Site characterization activities at La Palma

- Molecular profiles
- Aerosol profiles
- Weather data
- All-Sky-Camera
- Further wind studies
- Further rain/humidity studies

Molecular profile

Has effects on size of Cherenkov light pool (via shower altitude and Cherenkov angle) and transmission of Cherenkov light.

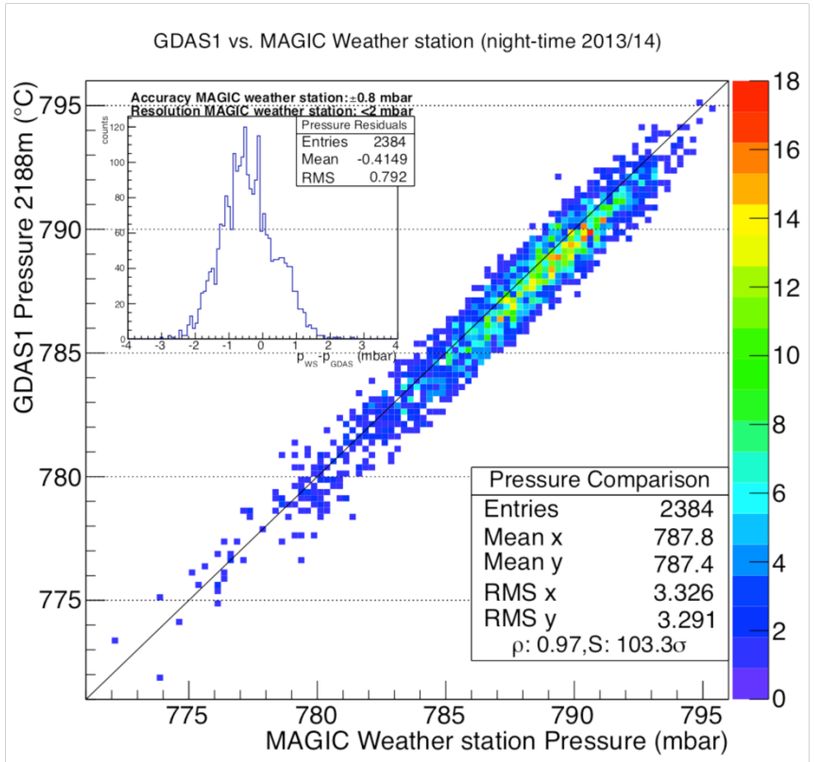
Both affect energy and effective area reconstruction

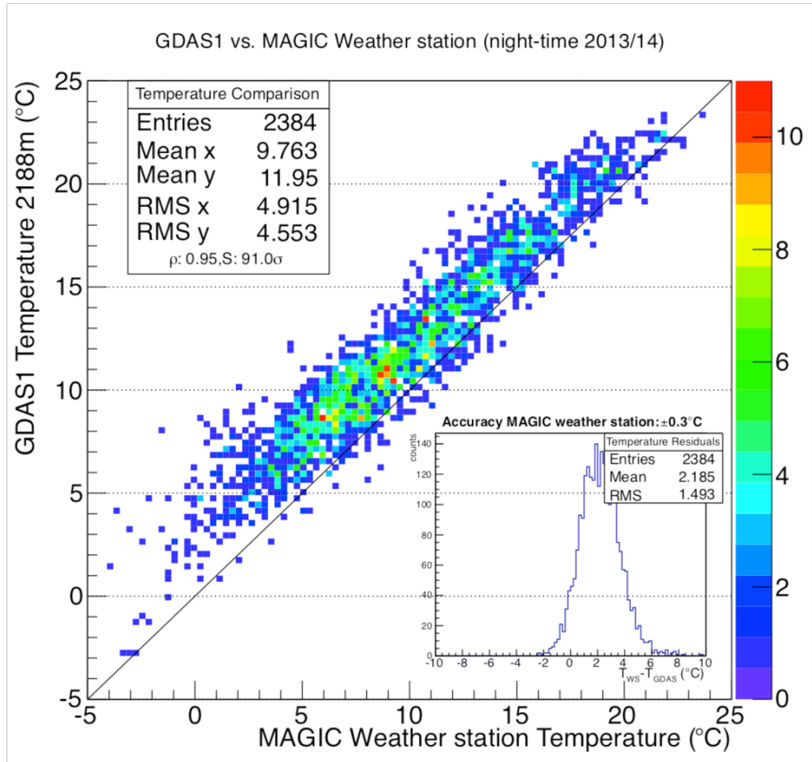
- E_{rec} scales directly with optical transmission, i.e. integrated density from emission point to ground
- E_{rec} approximately with $\rho_c \approx (h_{med} - h_{obs})^{-2}$ Bernlöhr, Astrop. Phys. 12 (2000), 255)
- A_{eff} more complicated, needs simulations

