

# **GNSS-R Observation Operator Development and Impact Evaluation (GOODIE): Introduction and work plan**

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# Outline

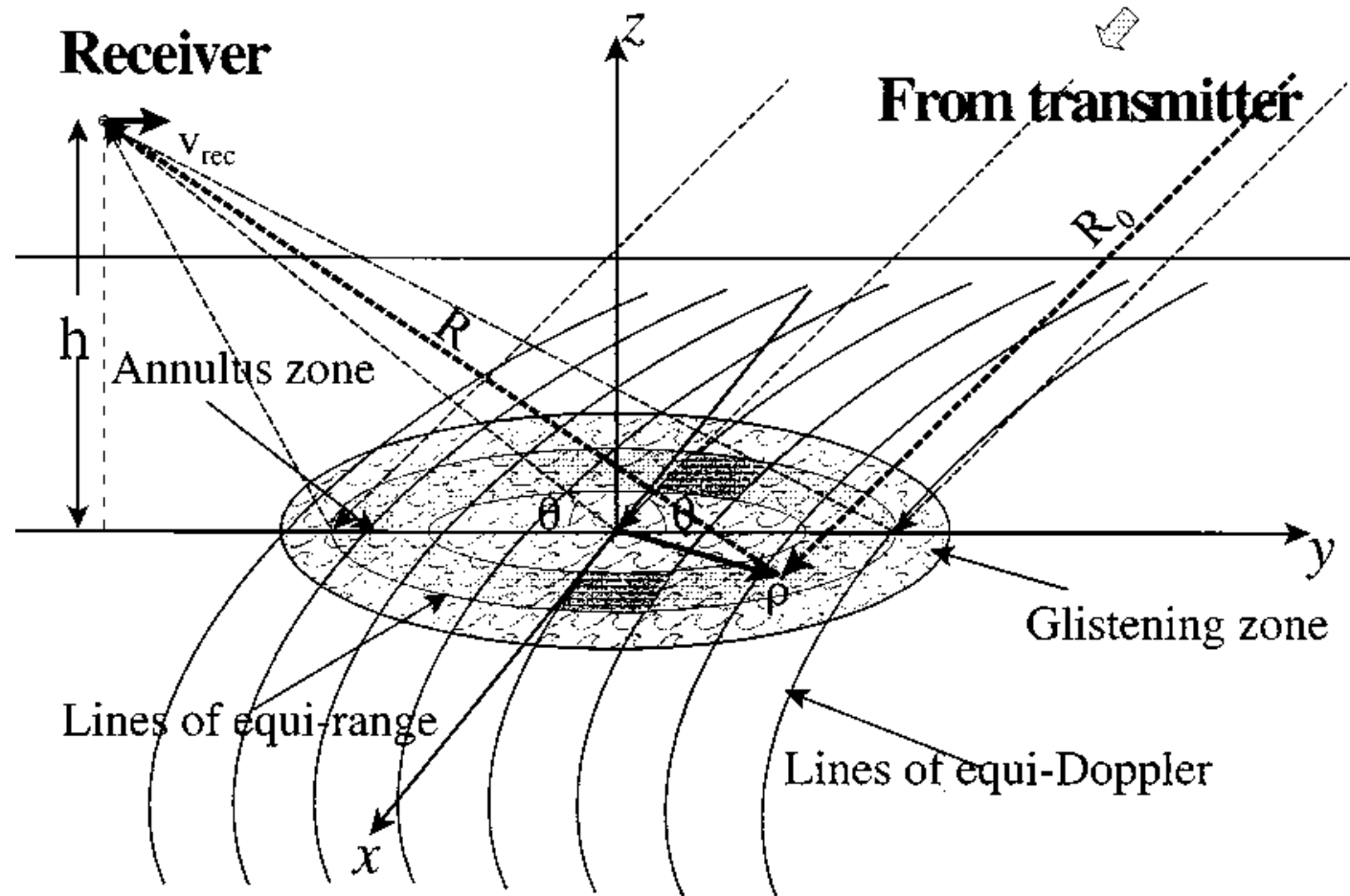
- Aim of the fellow
- Basics of GNSS-R
- Data
- Schedule
- Tasks of the partners of the project

# Aim of the fellow

- Increase the temporal sampling of wind field
- Exploit signals of opportunity (GNSS-R) for wind field retrieval
- Assimilate this info in NWP
- Evaluate the benefits on mesoscale circulation and in extreme winds

