

# Project 5 Noise Emission and Propagation Modelling

## Motivation

Critical issues for source emission & propagation

- Radiation patterns - Level & directionality
- Speed and accuracy of prediction
- Real world atmospheric models
- Integration with environmental models

Noise contours need to be accurate when implementing policy

## Objectives

- Study effect of source motion and further develop numerical modeling methods
- Investigate meteorological reanalysis datasets for use in aircraft noise prediction.
- Assess field measurement data for validation of noise propagation models.

## Approach - Purdue

- Study combined effect of source motion, directivity, atmospheric and terrain profiles on propagation of en-route noise
- Investigate the effect of terrain profile and microphone placement in noise measurements
- Begin assessment of DISCOVER AQ Acoustics dataset

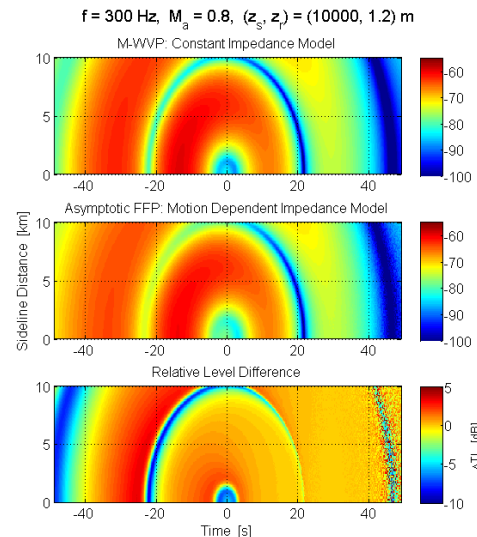
## Approach - PSU

- Evaluate alternative atmospheric profiles to ones currently used by Volpe/FAA.
- Assess links between noise tools and AEDT weather databases
- Identify avenues for propagation model validation using aircraft trajectory data from databases such as BANOERAC and DISCOVER AQ.

## Source Motion Modeling - Purdue

Multi-layered Linear Sound Speed Profile (LSSP)

- More accurate representation of atm.
  - Analytical approx. for two-layered non-increasing or non-decreasing LSSP's
  - Greater efficiency with comparable accuracy
- Dopplerized quantities:
- Source motion dependent ground model (Time-domain Finite Difference Method)
  - Ray path dependent atm. absorption



Ground impedance model comparison for a cruise condition monopole source in a homogeneous atmosphere. Source motion effects greatly influence the predictions on approach.

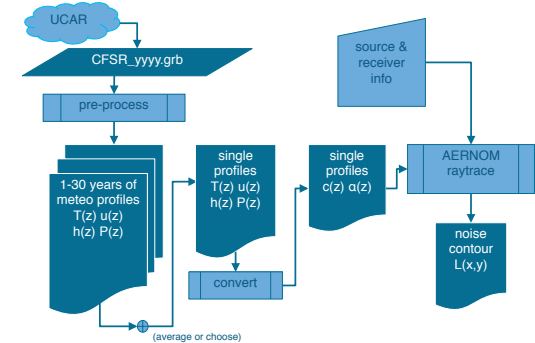
## Reanalysis Data Assessment - PSU

For aircraft noise prediction, determine applicability of reanalysis meteorology models: accessible, consistent, quality controlled

Recommendations for using Reanalysis

- Use specific humidity instead of relative
- Dry air assumption overpredicts received SPL compared to moist air result
- Appropriate profile curve fitting is important for higher altitude sources

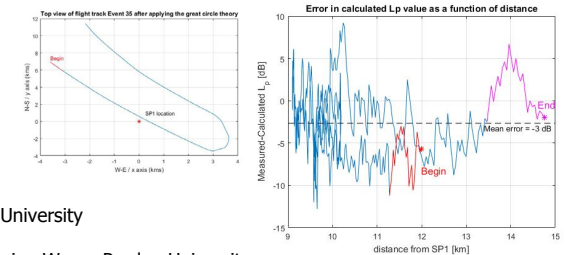
### Using Reanalysis Data for Propagation



## Analysis of DISCOVER AQ dataset - PSU



Error(Measured-Calculated) ranges +8 dB to -12dB



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