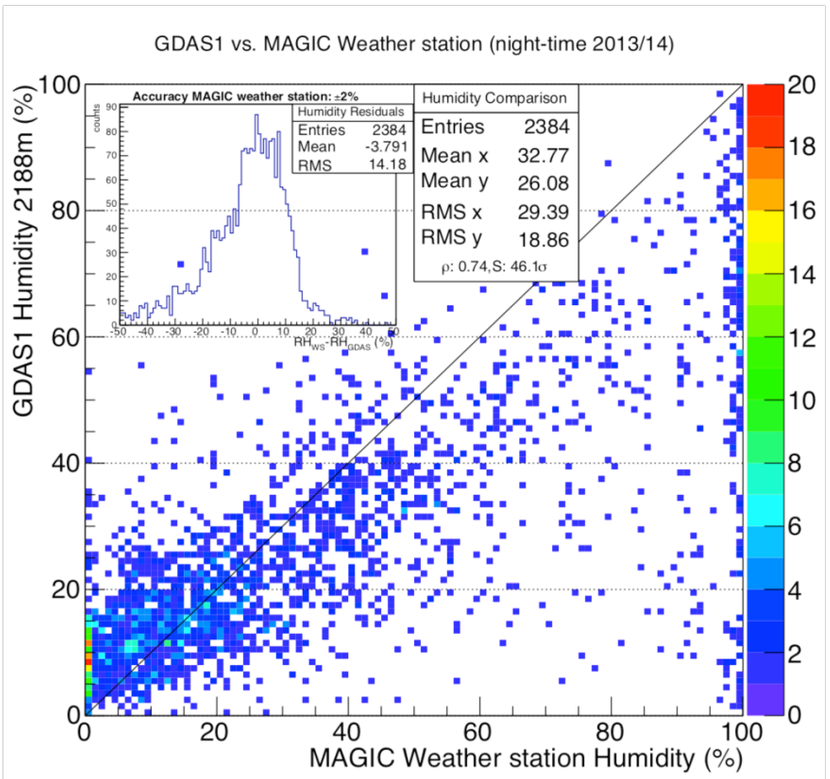
Have excellent Data Assimilation models for La Palma (for free):

- Global Data Assimilation System (GDAS) from ground to 25 km a.s.l.
- (ftp://arlftp.arlhq.noaa.gov/pub/archives/gdas1/)
- The NRLMSIS-00 model for 20 to 100 km a.s.l.
- (http://ccmc.gsfc.nasa.gov/modelweb/atmos/nrlmsise00.html)

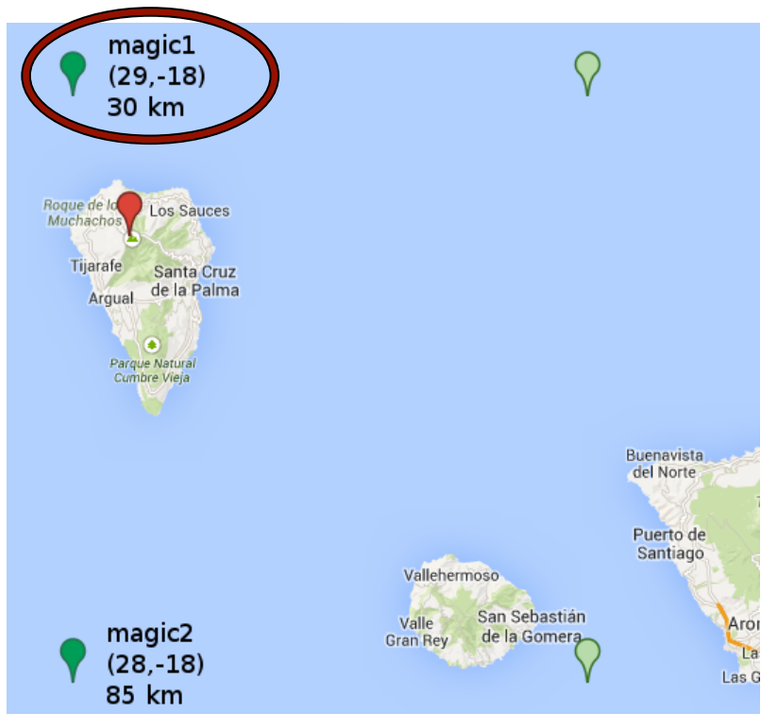
Molecular profile (GDAS and NRLMSISE-00)







- Perfect match for pressure comparison
- Systematic shift for temperatures can be explained by local ground effects (inverse for day-time data)
- Even correlation for humidity is good (difficult because of very local variation)



M. Gaug, Site characterization activities for La Palma, CTA consortium pre-meeting Liverpool, September 14th, 2015

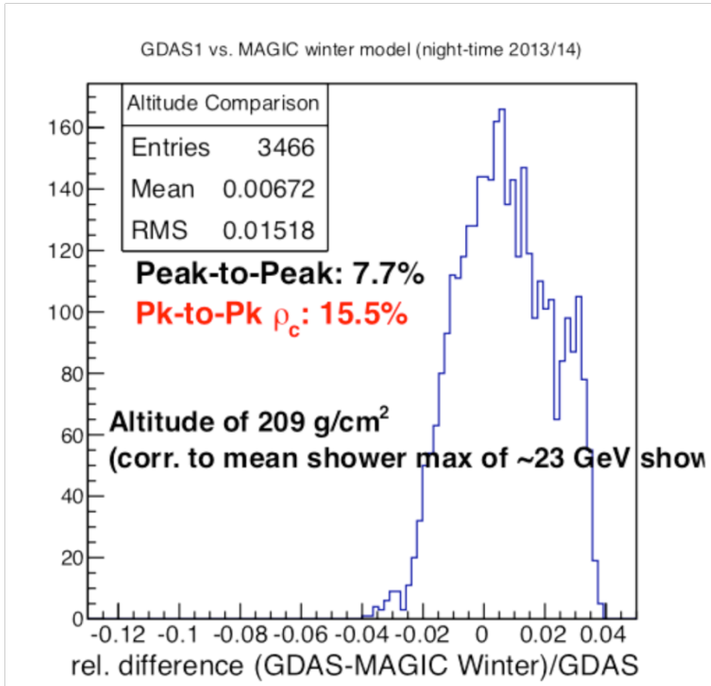
Molecular profile (GDAS and NRLMSISE-00)