# Basics of GNSS-R: bistatic model (Zavorothny and Voronovich 2000, IEEE TGARS)

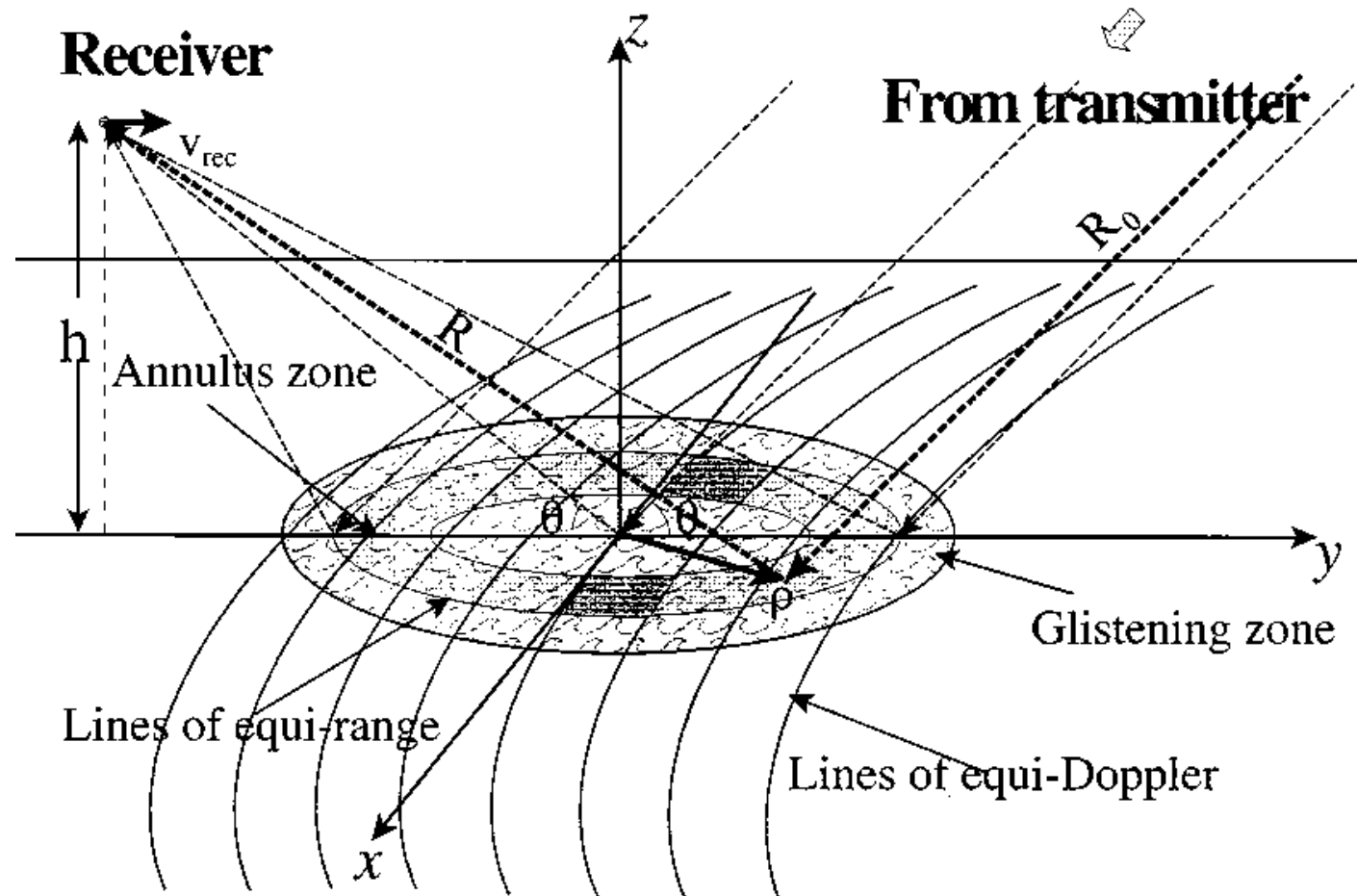
- Specular scattering  
(Kirchoff approximation)  
(Bragg scat negligible)
- Doppler shift:
  - $\mathbf{V}_t$
  - $\mathbf{V}_r$
  - $\mathbf{v}_s$  (currents, surface waves, etc.)
- Spatial resolution depends on
  - $\tau_c$  (duration of the chip)
  - $T_i$  (integration time)



