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COSMO Radiation Scheme Using ICON-ART Forecasted Aerosols

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Part of **$T^2(RC)^2$** Priority Project

COSMO General Meeting- September 1, 2020

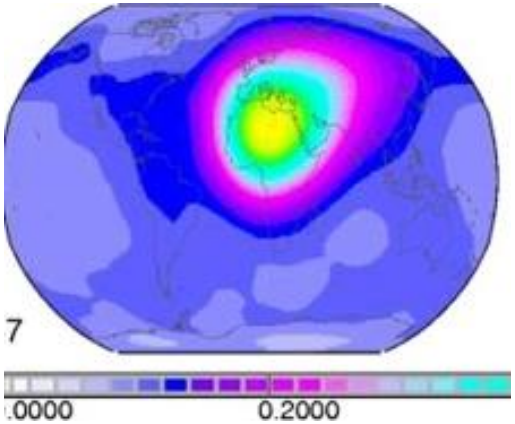
Outline

- Aerosols models currently available in COSMO radiation
- Explanation on the new test version and on the verification system
- Verifications in Israel Oct-Nov-2018/Apr-May-2019
  - ➢ Global radiation - GR
  - ➢ Aerosols optical depth - AOD
- Concluding remarks

Aerosols Input for COSMO Radiation

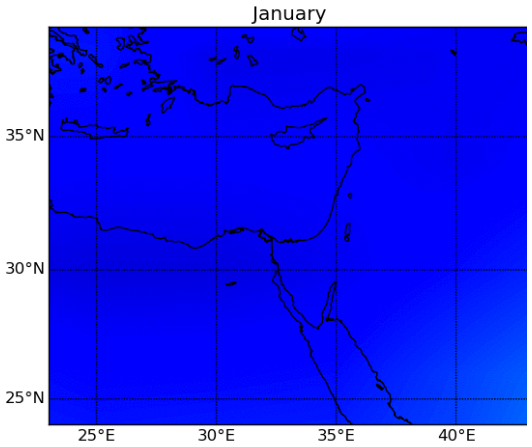
Tanre (1983)

itype_aerosol = 1



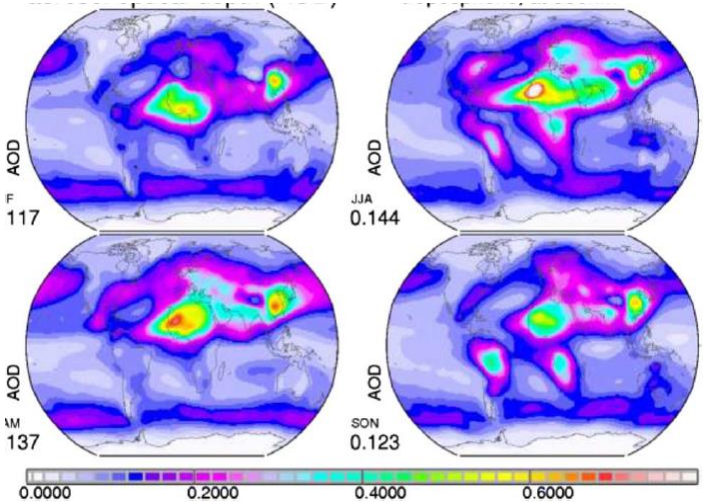
Tegen (1997)

itype_aerosol = 2



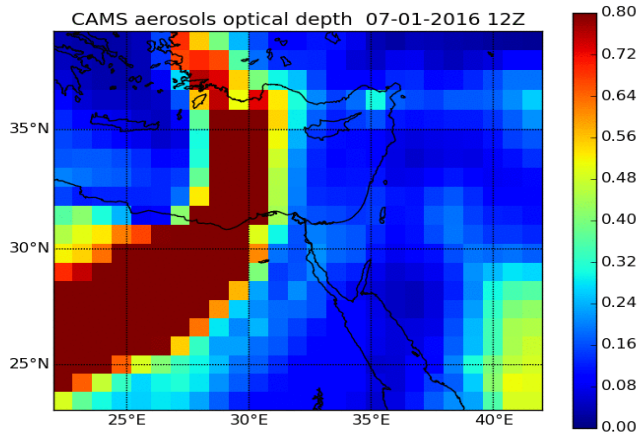
Kinne (2013)

itype_aerosol = 3



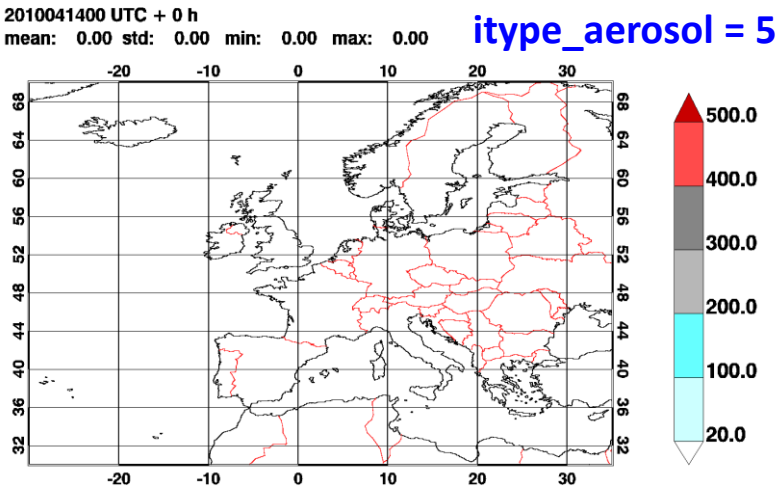
CAMS-ECMWF

itype_aerosol = 4



ICON-ART

itype_aerosol = 5



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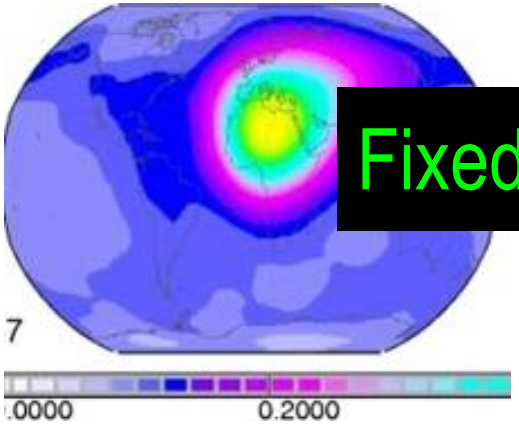

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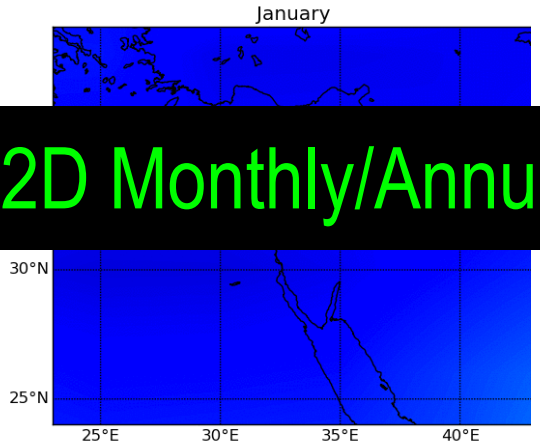

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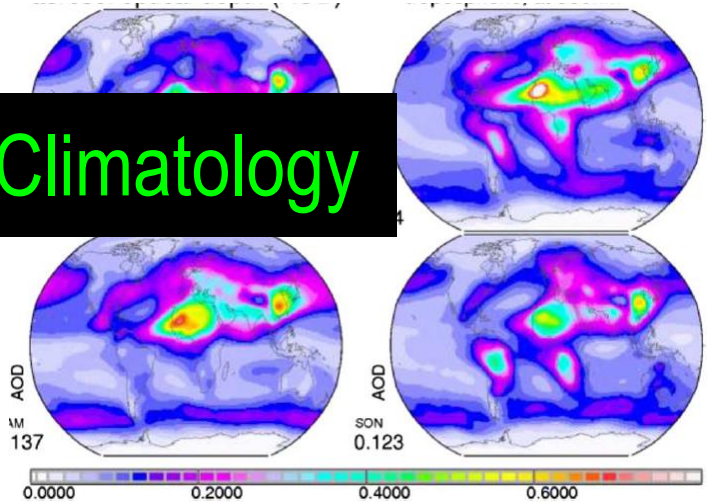

Fixed 2D Monthly/Annual Climatology

CAMS-ECMWF
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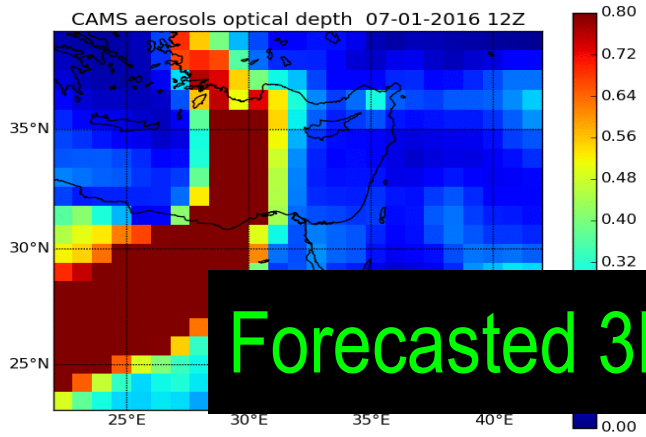