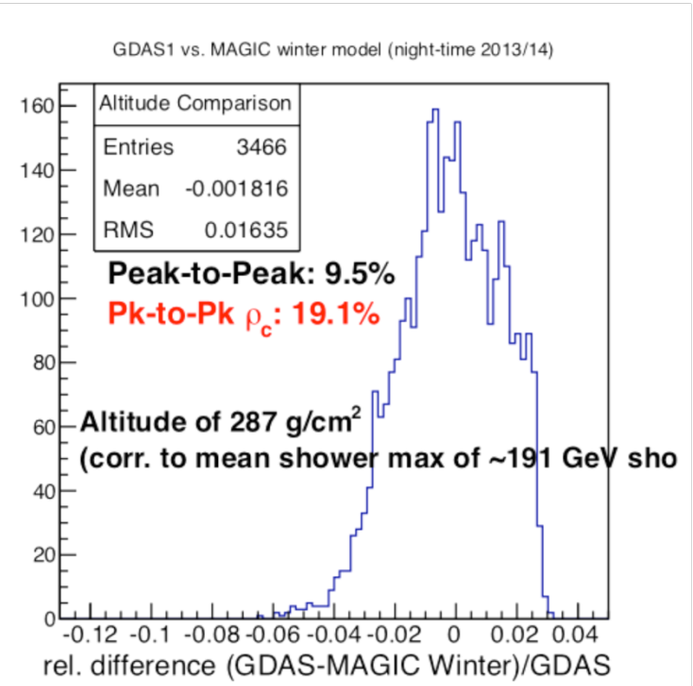
- RMS variations of ρ_c range from 3%-4% (dep. on energy)
- Peak-to-Peak variations can go up to 28% (!) for the highest energies

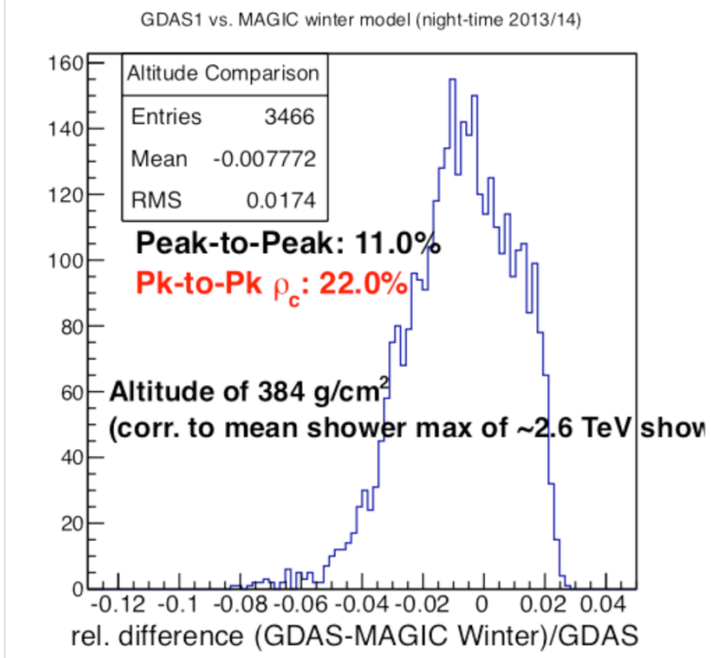
- RMS variations of molecular light extinction range from 1%-2% (dep. on energy),
- Peak-to-Peak from 7% to 12%

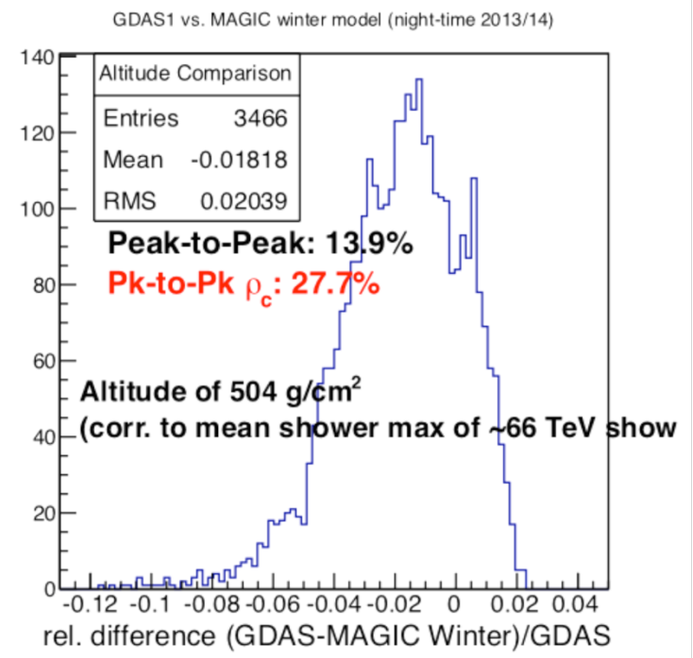
- The INFN Torino (Piero Vallania, Ciro Bigongiari, Carlo Vigorito, Biancha Dinelli) is currently running simulations with these profiles.

- Automated macros and scripts can serve also as blue-print for South (but need to be cross-validated first).

