NWCSAF CDOP3 Users' Workshop 2020

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Exploiting of NWCGEO CT and EXIM packages for irradiation estimation: analysis and validation

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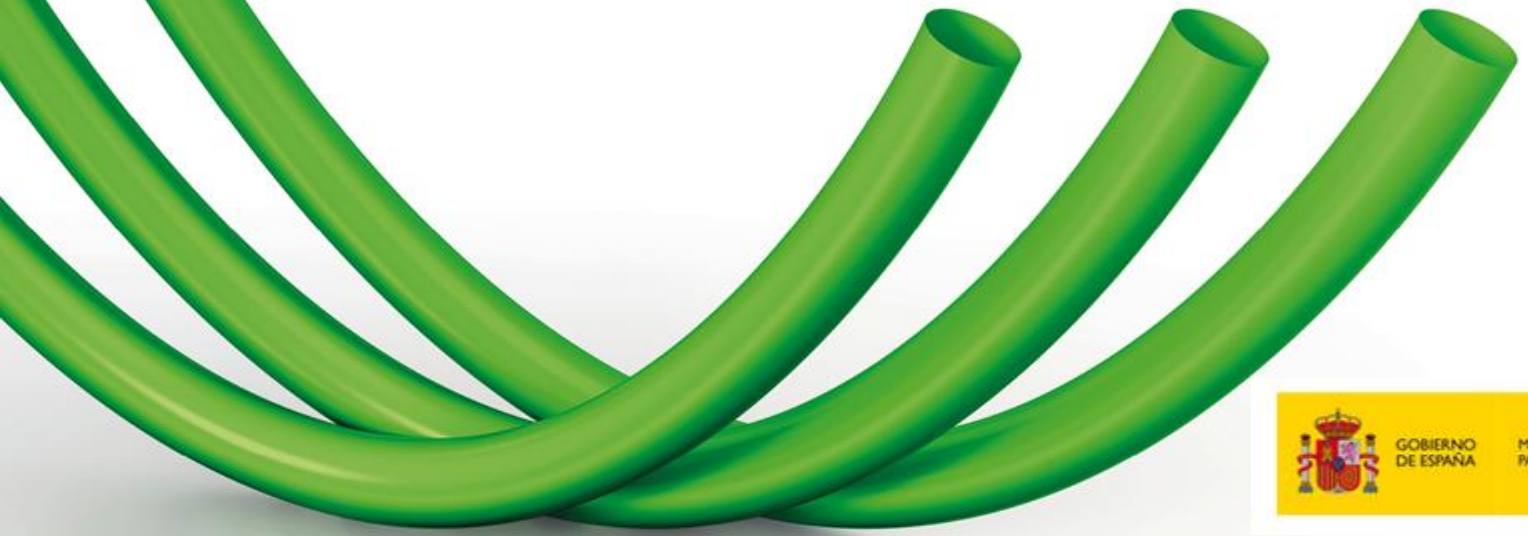

