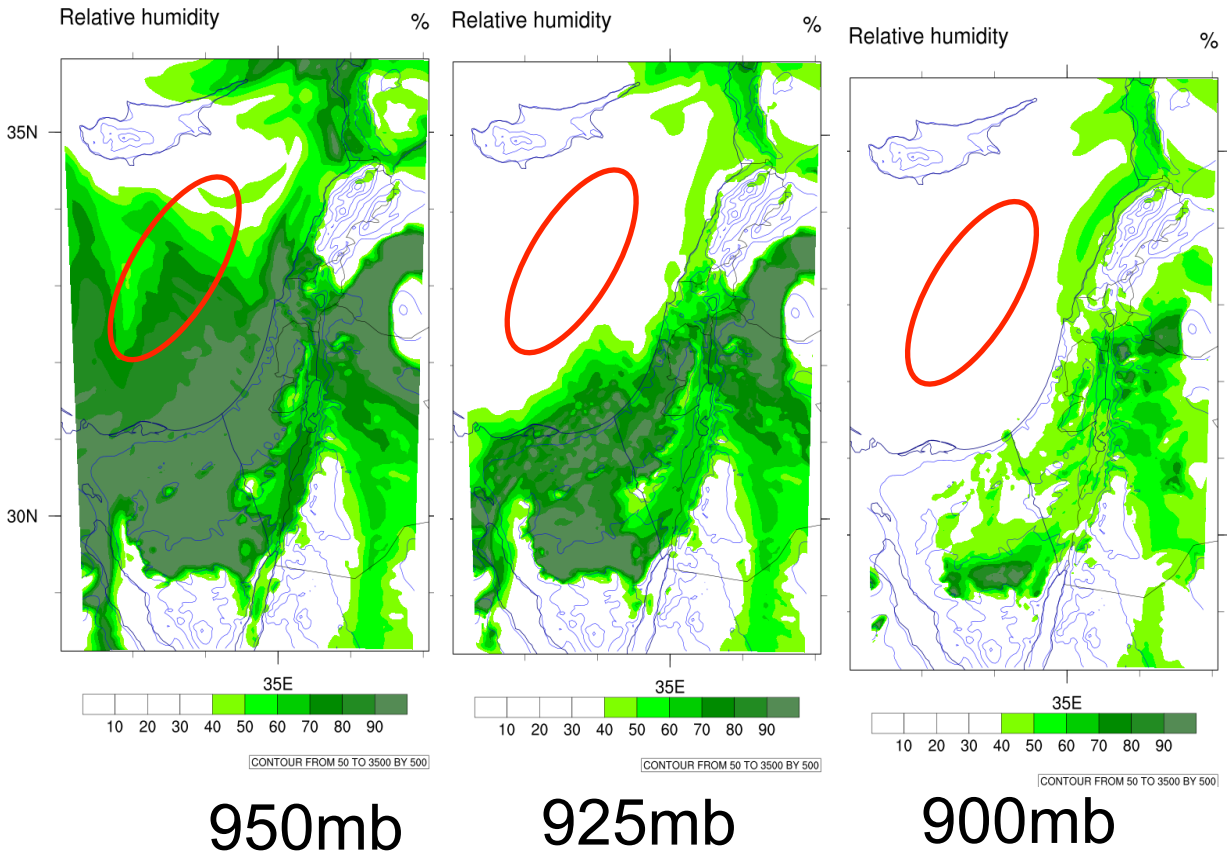
Summary

- RH is higher in ECMWF/MAGEN than that in ECMWF-WRF system at near surface (e.g., 950mb)
- low-level RH can be a better proxy for low-level clouds than the hydrometeors, even for ECMWF WRF runs; it is possible to develop a diagnostic algorithm for low-level cloud covers based on RH.