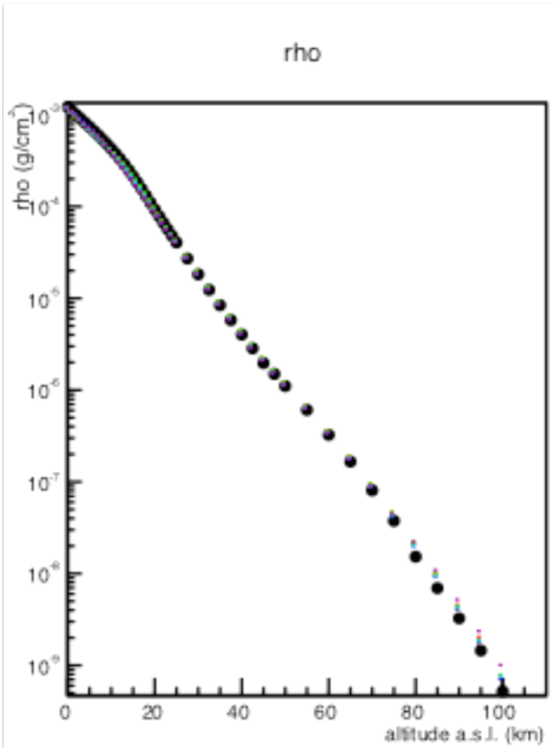


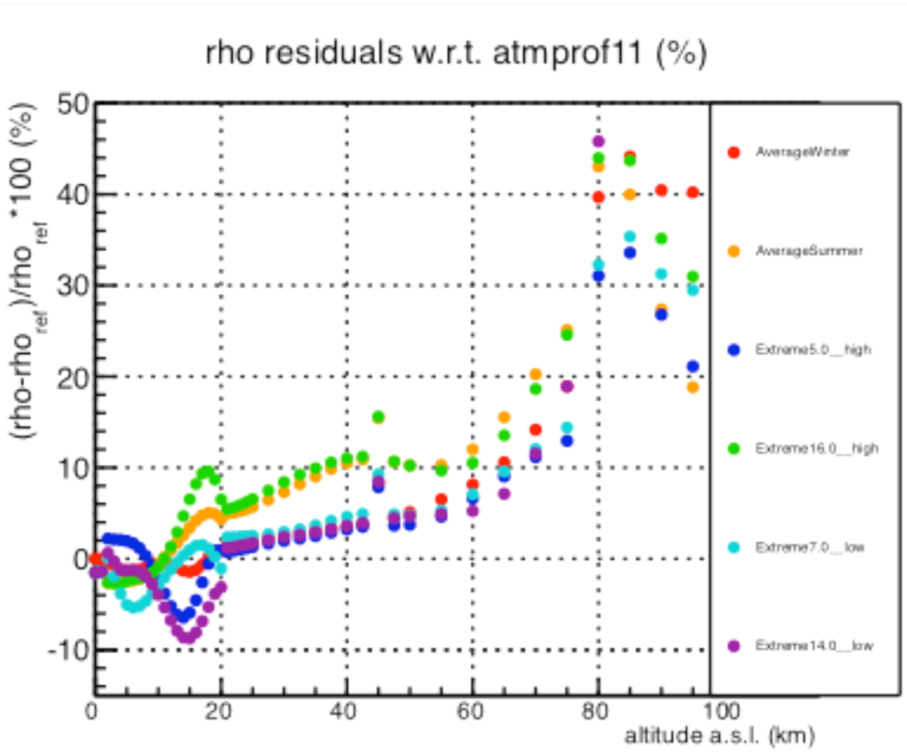


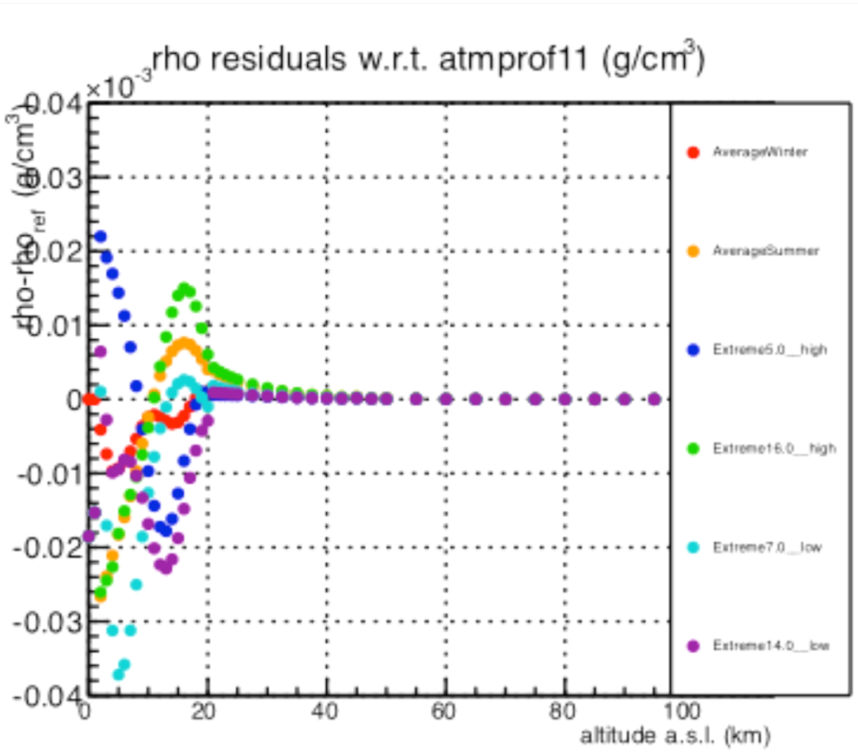


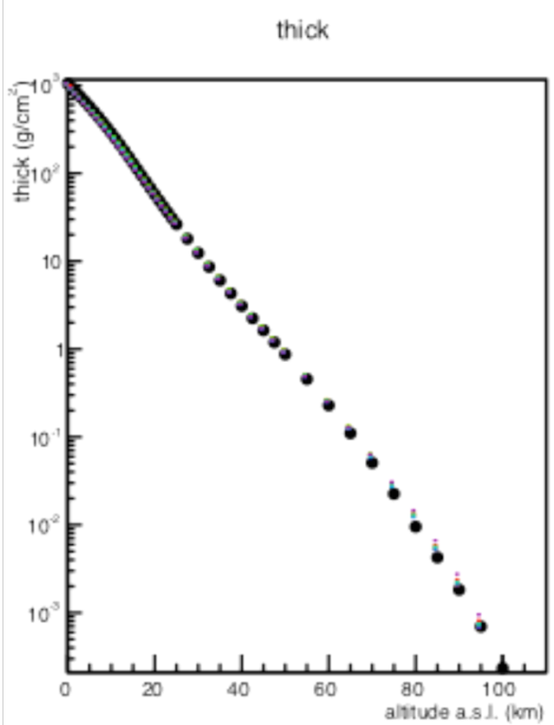


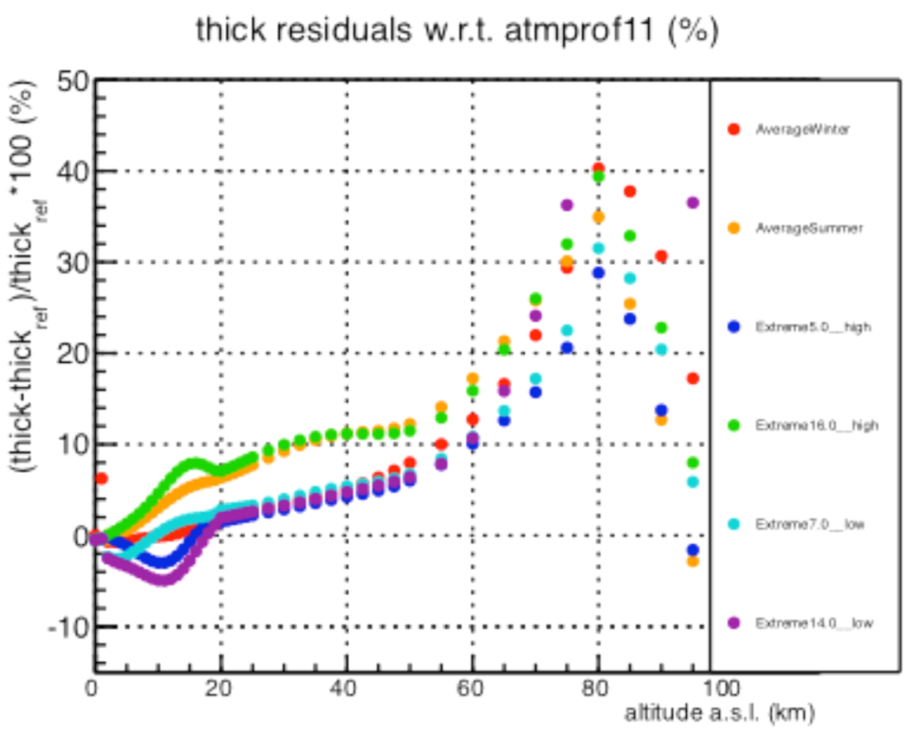
Simulation input for the La Palma studies (work started with INFN Italy)