GOBIERNO DE ESPAÑA MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA

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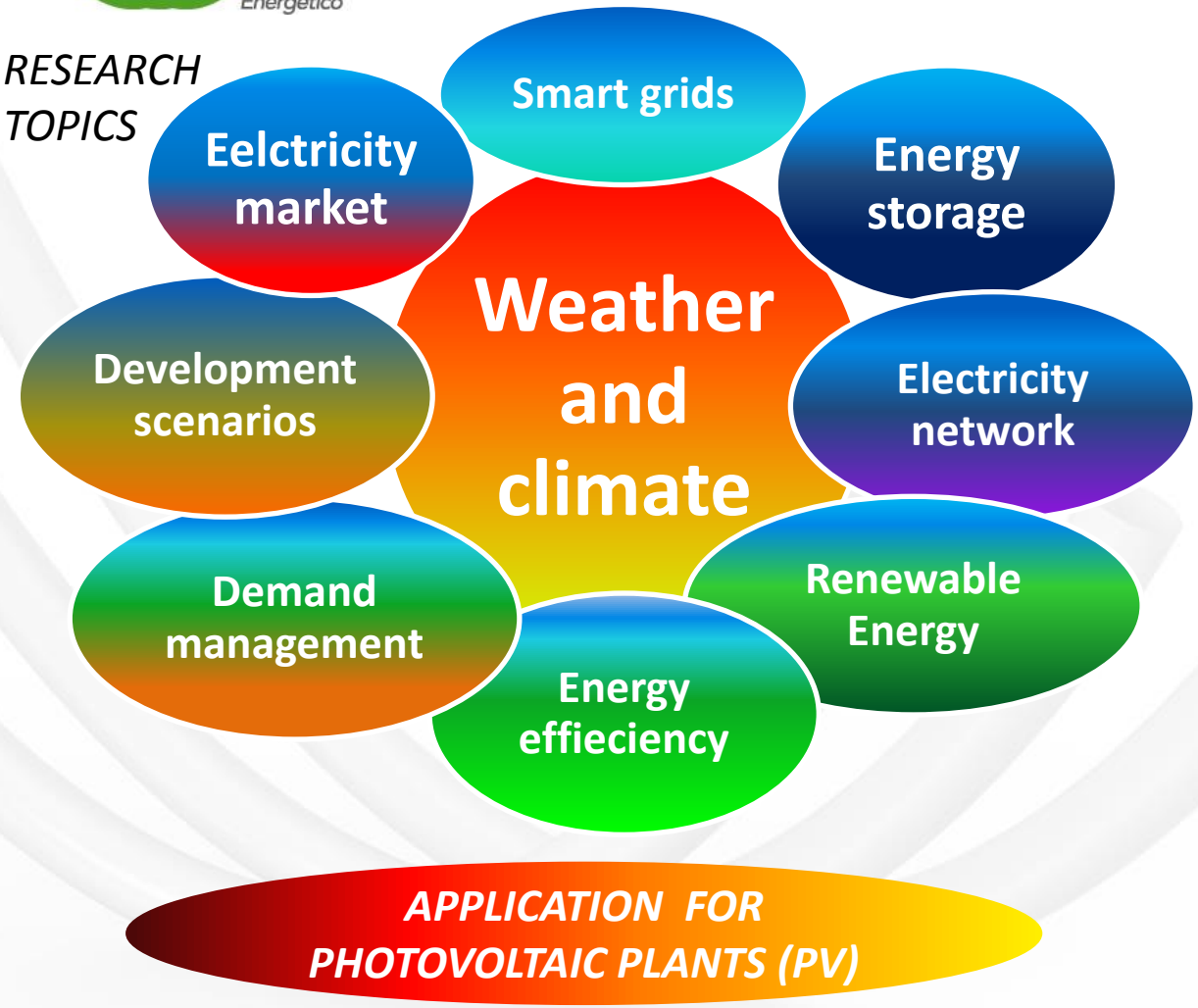
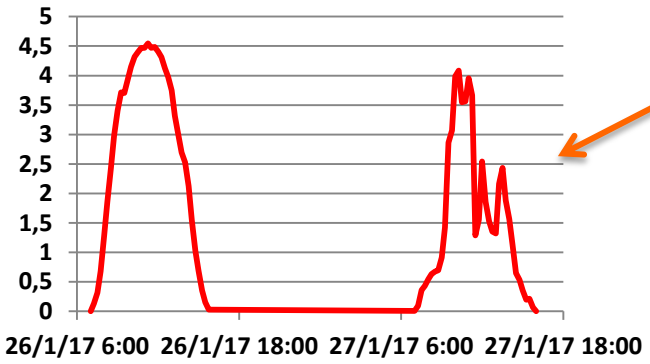
OUTLINE