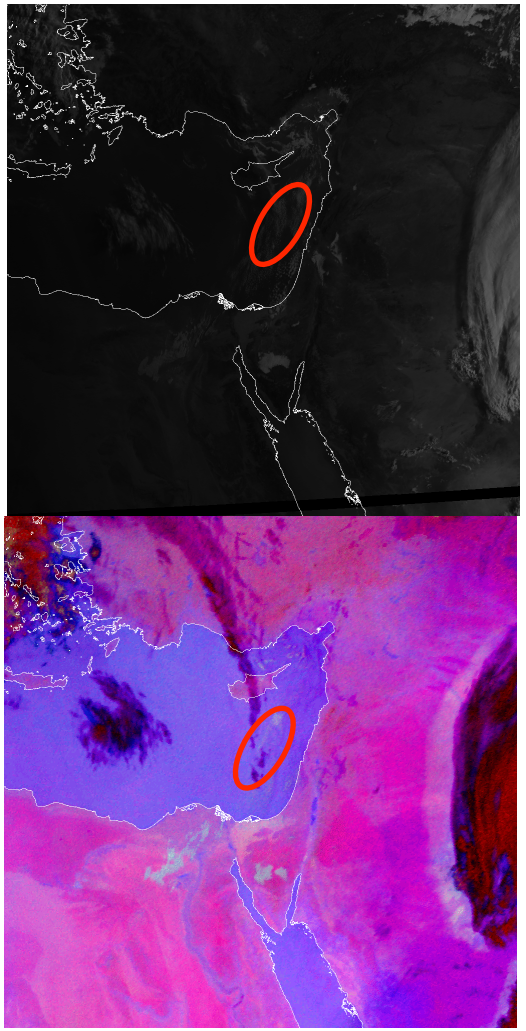
Future work

- Put the changes into operational system to do more verifications
- Further study on the resolution changes (e.g.,1km, 0.5km) on the low-cloud simulations

MAGEN at 2016042903

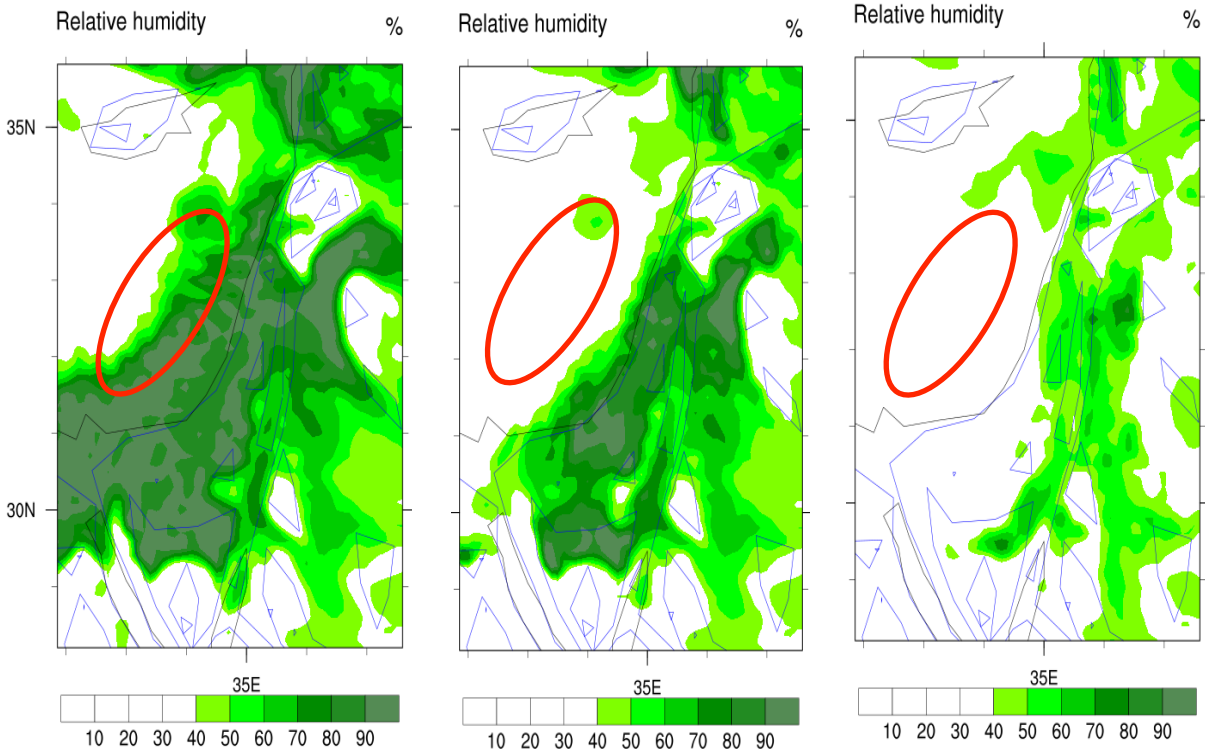


950mb 925mb 900mb



Thanks!