# Basics of GNSS-R: bistatic model (Zavorothny and Voronovich 2000, IEEE TGARS)

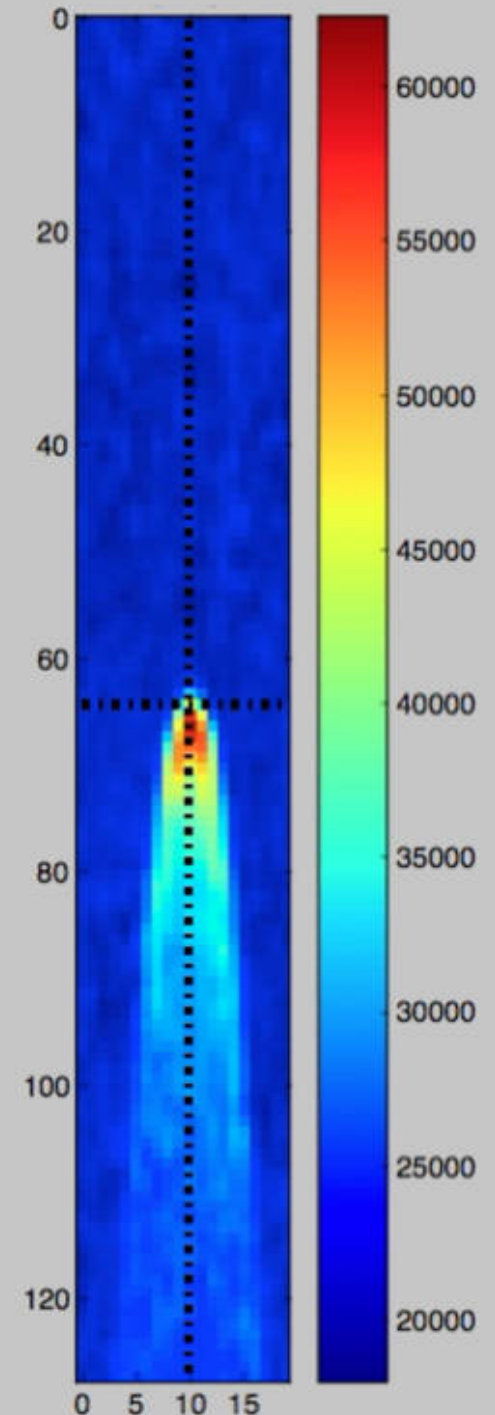
$$\langle |Y(\tau)|^2 \rangle = T_i^2 \int \frac{|\mathfrak{R}|^2 D^2(\vec{\rho}) \Lambda^2[\tau - (R_0 + R)/c]}{4 R_0^2(\rho) R^2(\rho)} \times |S[f_D(\rho) - f_c]|^2 P\left(\frac{-\vec{q}_\perp}{q_z}\right) \frac{q^4}{q_z^4} d^2 \rho$$

- ›  $Y$  waveform
- ›  $\tau$  delay time
- ›  $T_i$  integration time
- ›  $R_e$  polarization sensitive reflection coefficient
- ›  $D^2$  power antenna footprint
- ›  $P$  pdf of surface slopes



# Data

- TechDemoSat (TDS): 2014 on
- CYGNSS: 2016 on
- GEROS-ISS: to be launched in 2019
- <https://www.nasa.gov/feature/cygnss-hurricane-mission-measures-first-light-science-data>



# Schedule: 1<sup>st</sup> year

- Geophysical interpretation of BNRCS (TDS, CYGNSS) (OSI SAF KNMI)
  - Assessment of the dependency of BNRCS on  $U^{10}$ ,  $\varphi$ ,  $\theta$ , SST,  $H_s$ , etc..
- Assessment of L-band GMF (OSI SAF KNMI)
- Instrument and GMF error attribution (OSI SAF KNMI)
- Evaluation and validation of TDS and CYGNSS data (OSI SAF KNMI, ROM SAF IEEC and ICM in collaboration with UM, NOC and NOAA)

# Schedule: 2<sup>nd</sup> and 3<sup>rd</sup> years

- GNSS-R retrieval (OSI SAF KNMI)
- Observation operator
- Assimilation on NWP
- Evaluation of the assimilation on mesoscale circulation and extreme events forecast