ICON-ART
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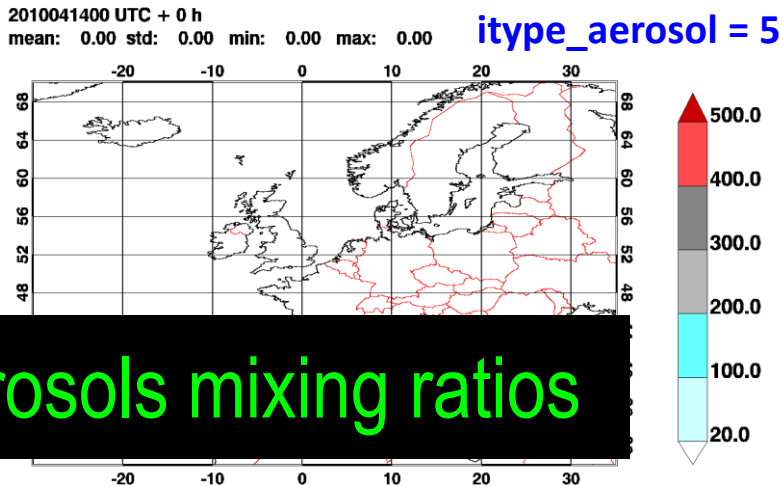
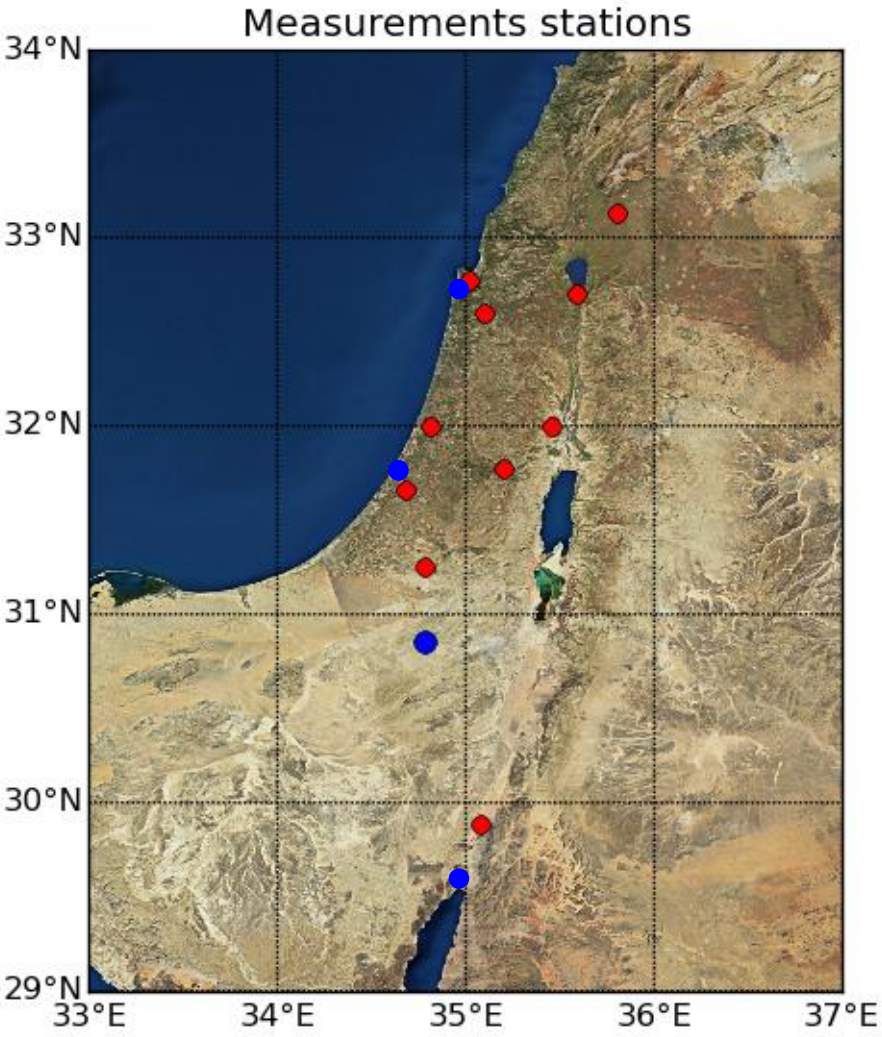


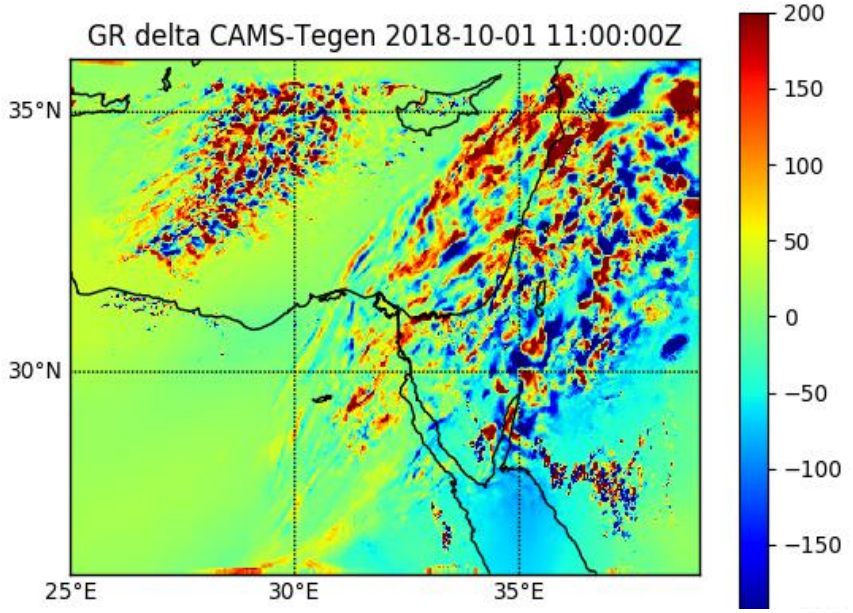
Forecasted 3D aerosols mixing ratios

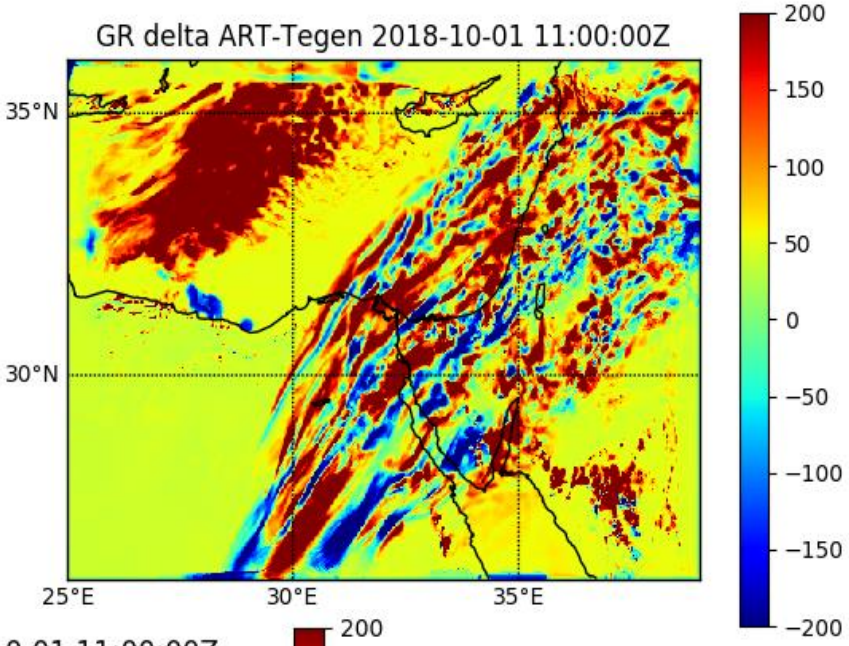
The Verification system

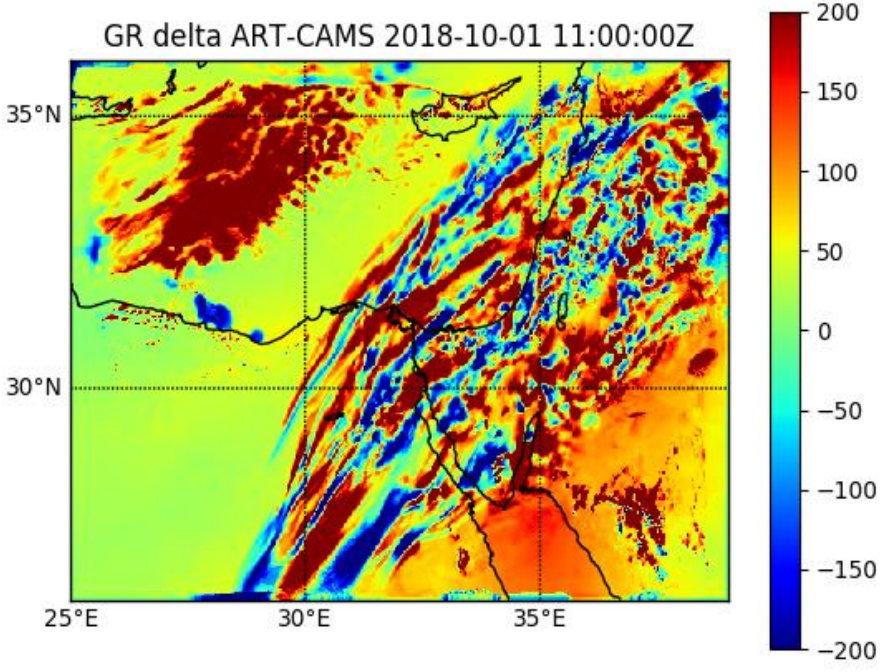
- **4 months** in Oct-Nov-2018 + Apr-May-2019
- **10** radiation measurement stations
- **4 AEORNET** (AOD) stations: Technion, Wiezmann, Sede-Boker, Eilat
- **3 models**: **COSMO 2.8km CLOUDRAD 00UTC run for 24h with aerosols input by:**
  - **Tegen**
  - **CAMS**
  - **ICON-ART-dust (+ other 4 species Tegen)**