ECMWF at 2016042903



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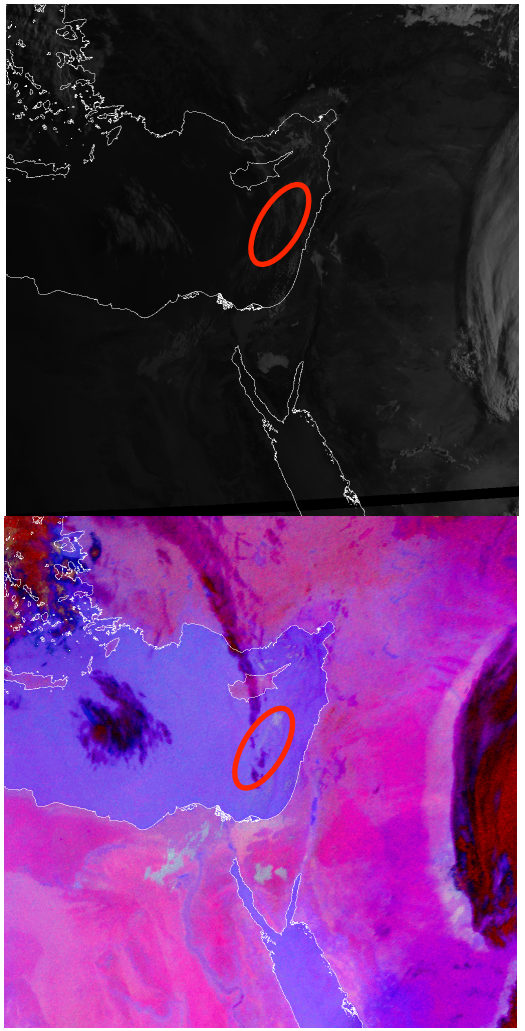
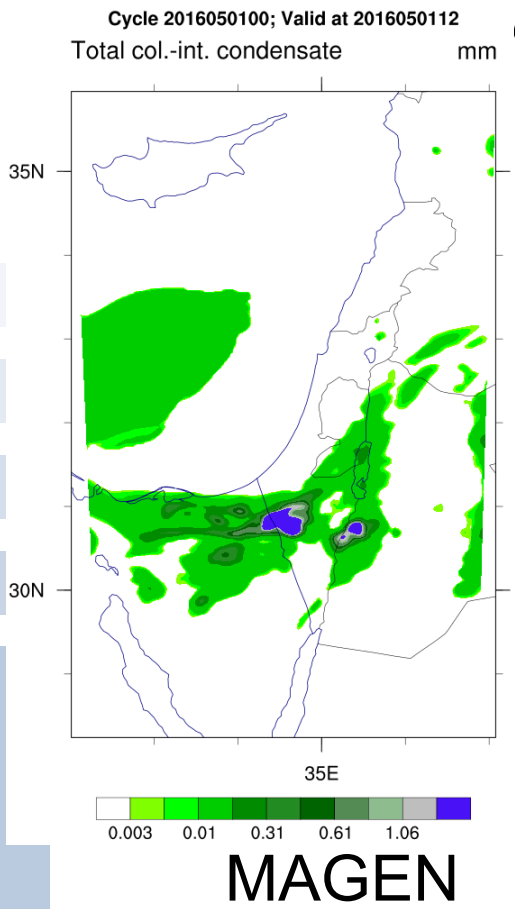