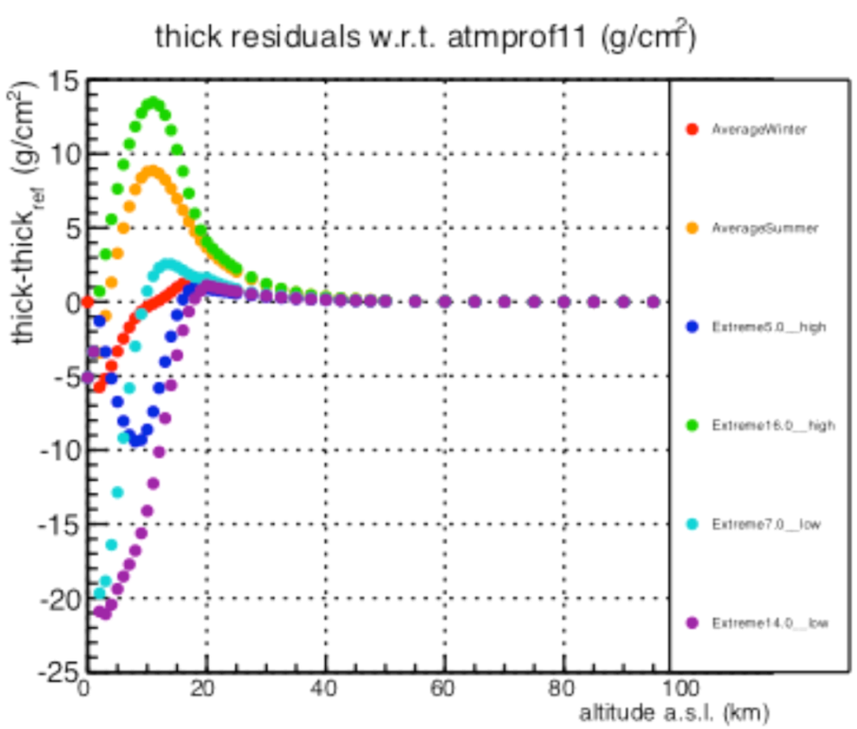




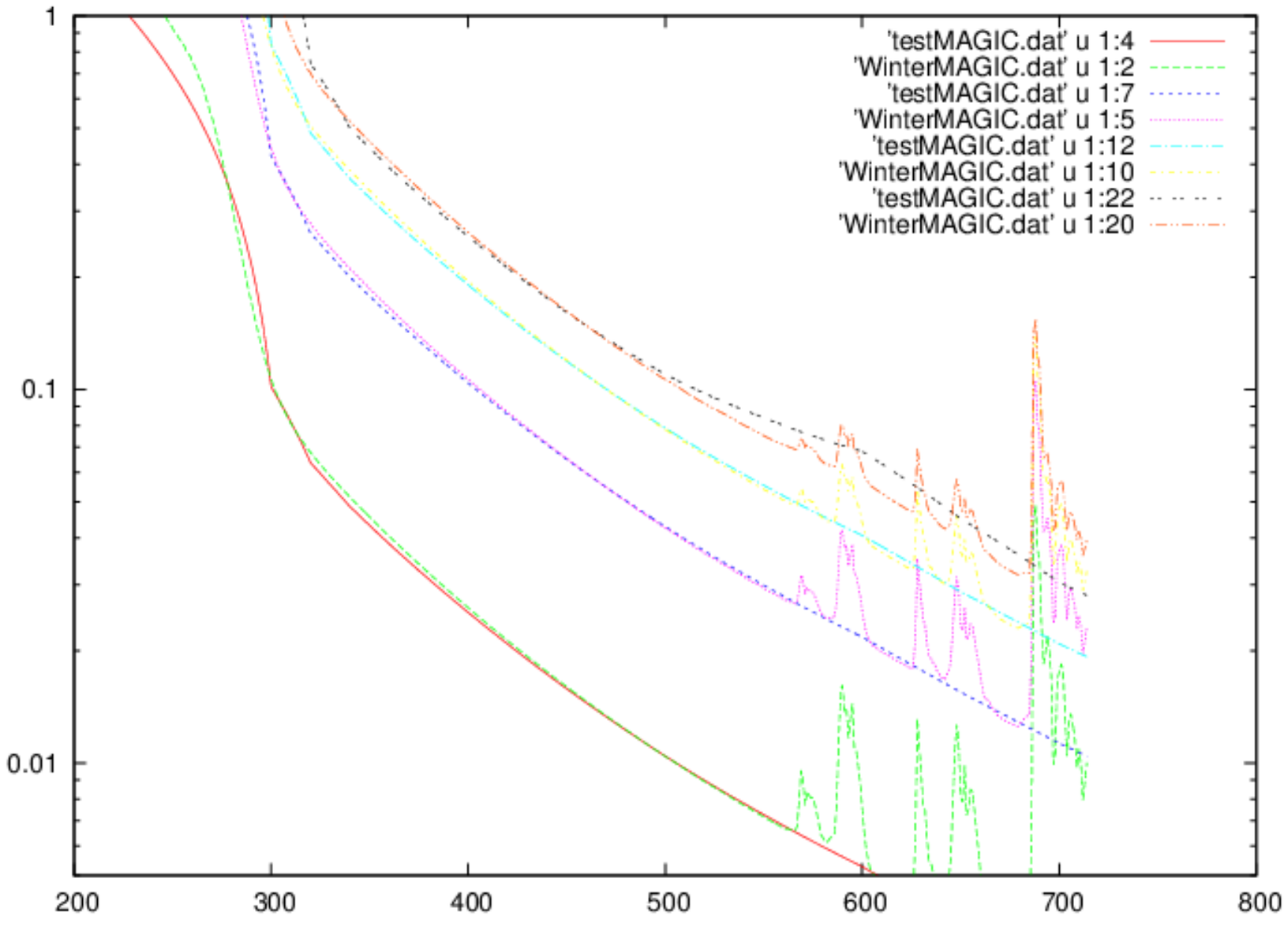








First comparison between MAGIC extinction and MODTRAN