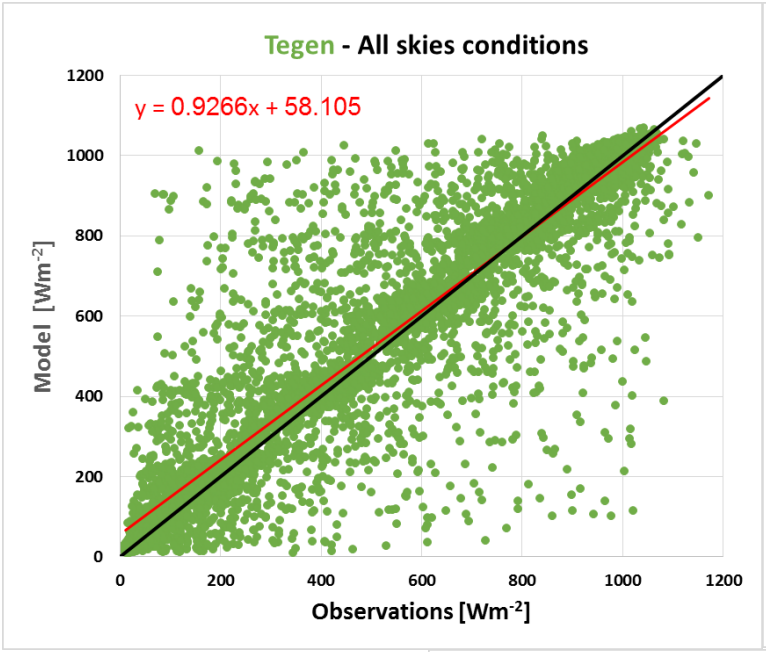
Global radiation – model vs. model

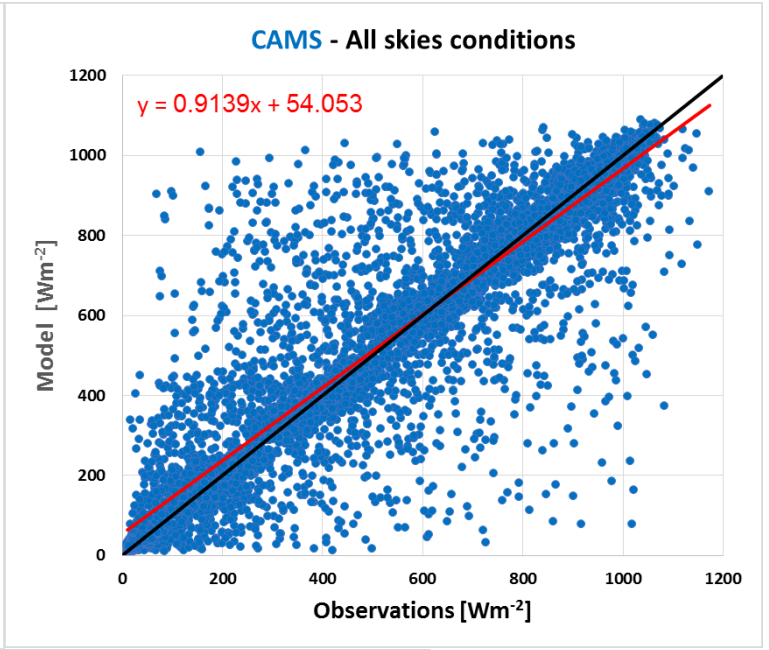


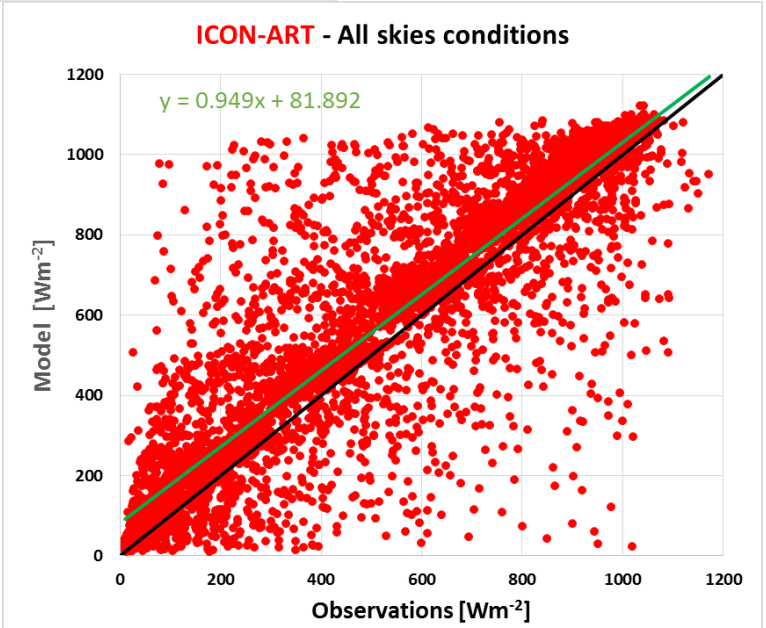




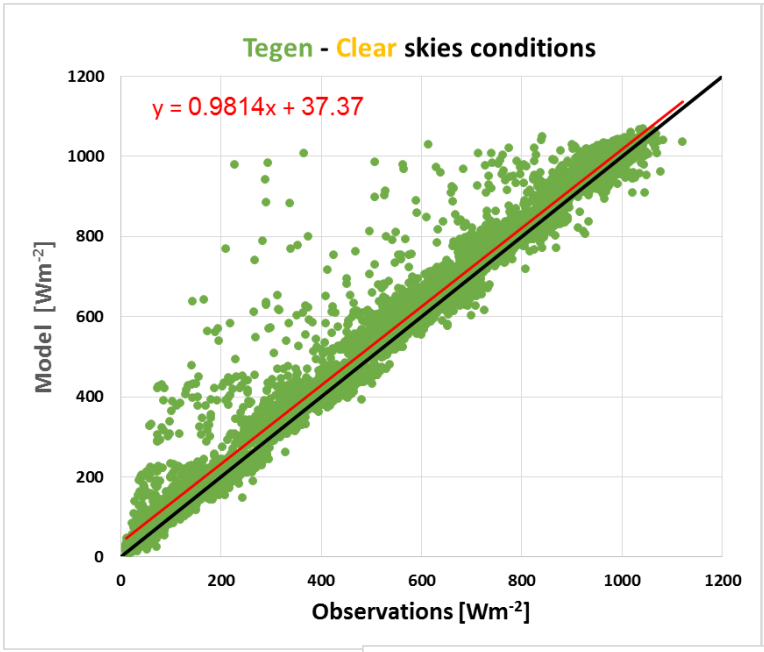
Global radiation – model vs. Observations

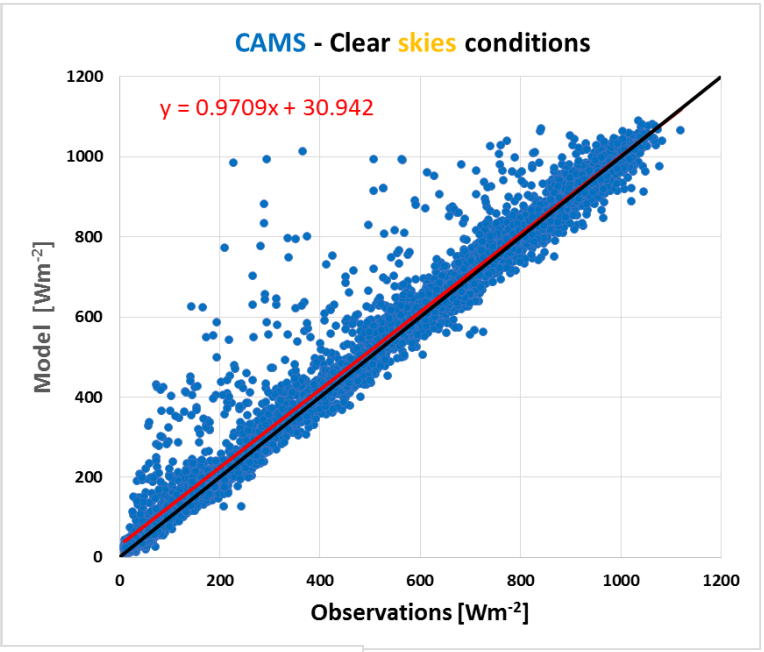


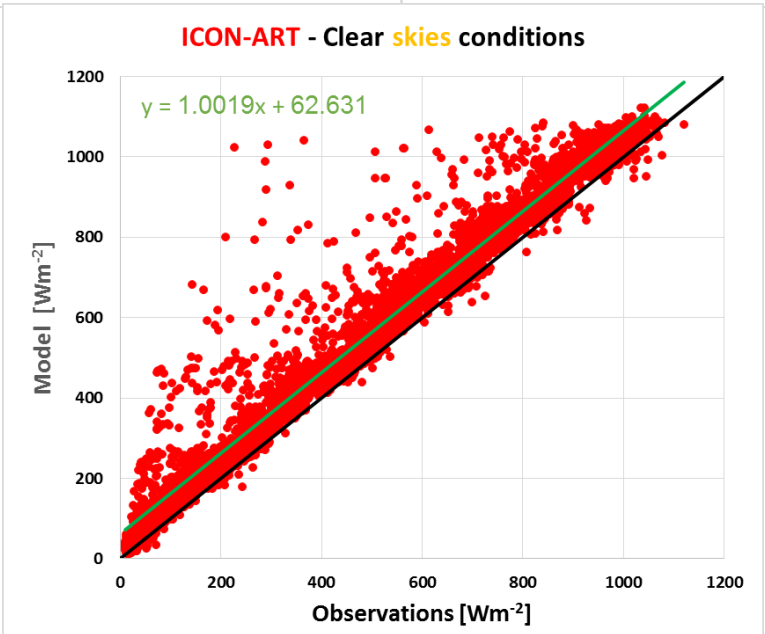




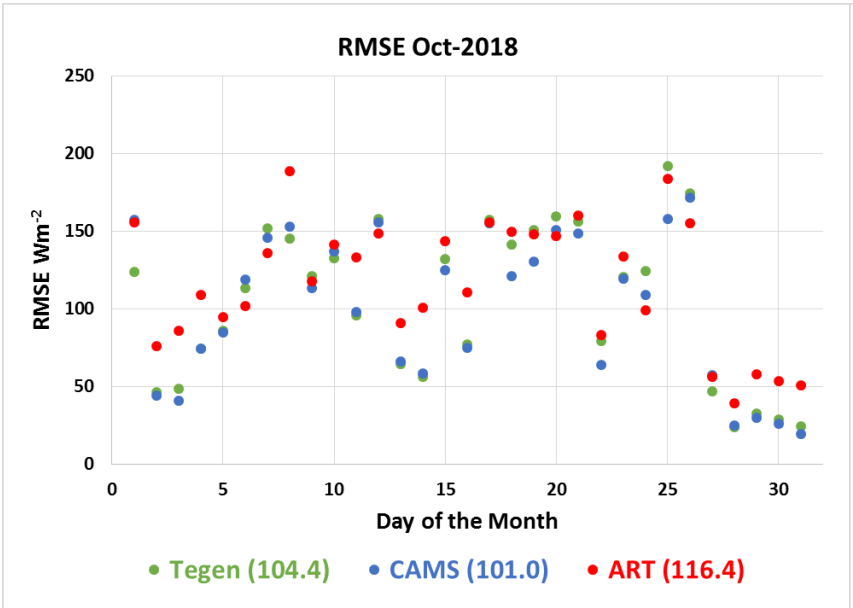
Global radiation – model vs. Observations