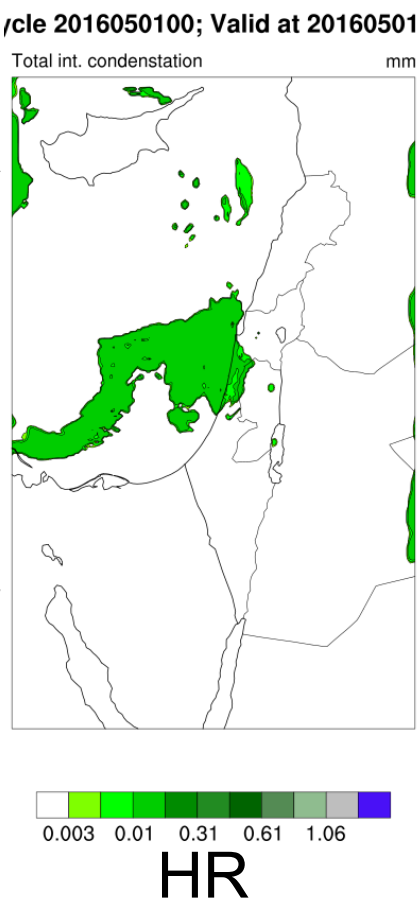
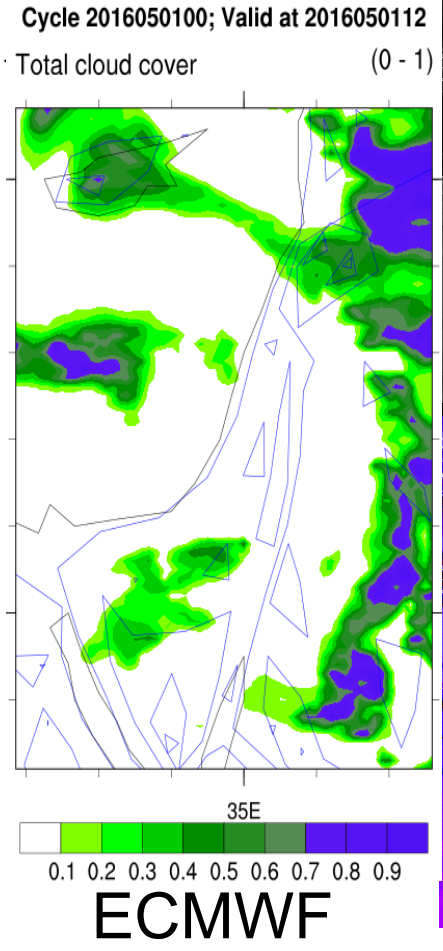
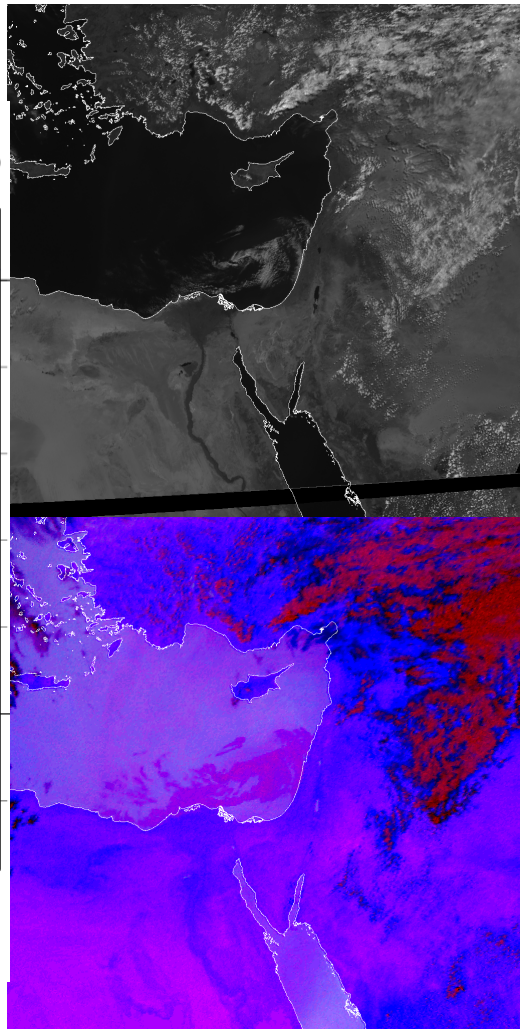