- Introduction
- Global Horizontal Irradiation (GHI) with SAFGEO CT
- GHI nowcasting with SAFGEO EXIM-CT
- Comments

research institute on energy system
Milan (Italy) 350 employes

RESEARCH TOPICS

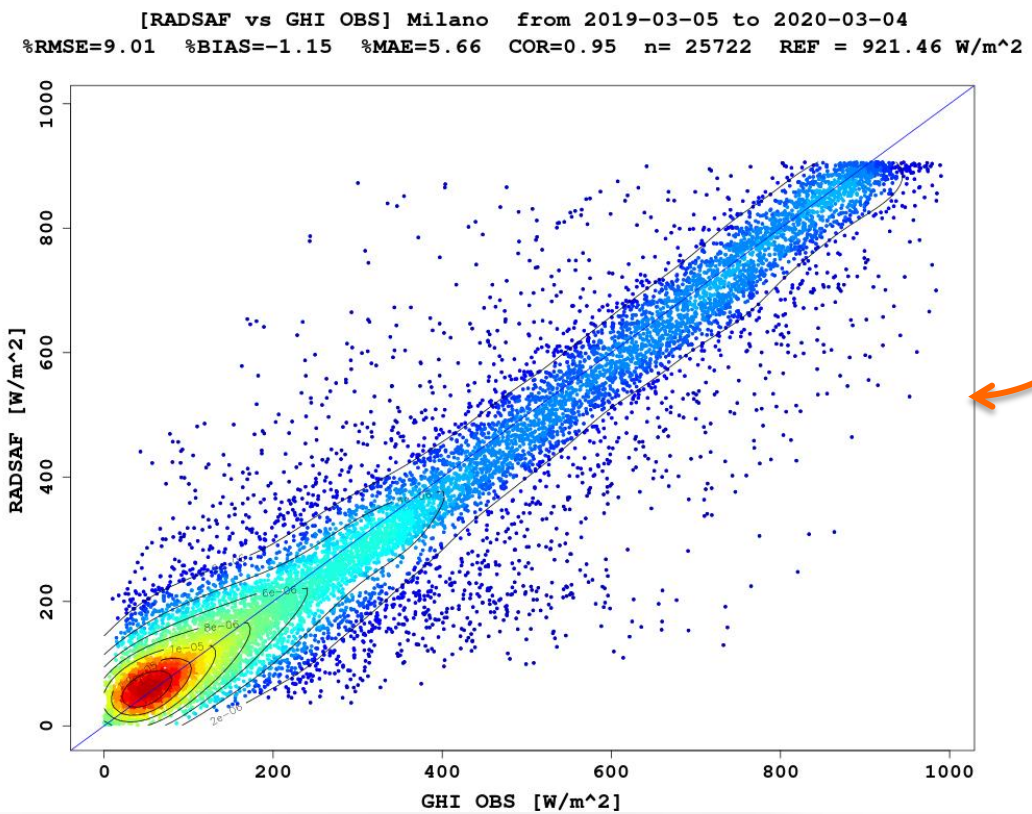


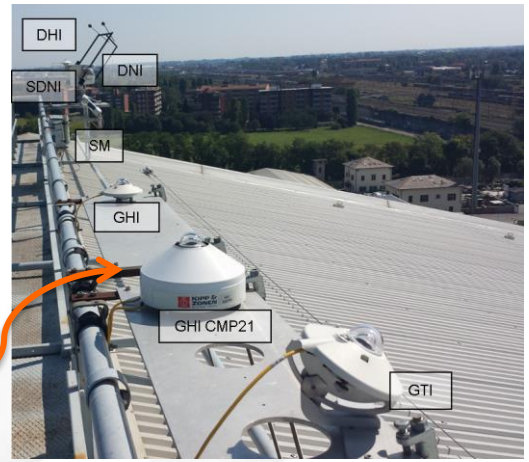


- **High variability in PV production** due to rapid variations of the global horizontal irradiation (GHI)
- Exploitation of **CT, HRW and EXIM - CT** packages for Global Horizontal Irradiation estimation
- Valuable information in absence of ground based mesurements
- Support to PV production management

GHI estimation with SAFGEO CT (RADSAF)

- GHI estimated by means of a 3° order polynomial regression based on **solar zenith angle (cosθ) and cloud type (CT)** $GHI = \sum_{i=1}^{3} a_{i,CT} * (\cos\theta)^i$ (RADSAF)
- Constantly monitor in Milan with a pyranometer Kipp & Zonen CMP21





- High correlation
- Accurate enough for PV applications
- General underestimation
- Improve the method (work in progress…)

- **CT useful for GHI estimation**
- **Is it possible to use EXIM-CT for GHI nowcasting?**