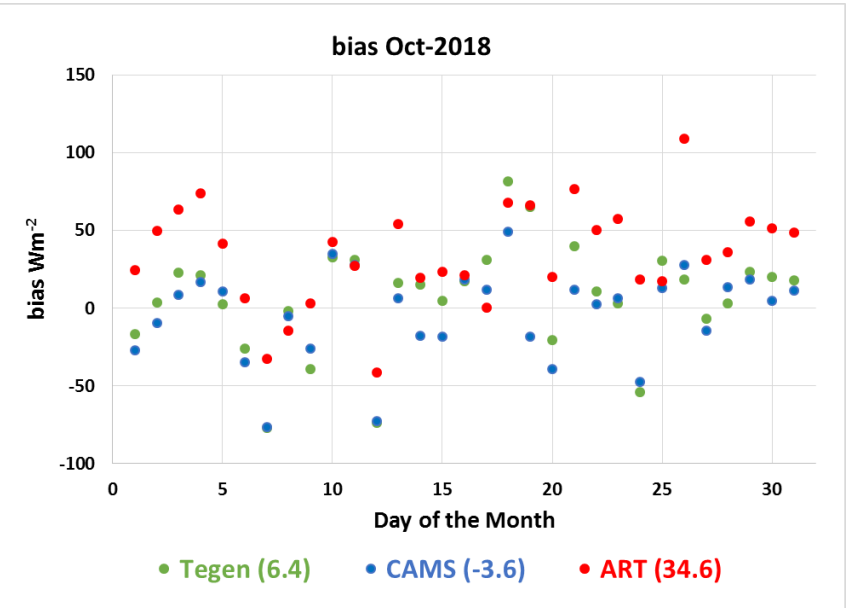


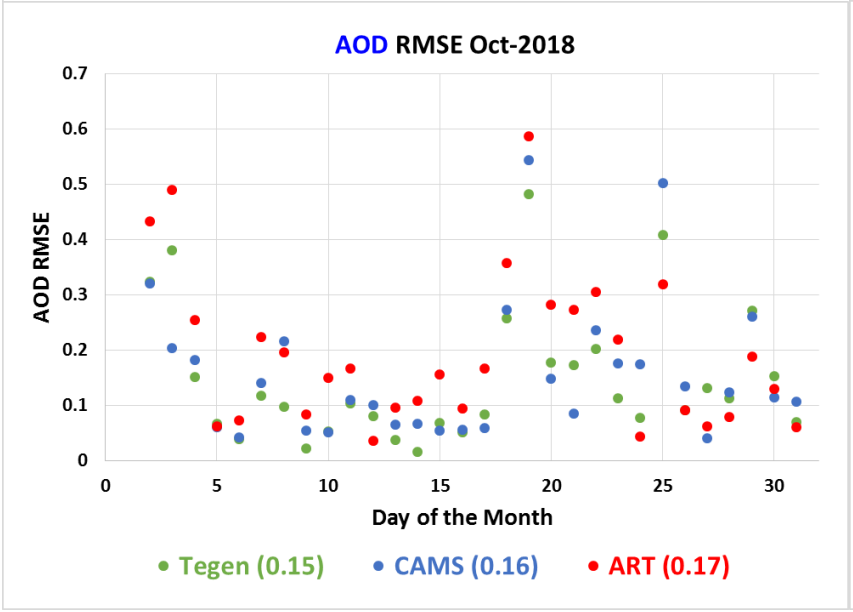


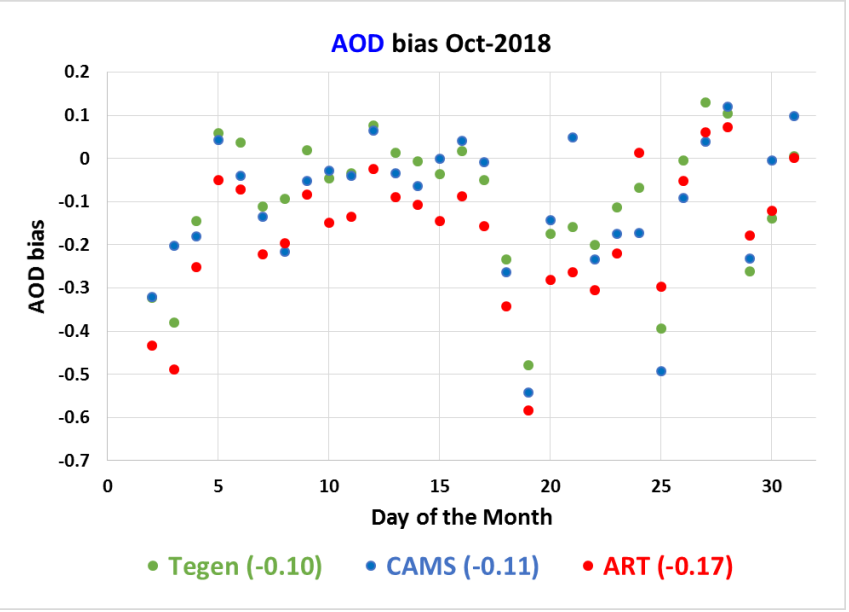


GR & AOD model vs. Observations Oct-2018

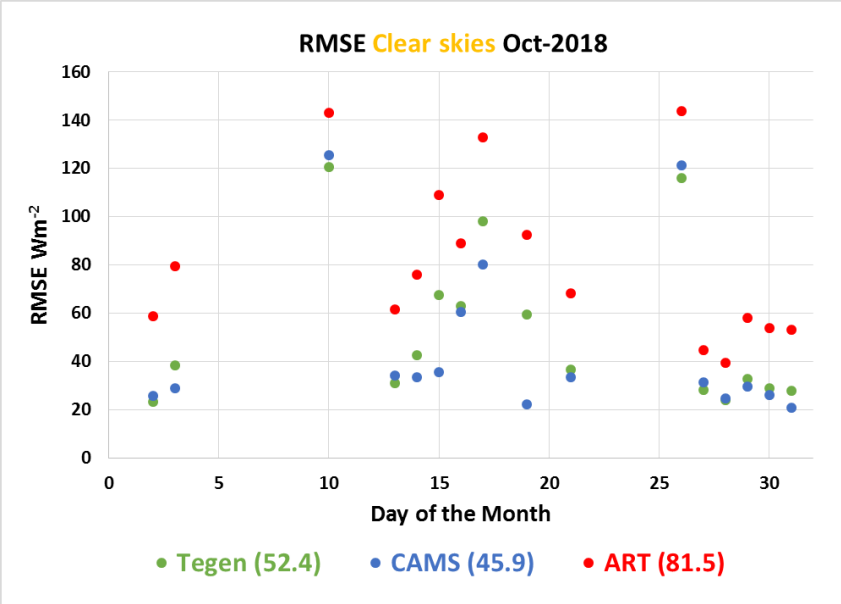


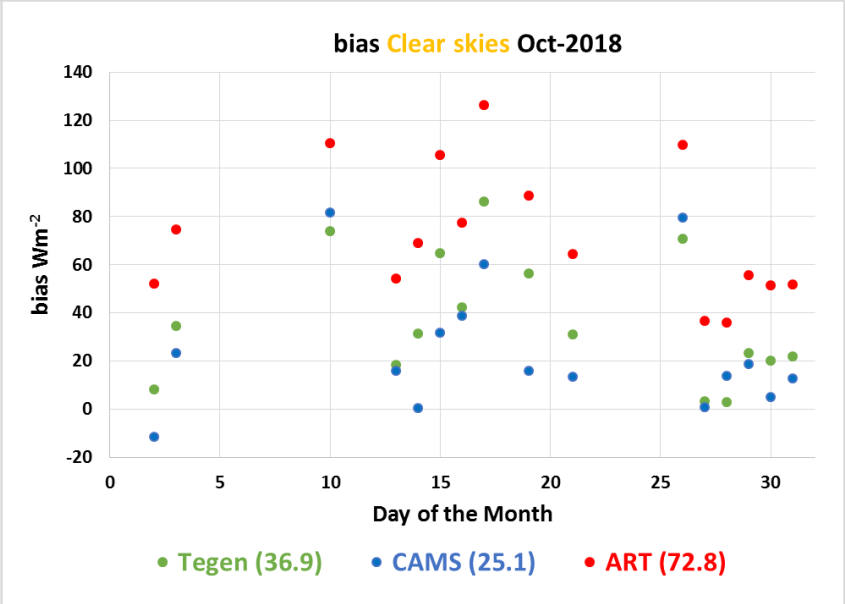


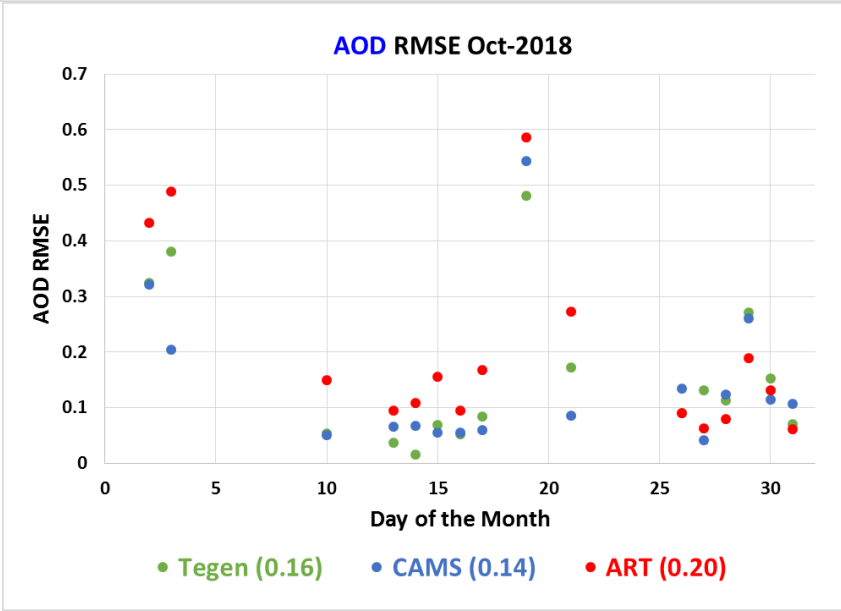


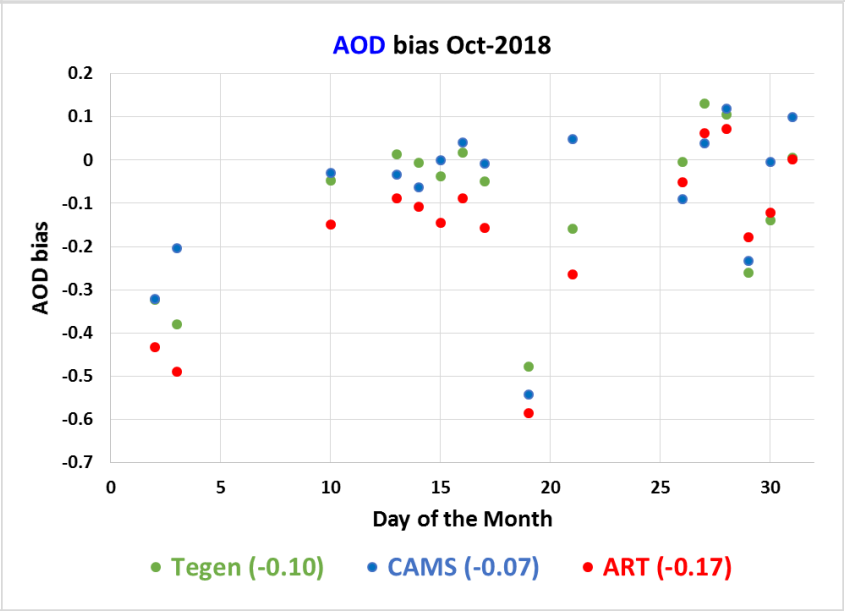


GR & AOD model vs. Observations Clear Skies Oct-2018

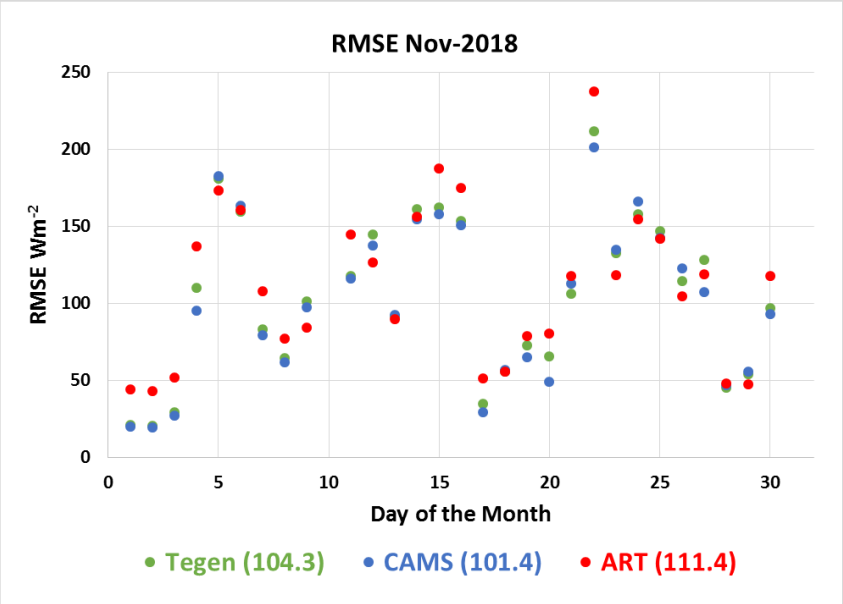


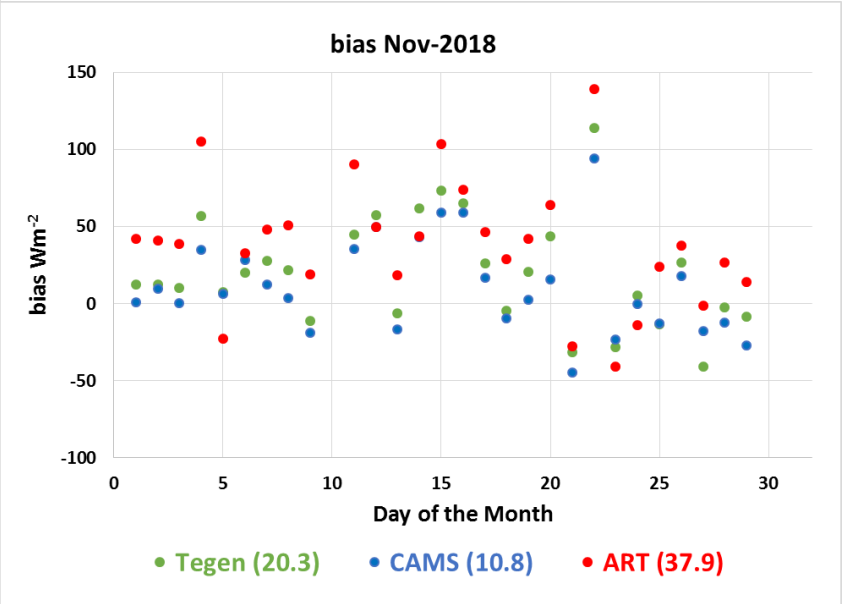