Total Cond. and TCC at 2016050112

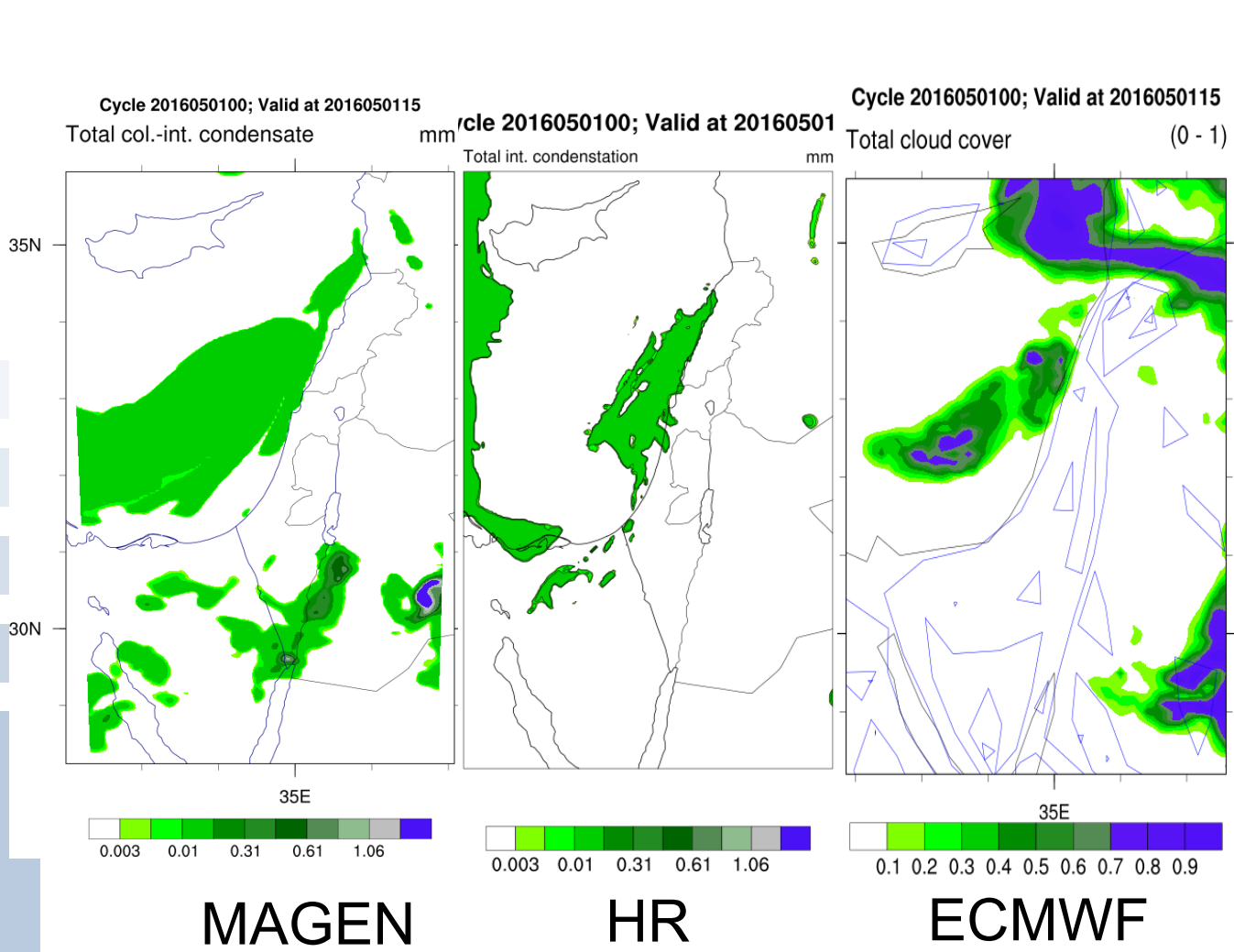


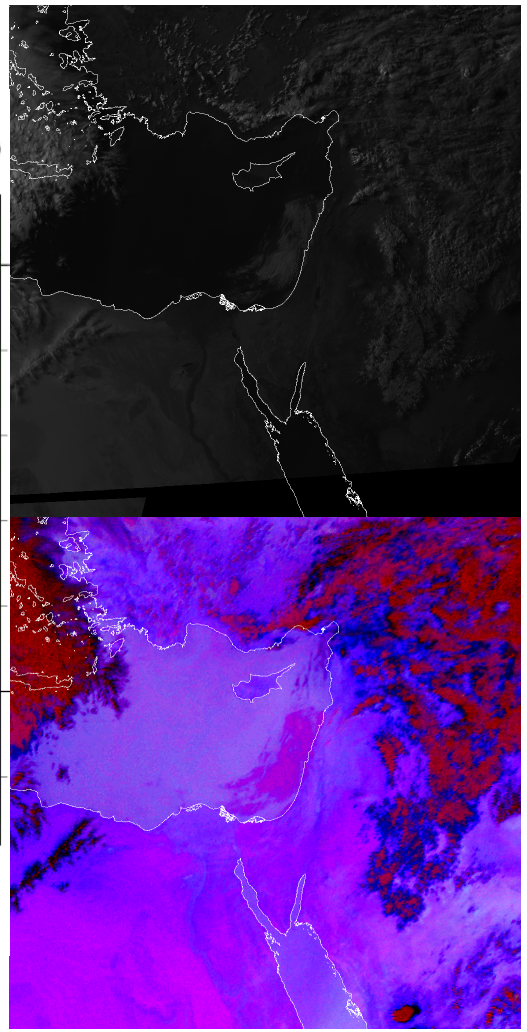