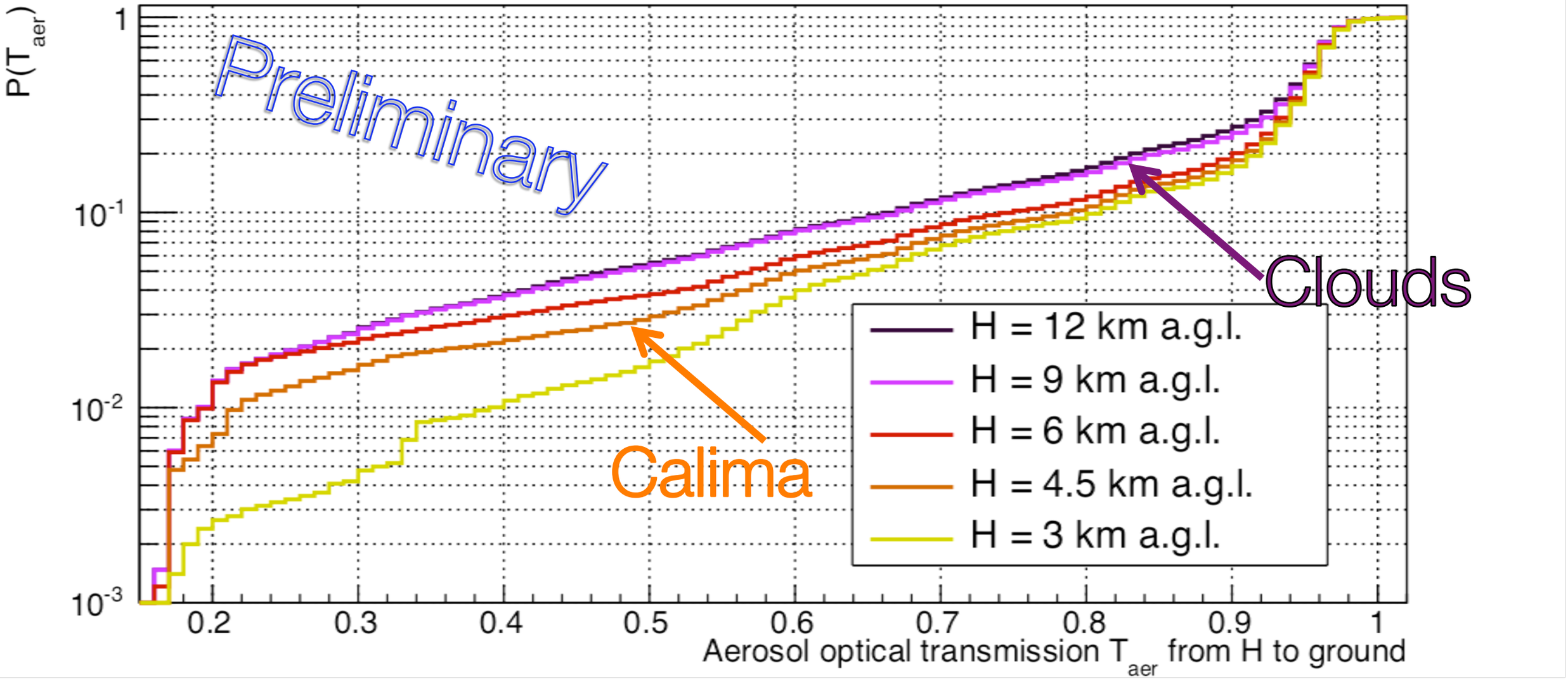


Have introduced also absorption by NO_x, O_3 and CO_2

Aerosol profiles (MAGIC LIDAR)