GHI nowcasting with EXIM – CT (NOWSAF):

Application of the polynomial to the cloud type forecasted by EXIM (up to 3 hours ahead)

OPERATIONAL SETTINGS

- SAFGEO v2016 **EXIM – CT**
- NWP data from GFS (run 00 UTC , run 12 UTC temporal resolution: 6 hours)
- HRW default configuration

- Nowcasting run every 15 minutes for the next three hours in Italy
- Verification for the year 2019 in Milan

ERRORS

- Mean Absolute Error: (normalized with the maximum GHI measured)

$$MAE = \frac{1}{N}\sum_{k=1}^{N}\left|GHI_k^{fore} - GHI_k^{obse}\right|$$

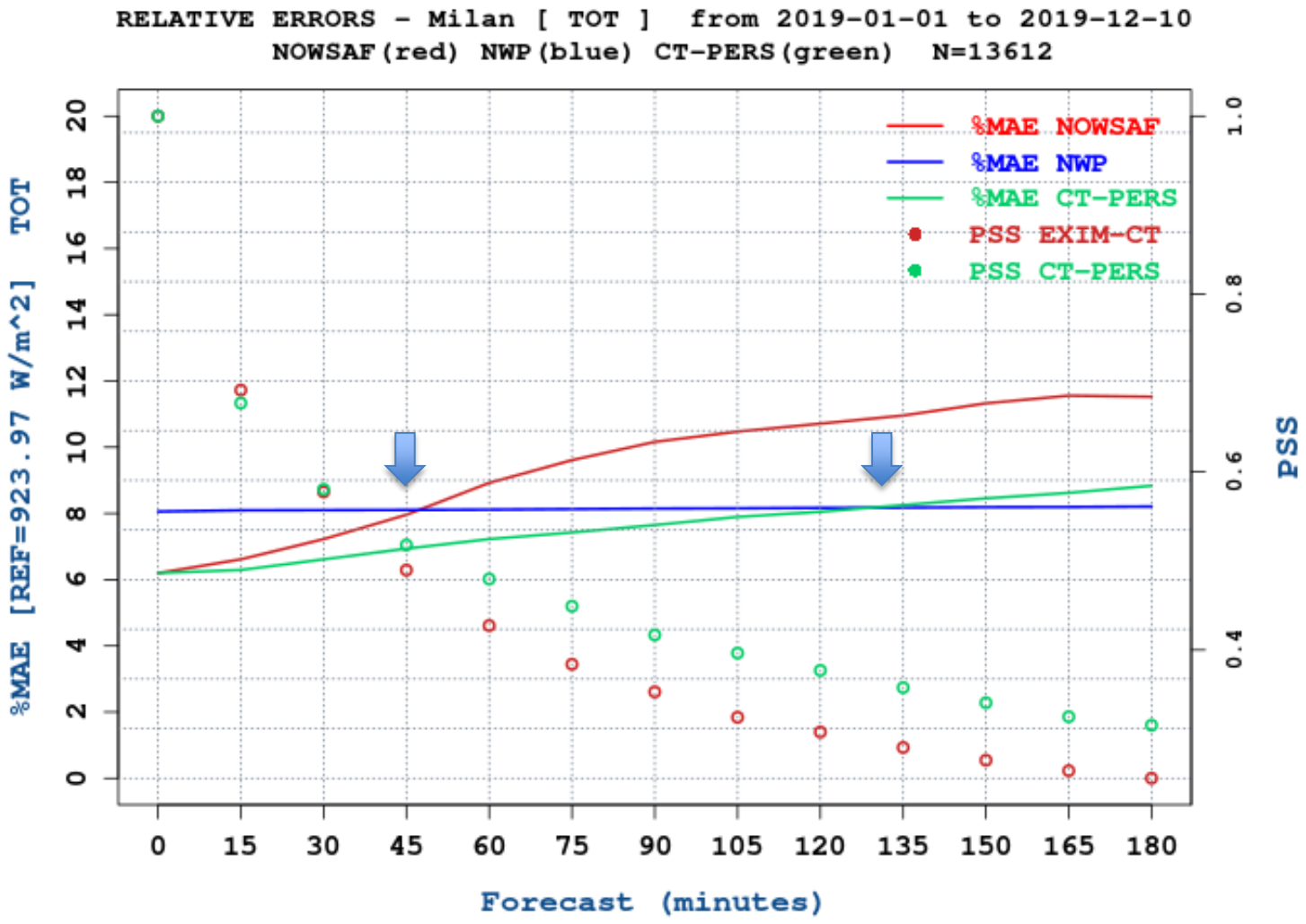
- Pierce Skill Score for cloudiness

PSS = Hit rate – False Rate

Comparison with:

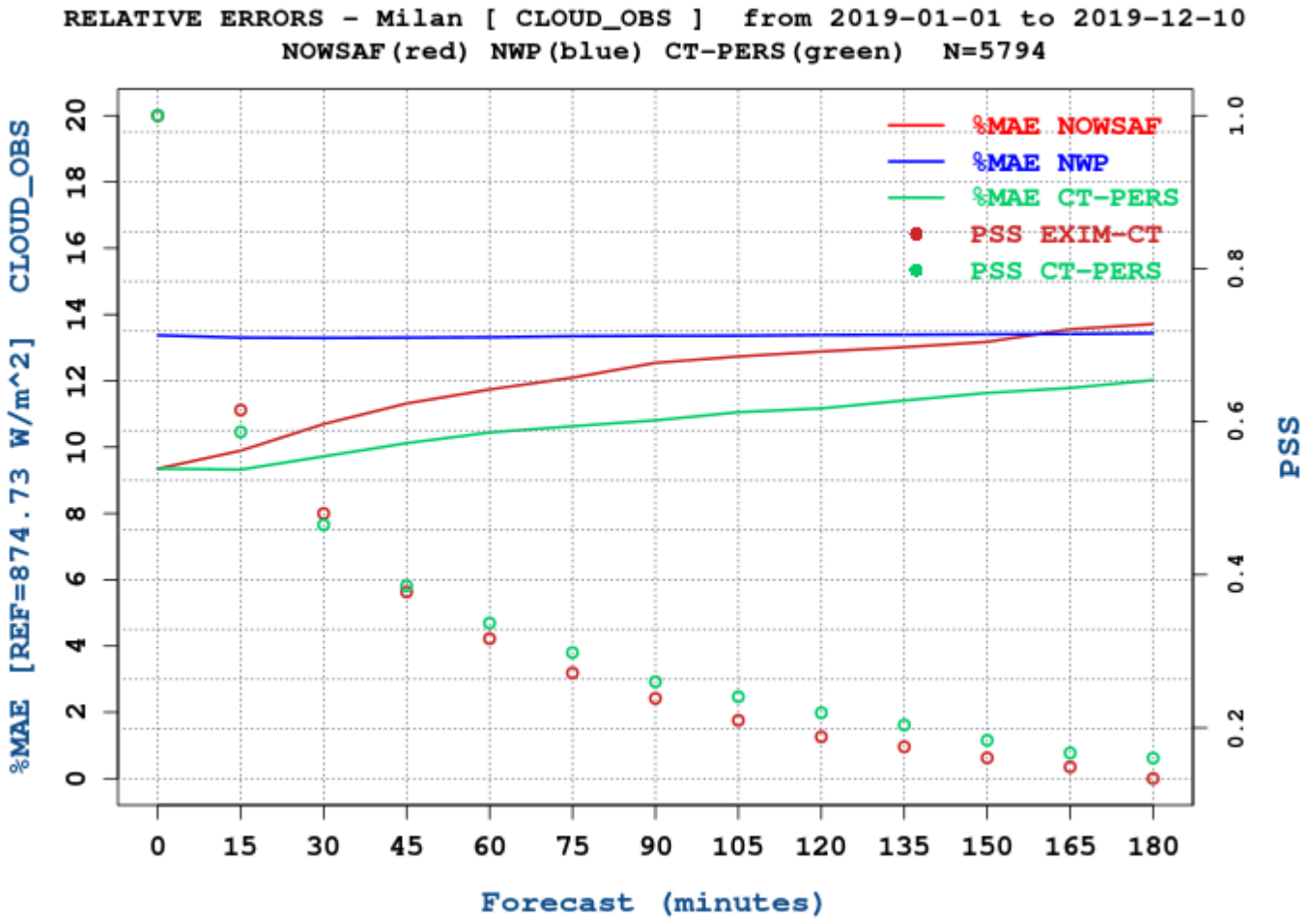
- **GHI from NWP forecast (multimodel)**
- GHI from CT persistence (polynomial applied to the persistence of cloudiness)