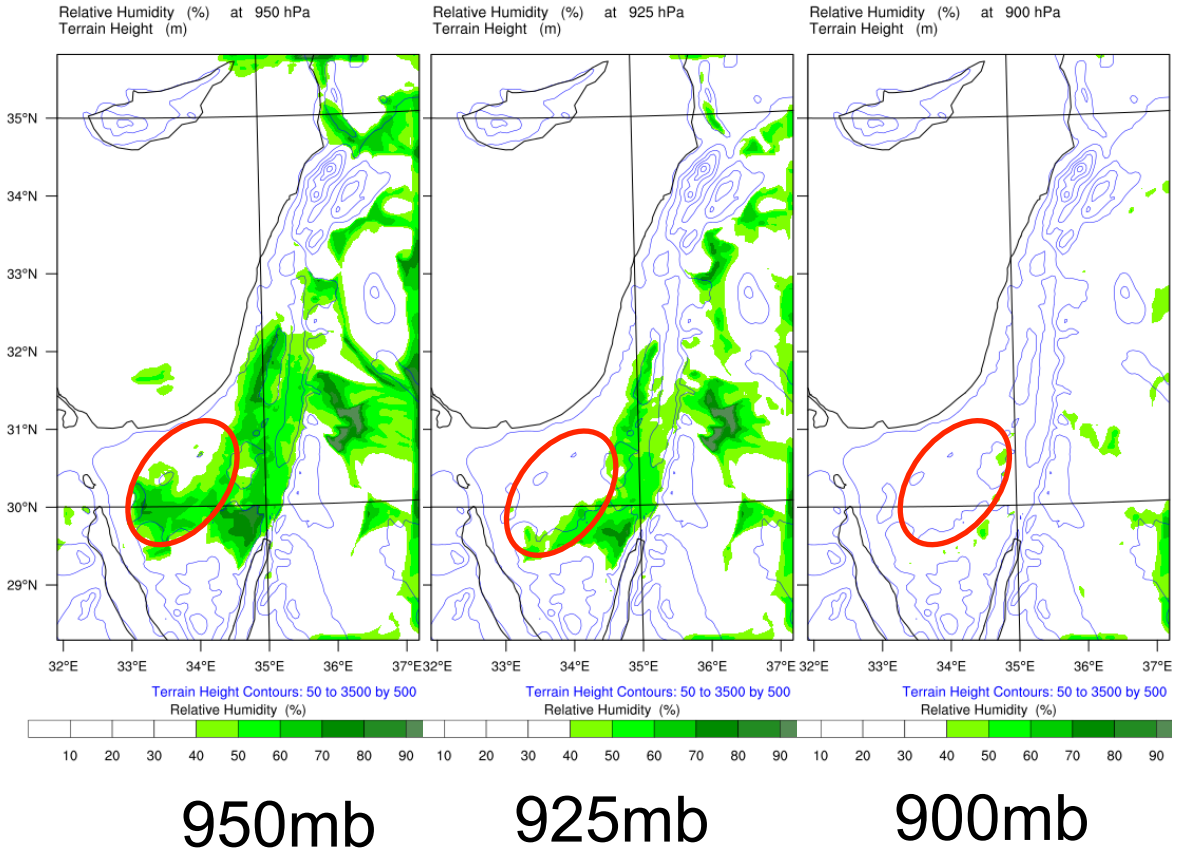


Total Cond. and TCC at 2016050115





HR at 2016043003



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