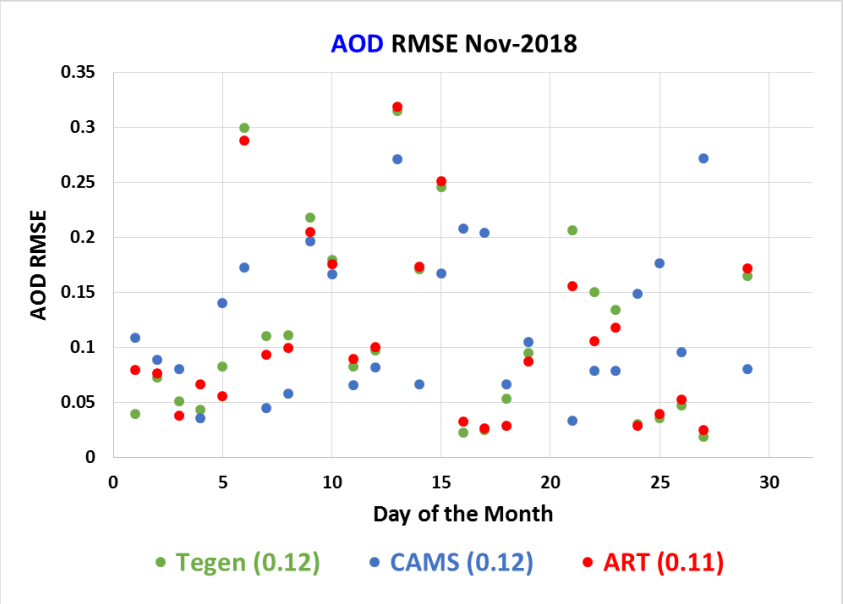


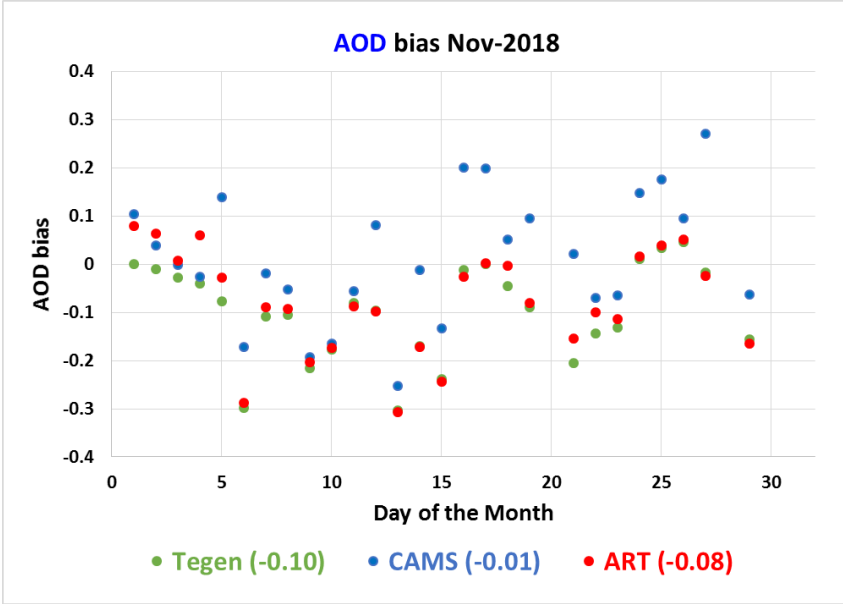


GR & AOD model vs. Observations Nov-2018

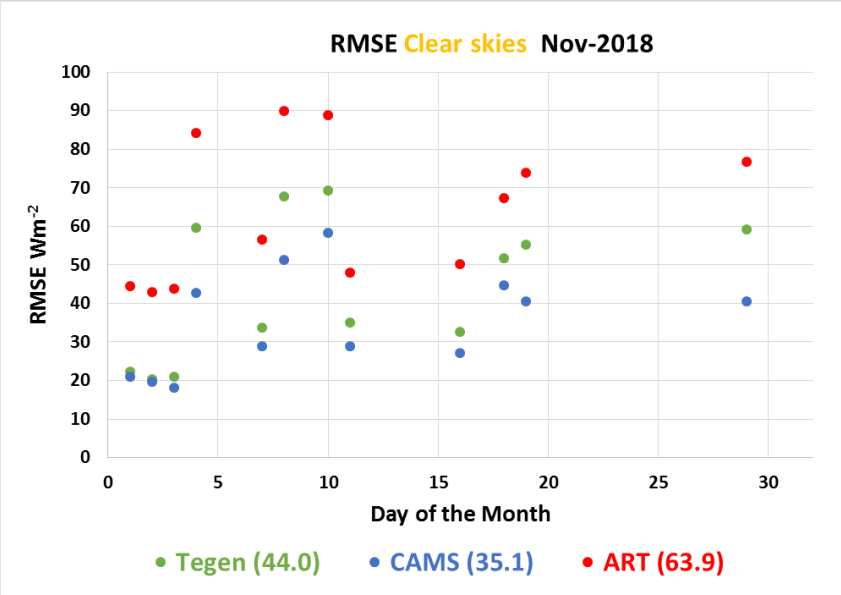


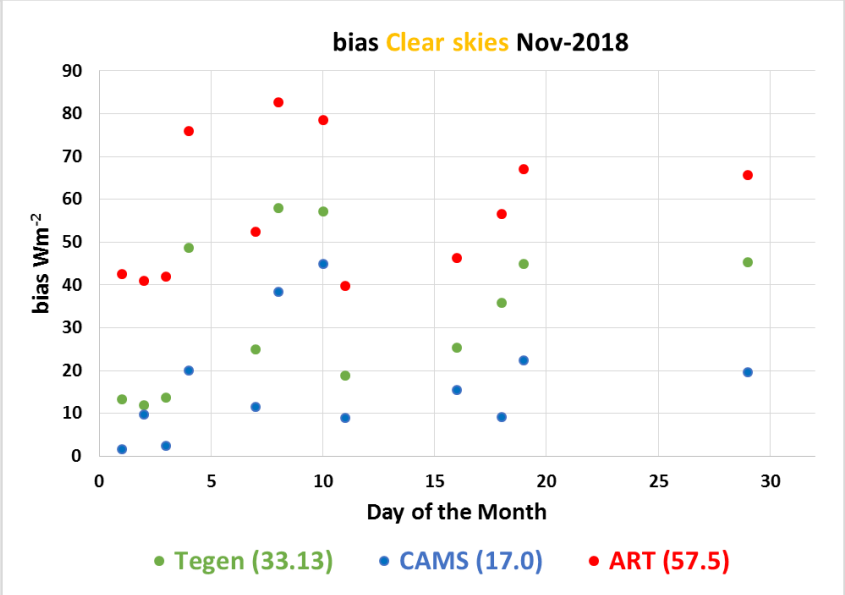


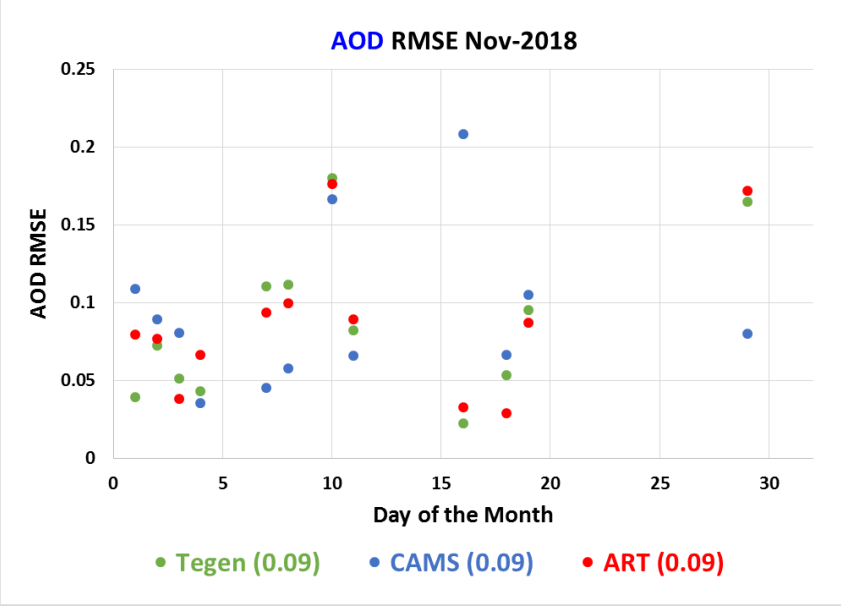


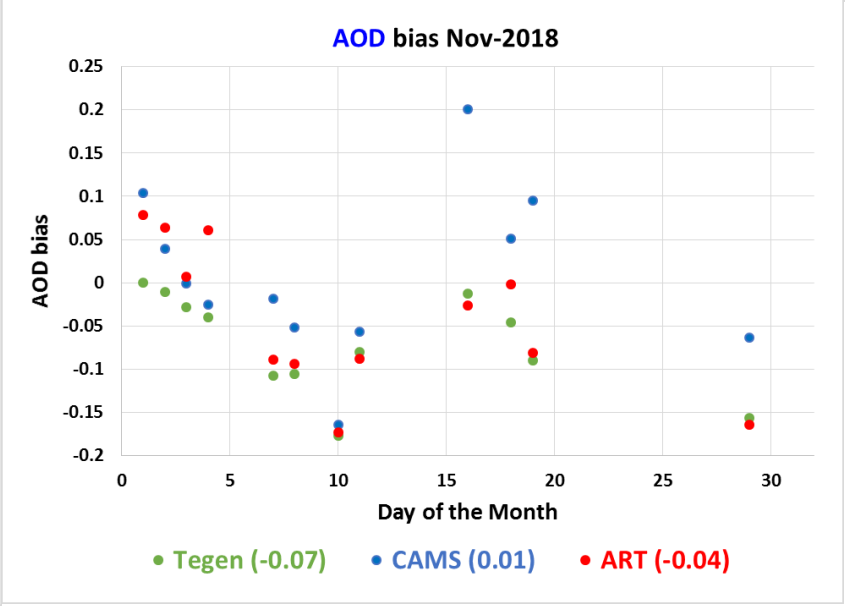


GR & AOD model vs. Observations Clear Skies Nov-2018

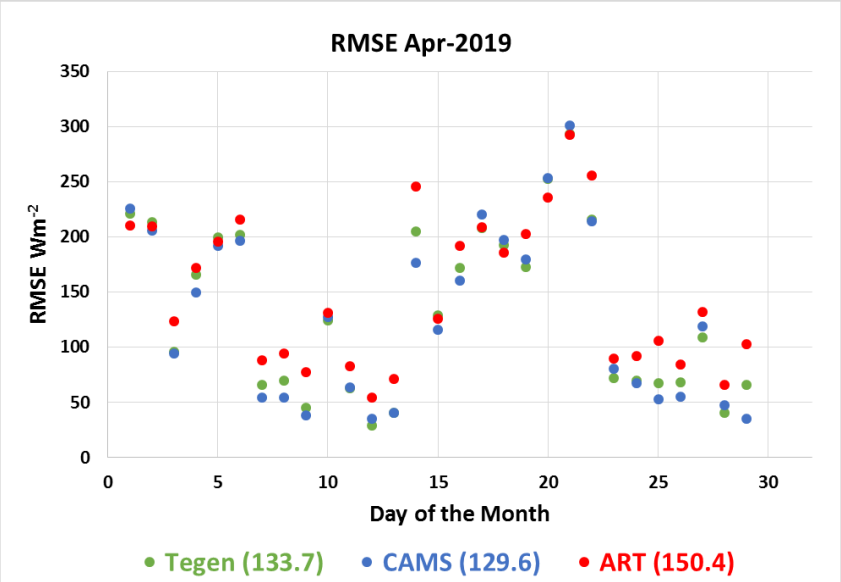


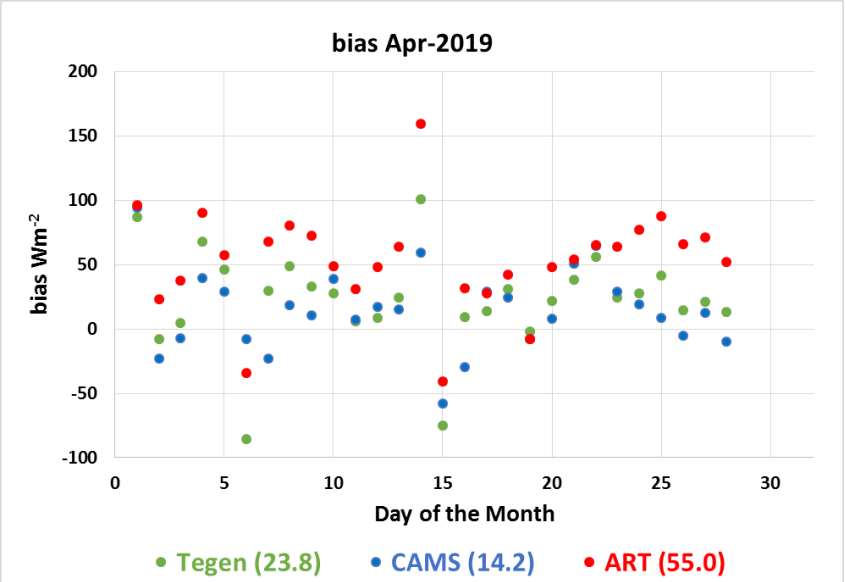