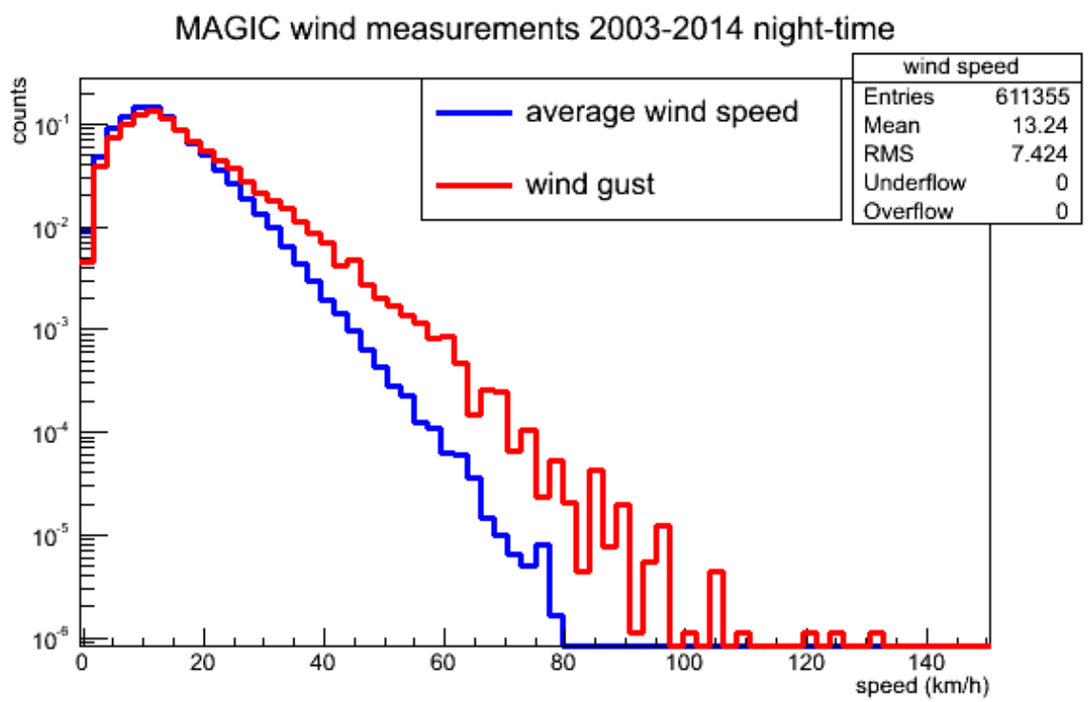
- Has potentially strong effect on extinction of Cherenkov light.
- Aerosol enhancements of ground layer (“calima”) and clouds (cumulus and cirrus)
- Strong dependency on time and altitude
- Strong energy dependency in case of clouds
- Have analyzed more than 2 years of good quality MAGIC LIDAR data
- Taken synchroneously with science data (5 deg. offset)

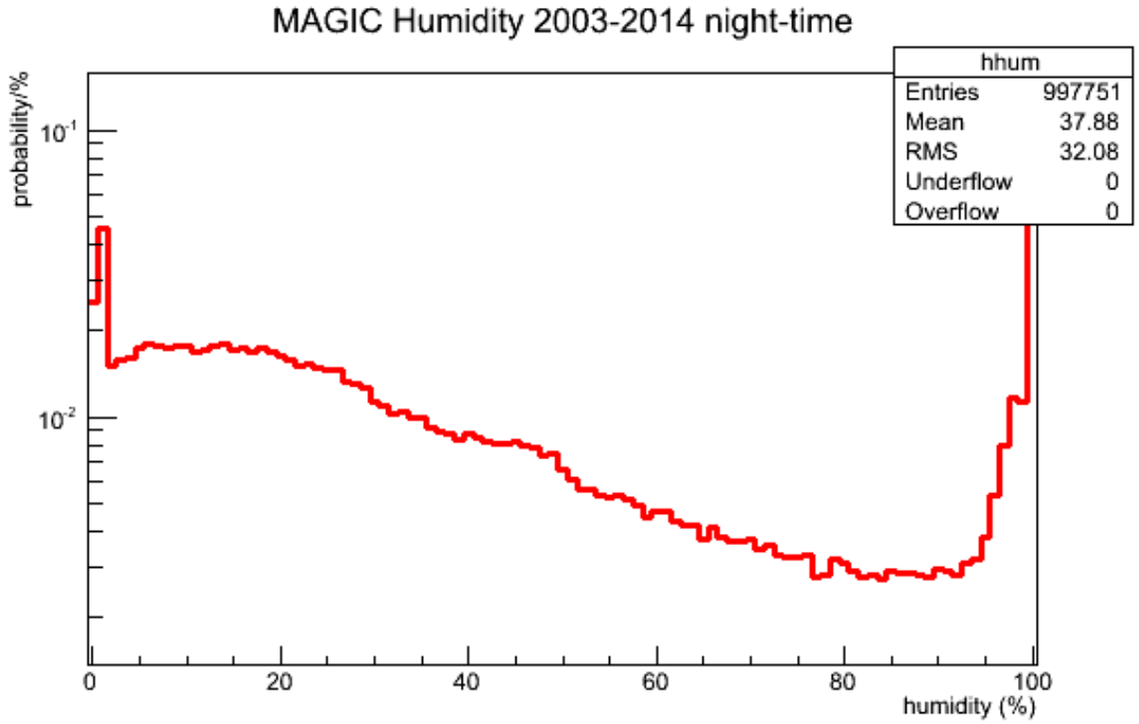
Aerosol profiles (MAGIC LIDAR)



