

## The Automotive Forum 2023

18<sup>th</sup> September 2023 hub27, Room Alpha 5



# **/||** SEE Performance of automotive radars in adverse weather conditions – first results





AI-SEE project targets High resolution adaptive all-weather sensor
suite with novel sensors

Al platform for predictive detection of prevailing environmental conditions including signal enhancement and sensor adaptation

Novel simulation path which allows to realistically simulate adverse weather near the sensor to adapt and test the system on both real and artificially generated road scenes

 High definition maps with dynamic layers
Adaptable to changing weather conditions. adaptable to changing weather conditions.

Permit safe driving 24h/365-days

## AI-SEE 24/365 concept & mission profile



AI-SEE work package breakdown



Source: ANSYS AI-SEE consortium – Description of Wor

Source: AI-SEE consortium – First annual project review

#### Radar impact factors by adverse weather effects



## Some extreme adverse weather situations



#### Polarization effects and raindrop size dependency





#### Worldwide rainfall rate map



Source: Tropical Raindrop Size Distribution for the Prediction of Rain Attenuation of Microwaves in the 10-40 GHz Band, IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION, VOL. 49, NO. 1, JANUARY 2001

Source: ANSYS AI-SEE project contribution

Source: Recommendation ITU-R P.837-1

## Matlab simulation of weather effect impacts on pass loss over frequency for air pressure, air temperature, fog, snow, humidity and rainfall (ITU & Crane rain model)



## Measurements of RCS (Radar Cross Section) variation of wet and dry materials: Aluminium, Asphalt, Plexiglas and Wood



## Matlab simulation – bad weather impact summary



## CARISSMA bad weather chamber detection performance test of Bosch imaging radar and Hesai lidar sensor







Bad weather drive with a sensor suite of front camera, dash camera, lidar and 4D radar (finally none of the exterior sensors is working any more)



Penta



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