GHI nowcasting with SAFGEO EXIM-CT (NOWSAF)



- Usefulness of NOWSAF up to 45 min
- Usefulness of CT persistence up to 2 hours
- Better PSS for CT persistence after 30 minutes

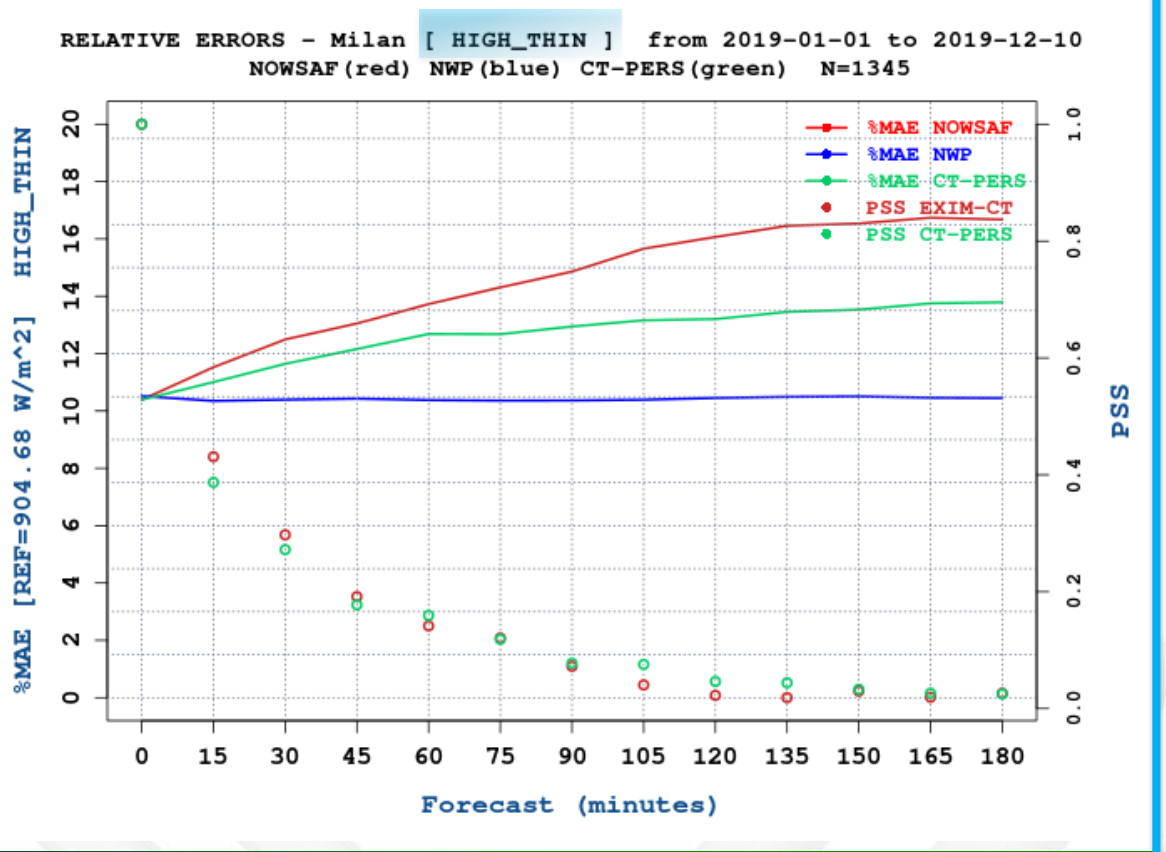
Cloudy conditions at the forecast time according to SAFGEO



CLOUDY CONDITIONS:

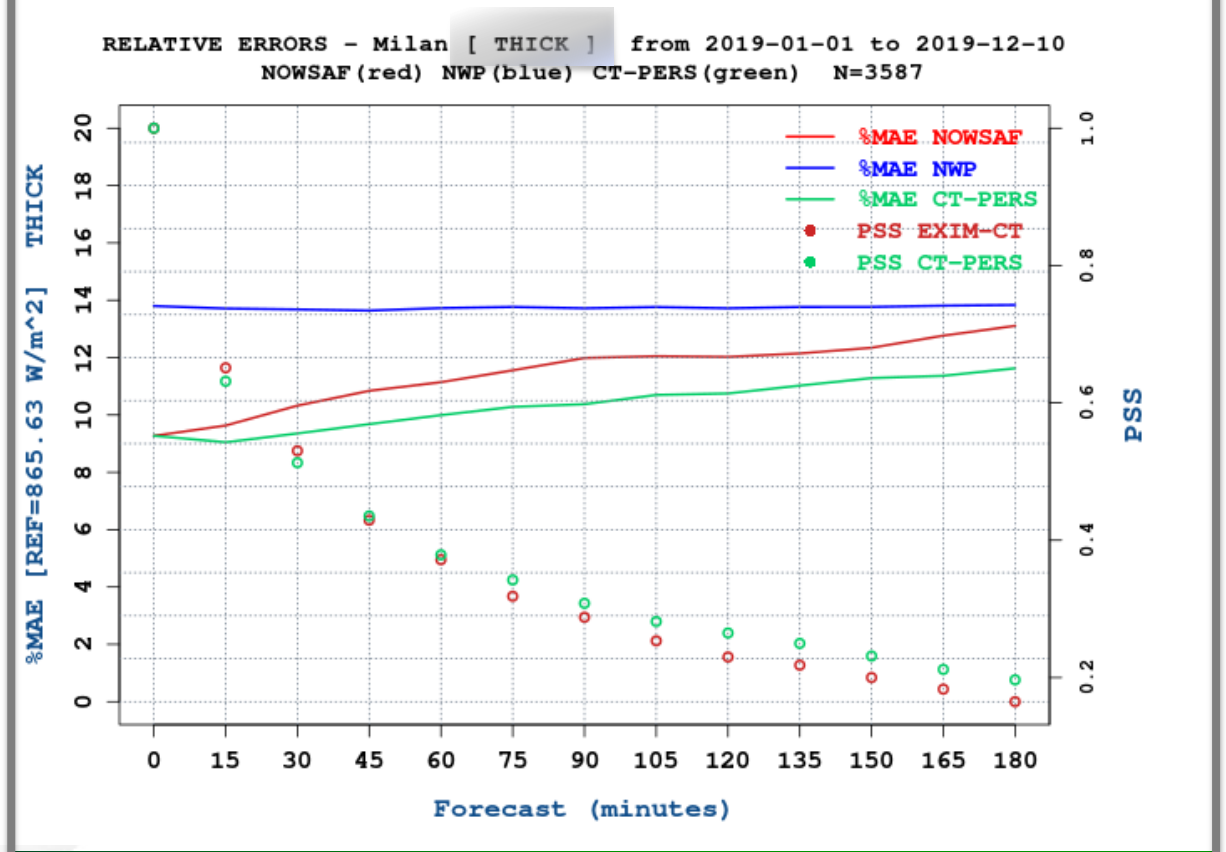
- GHI from satellite outperforms GHI from NWP for each time-frame
- Similar Pierce Skill Score of EXIM-CT and CT-PERS, but different performances in GHI forecasting

GHI nowcasting with SAFGEO EXIM-CT



HIGH_THIN CLOUDS:

- GHI from satellite **worse** than GHI from NWP
- Similar PSS of EXIM-CT and CT-PERS, but different performances of GHI forecasting