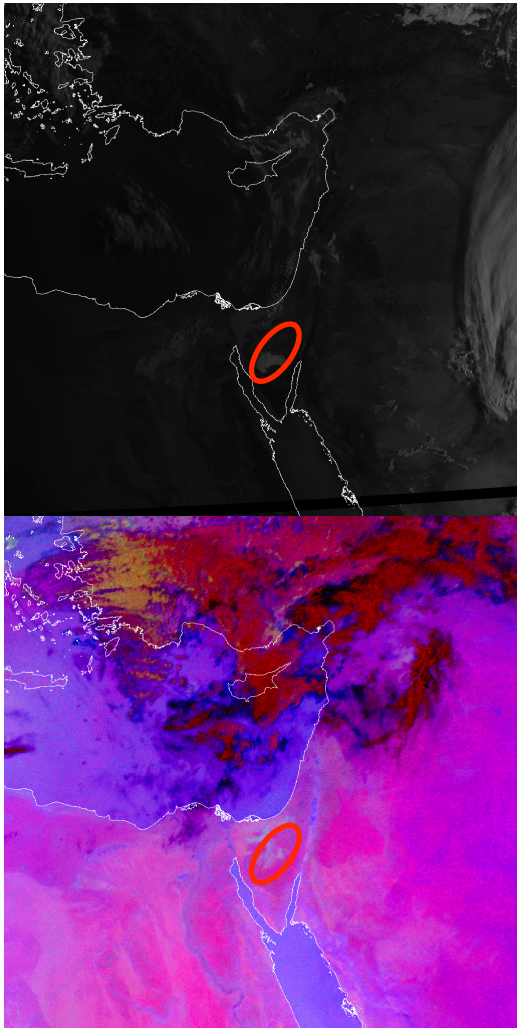
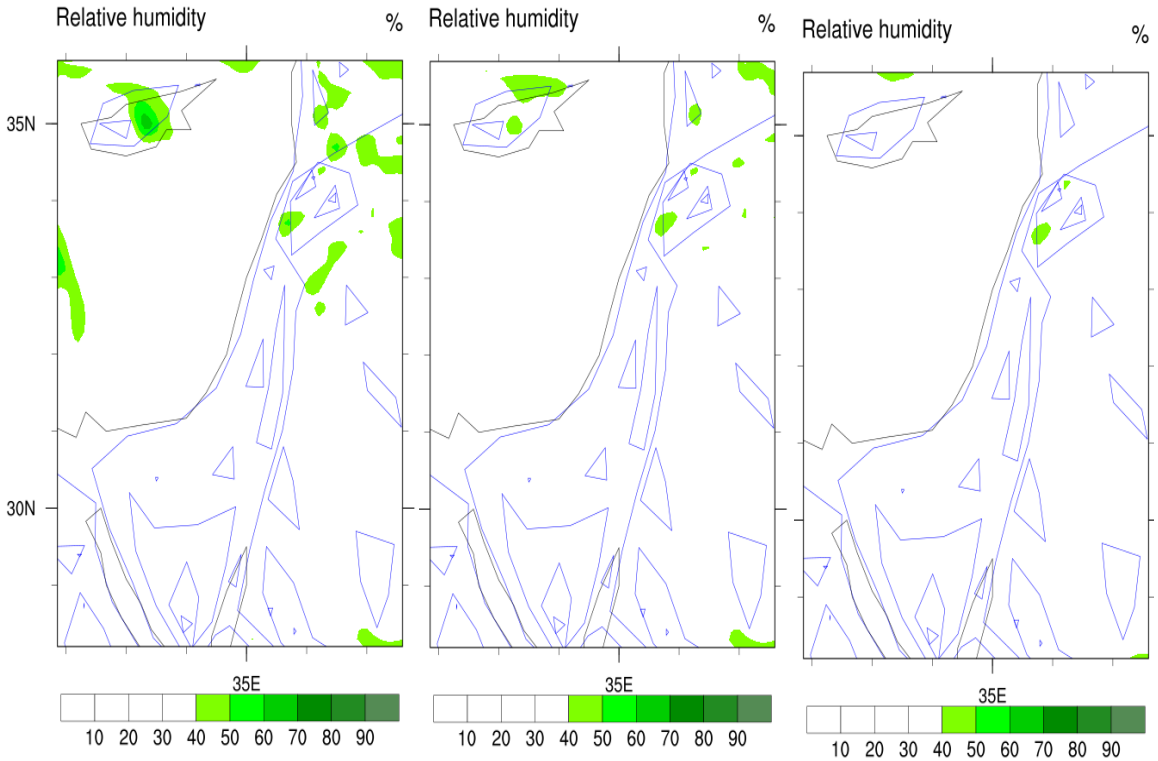
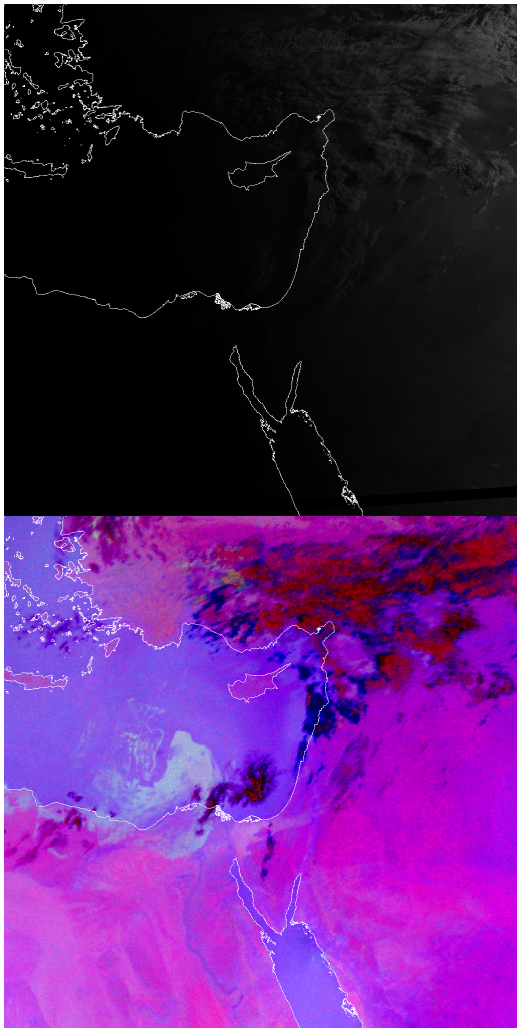