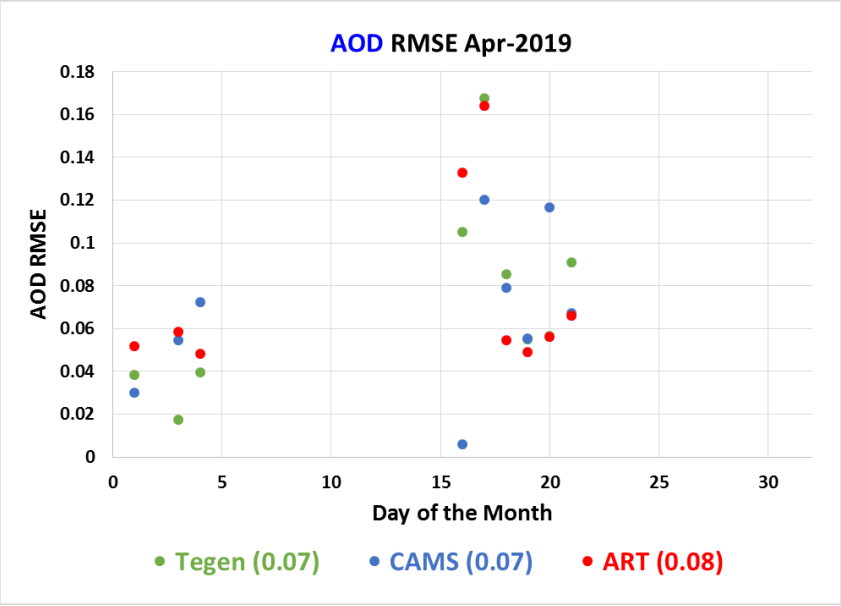


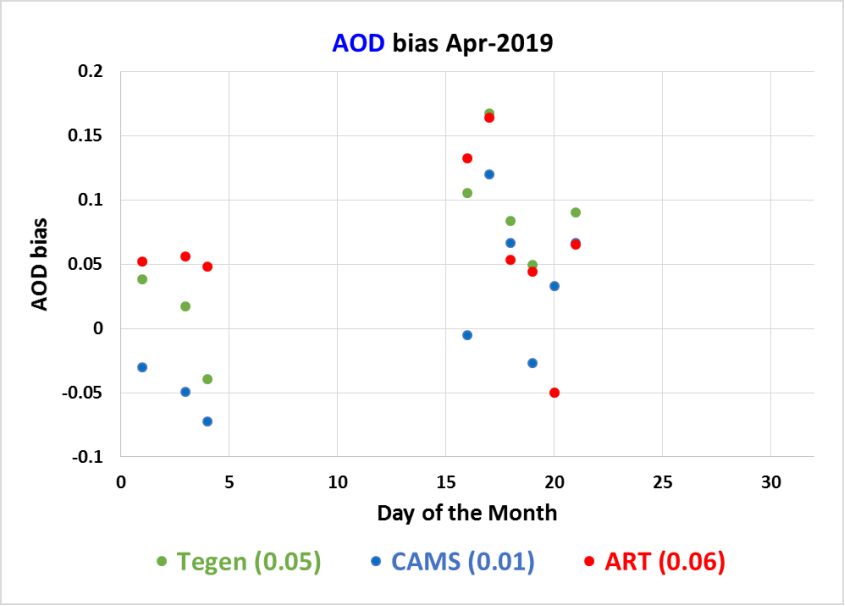


GR & AOD model vs. Observations Apr-2019

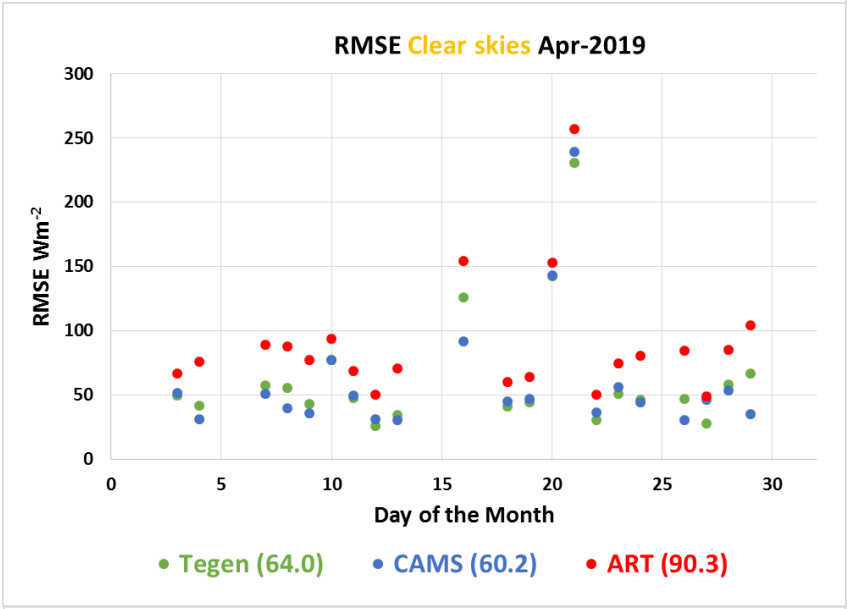


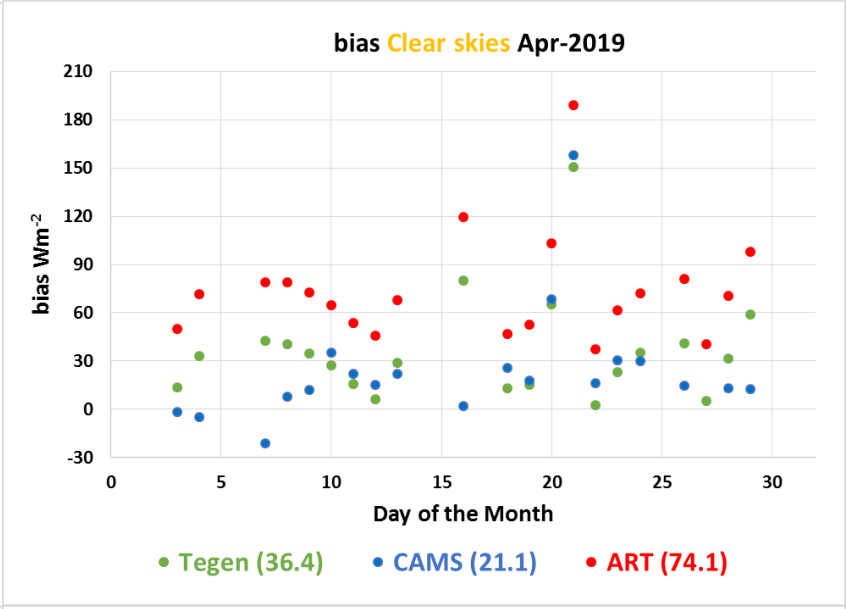


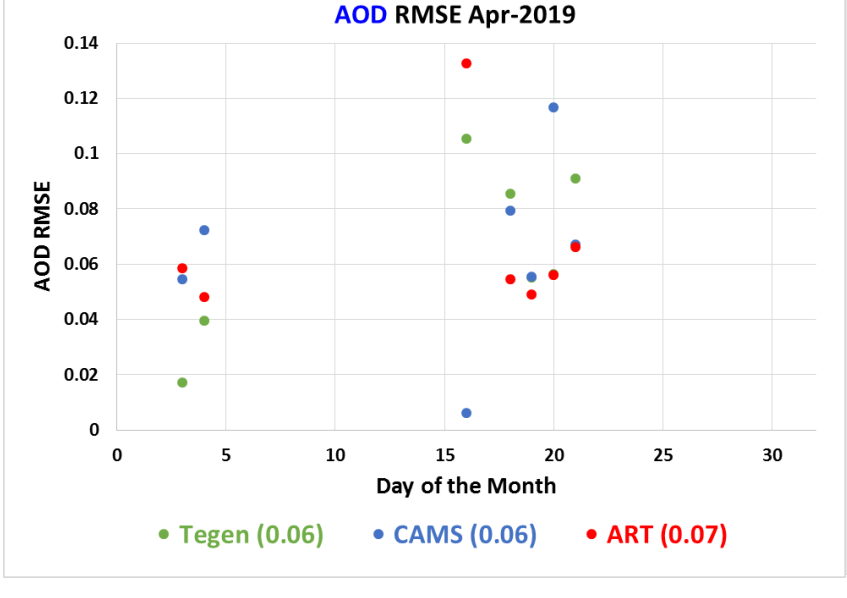


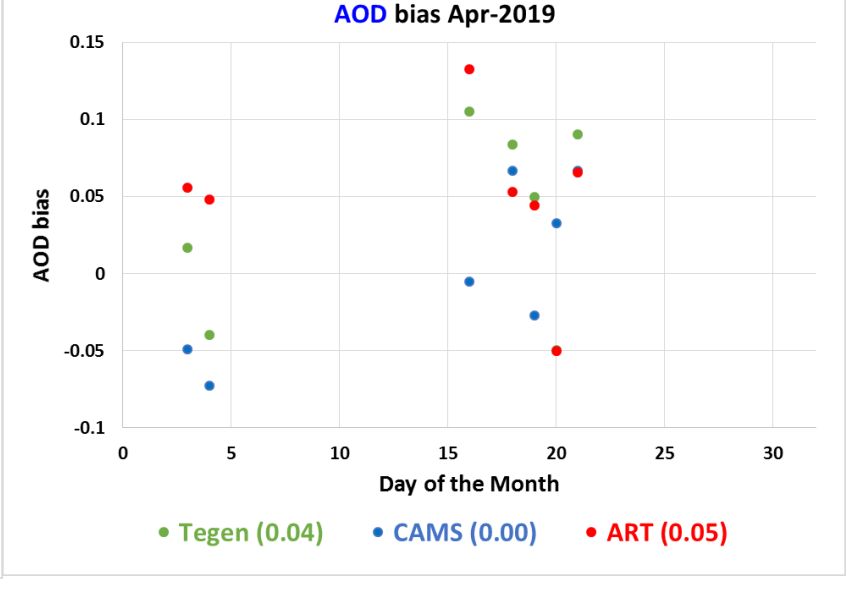


GR & AOD model vs. Observations Clear Skies Apr-2019

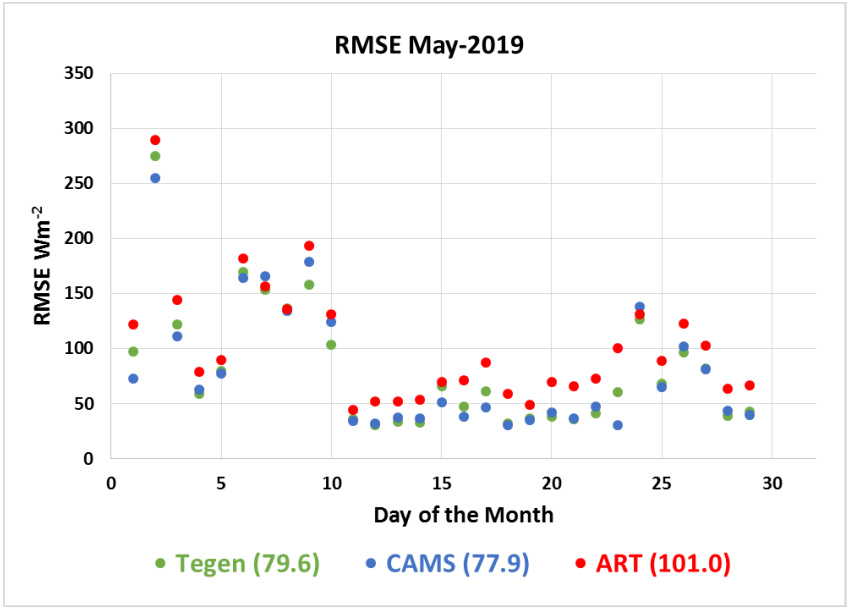


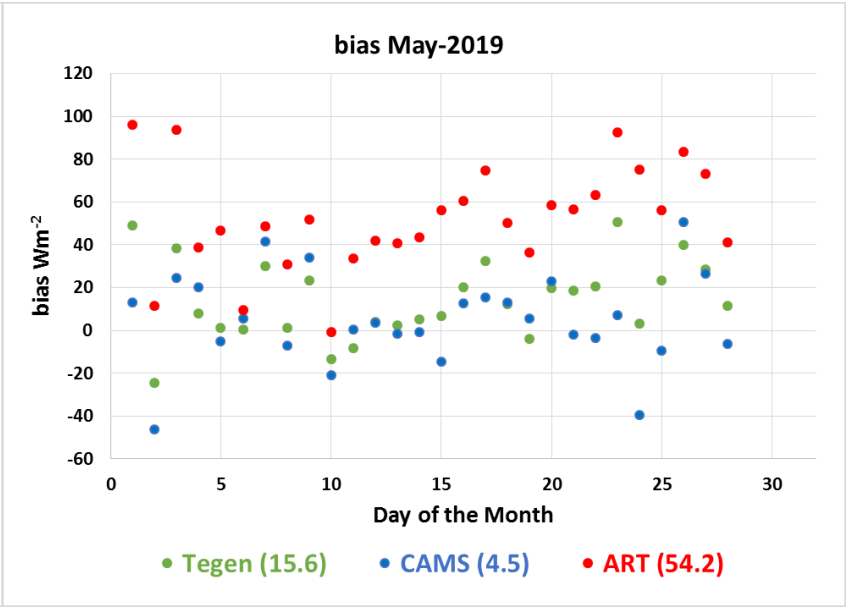


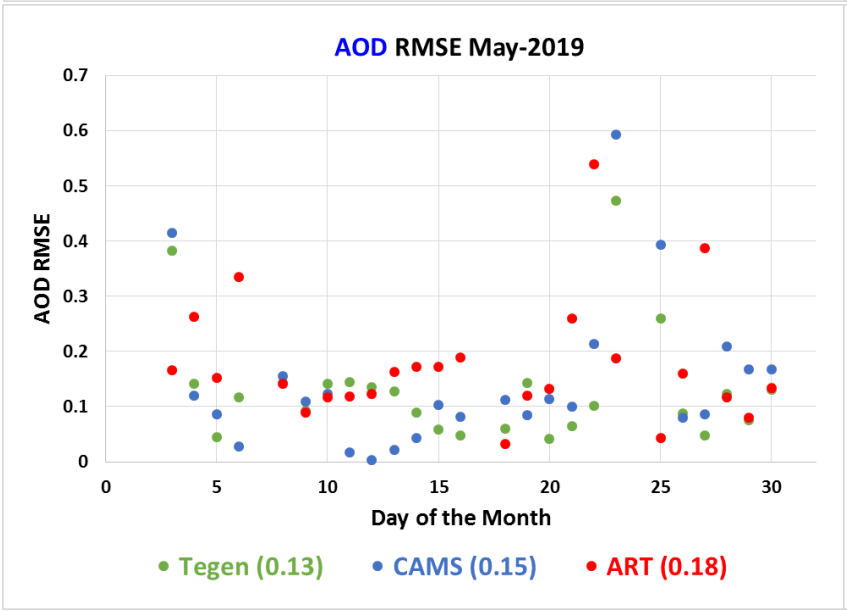