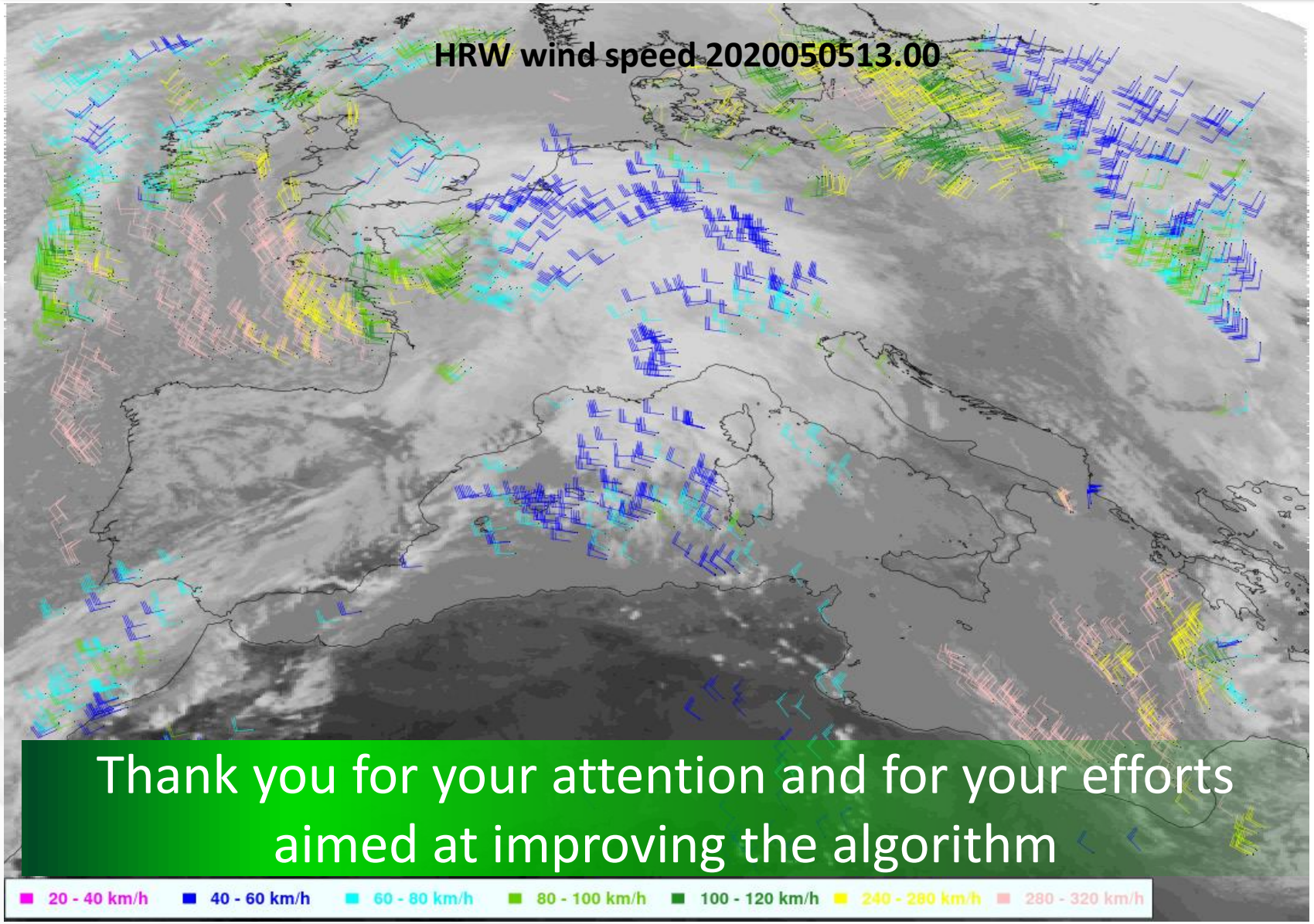
THICK CLOUDS:

- GHI from satellite **better** than GHI from NWP
- Similar PSS of EXIM-CT and CT-PERS, but different performances of GHI forecasting

COMMENTS

- Benefit using CT package for GHI estimation
- Better performance of the GHI nowcasting with CT persistence compared to EXIM-CT
- Different performances of EXIM-CT varying cloudiness conditions
- Effects of using GFS every 6 hours instead of IFS-ECMWF every 3 hours?
- SAFGEO Version 2016 versus Version 2018?
- Processing Time

Acknowledgemnts



Thank you for your attention and for your efforts aimed at improving the algorithm

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