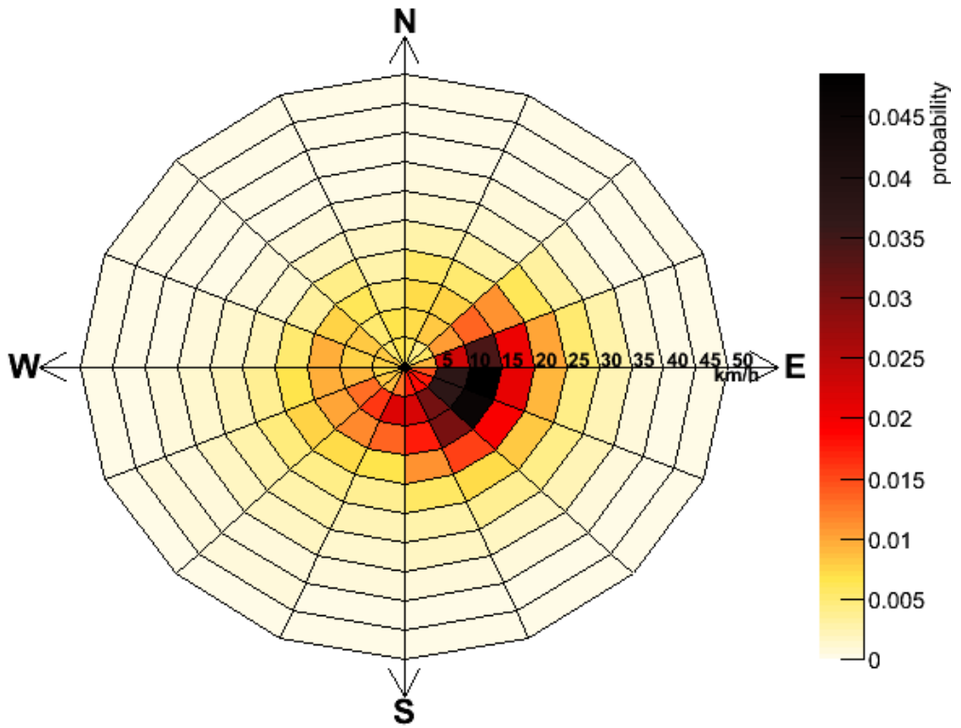
These distributions are now used for simulations of the most frequent “non-optimal” aerosol condition cases.
Also statistics of cloud heights available (not shown here).

12 years of MAGIC Weather station data





- Large data base of weather data from the roof of the MAGIC control house.
- Would be nice to study the wind at different points across the CTA area.

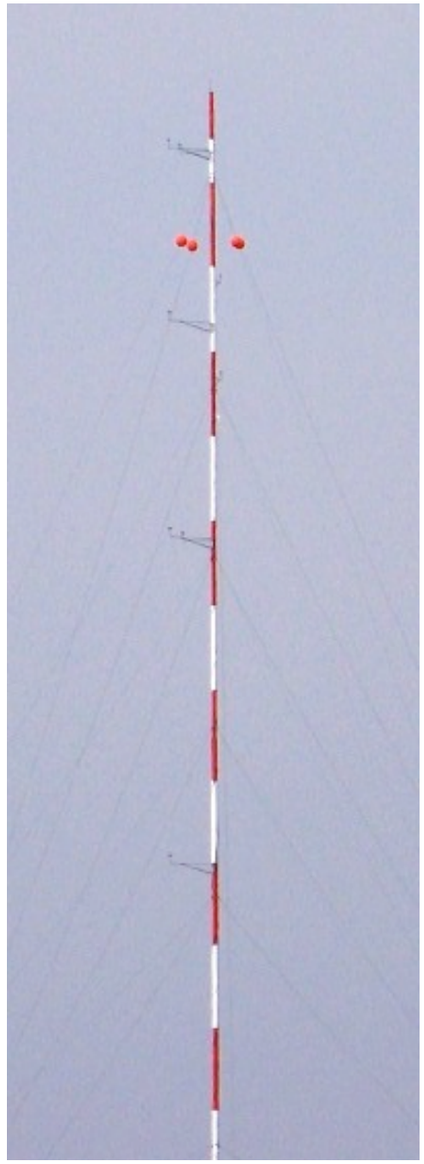


All-Sky-Cameras

- Dusan Mandat / AS-CR Olomouc has installed a brand-new All-Sky-Camera on the roof of the MAGIC control house in October (see his presentation).

Further wind studies

- 30 m tower at the LST site would be needed to measure the altitude profile.
- Contacted IAC for companies able to construct tower.
- Suggested CEMESA with which they had previous collaborations
- Funding critical though (needs to be available now to gather data before the installation of the LST prototype)!!



Rain/Humidity sensors

- Up to now, rain is only measured at one point (roof of MAGIC control house)

- However, clouds drift sometimes up the mountain, may affect parts of the CTA array without being seen at the MAGIC site. Not much known about statistics of this effect.

- Plan to install several rain/humidity sensors across the CTA area and characterize gradients across the terrain.

Thank you!