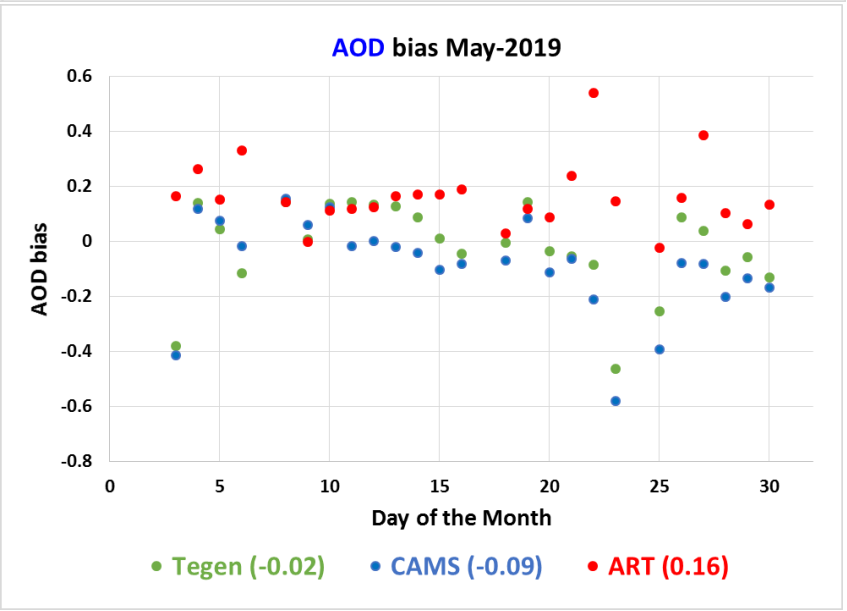


GR & AOD model vs. Observations May-2019

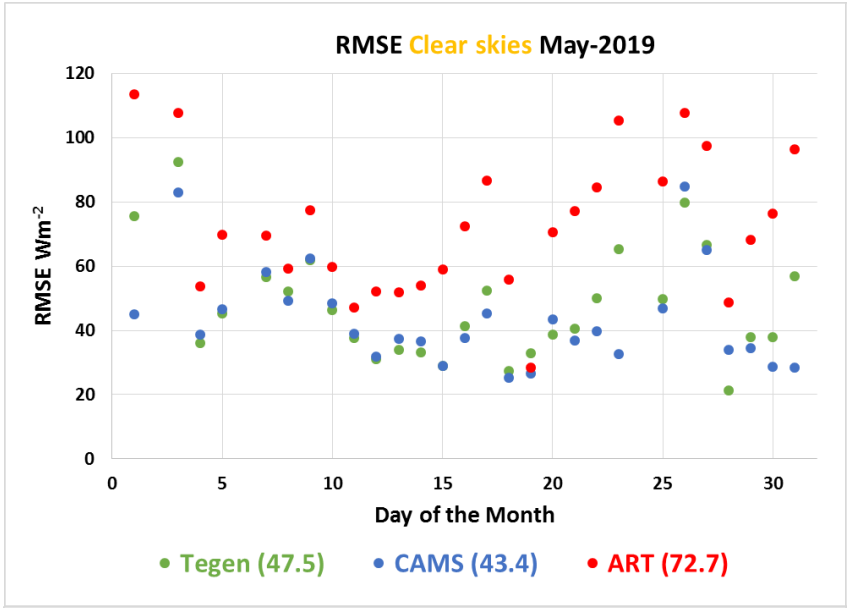


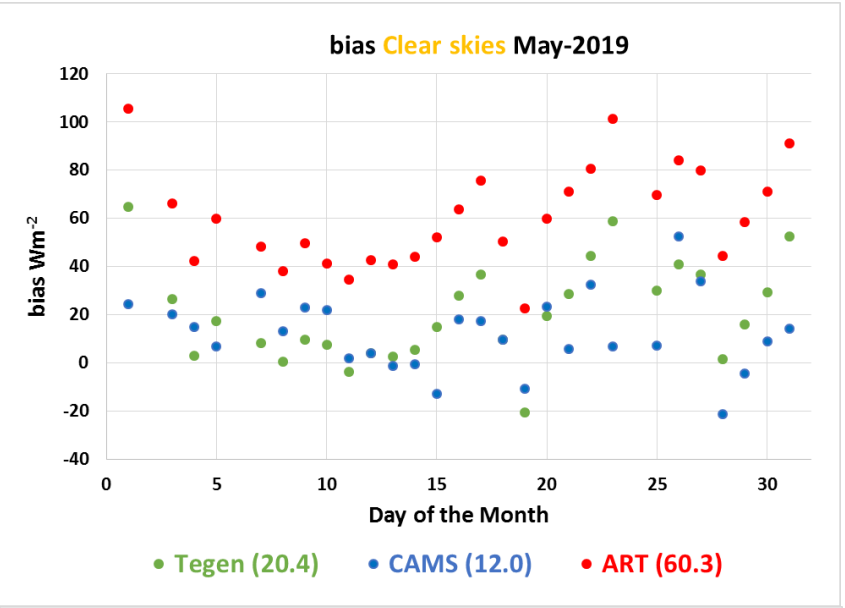


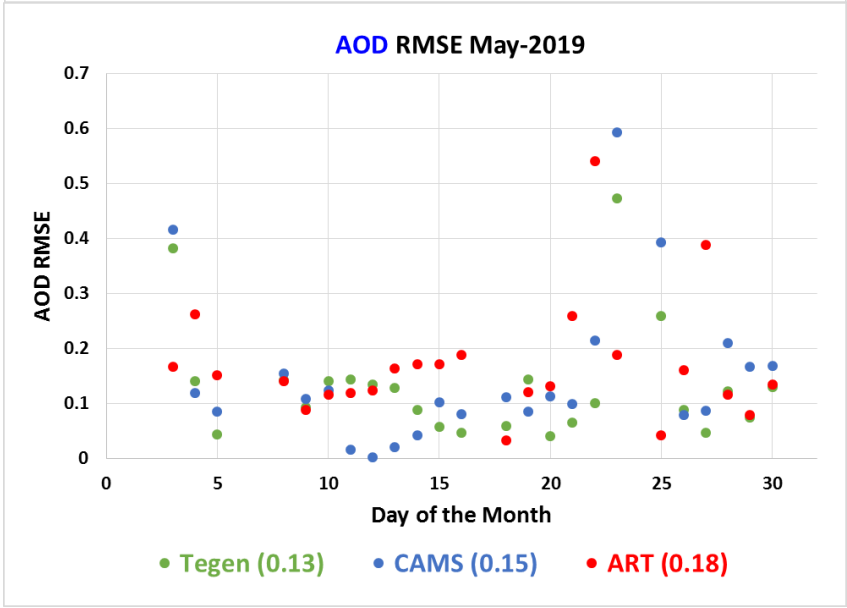


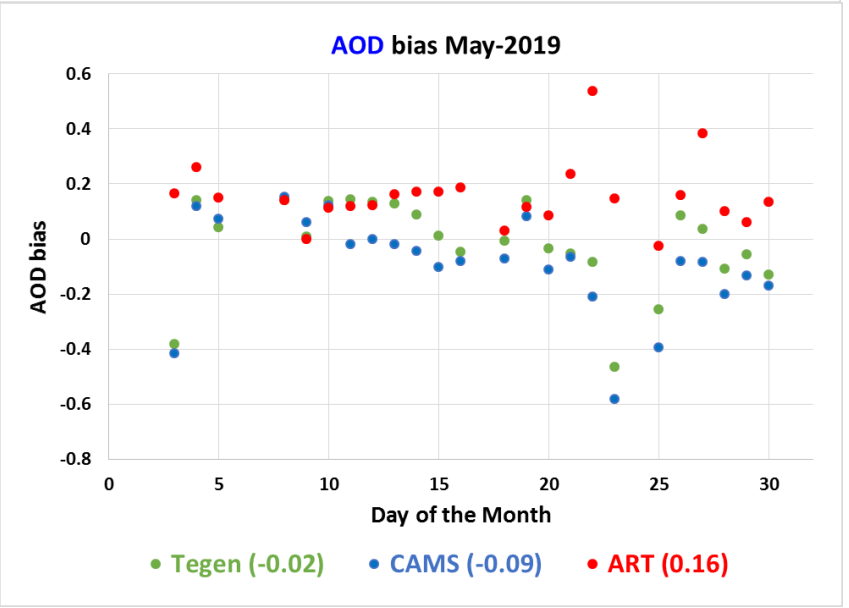


GR & AOD model vs. Observations Clear Skies May-2019









Concluding Remarks

- CAMS forecast has the best scores (AOD + radiation) for all months in the experiment. Usually ~10-15 Wm^{-2} better than Tegen.
- Tegen climatology has mixed average biases but with fixed positive radiation bias. Performs reasonably in “regular” situations.
- ICON-ART-dust – has negative AOD bias (underestimation of dust) which leads to positive radiation biases (few tens of Wm^{-2})
  Do you see this underestimation in other areas?
- Radiation overestimation is apparent even for positive ICON-ART AOD estimation. Investigation needed (bug? Optics? dynamics?)
- Feasible in ICON RRTM?