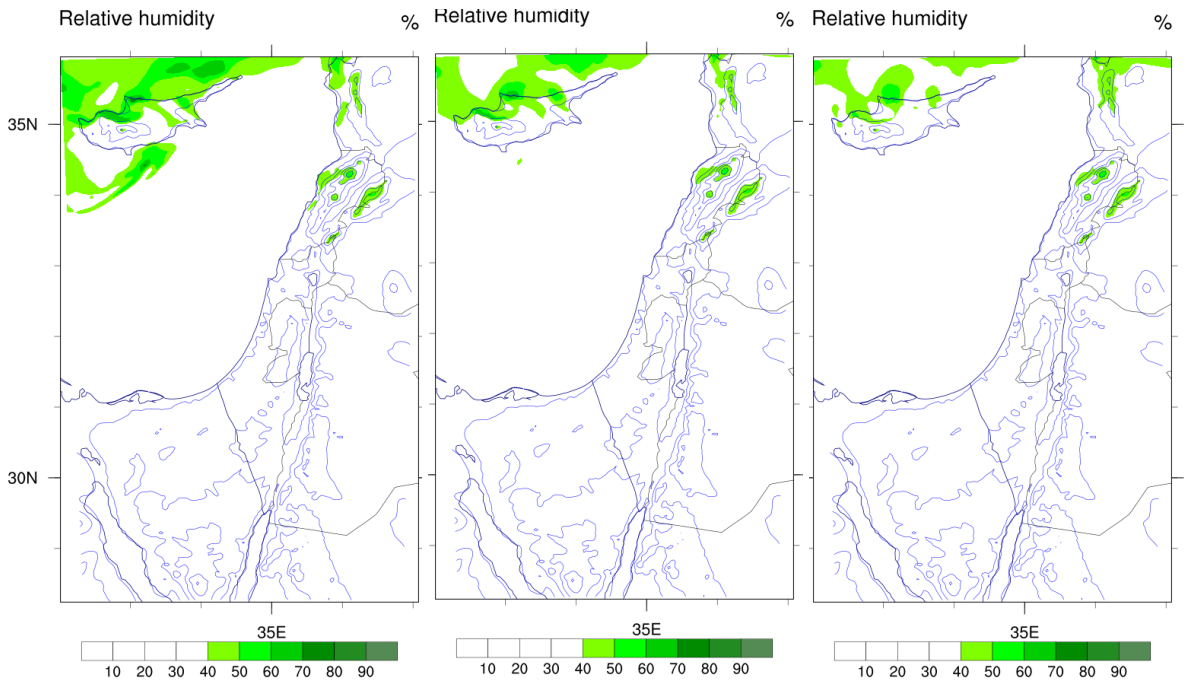
ECMWF at 2016050103



950mb 925mb 900mb



MAGEN at 2016050103



950mb 925mb 900mb