

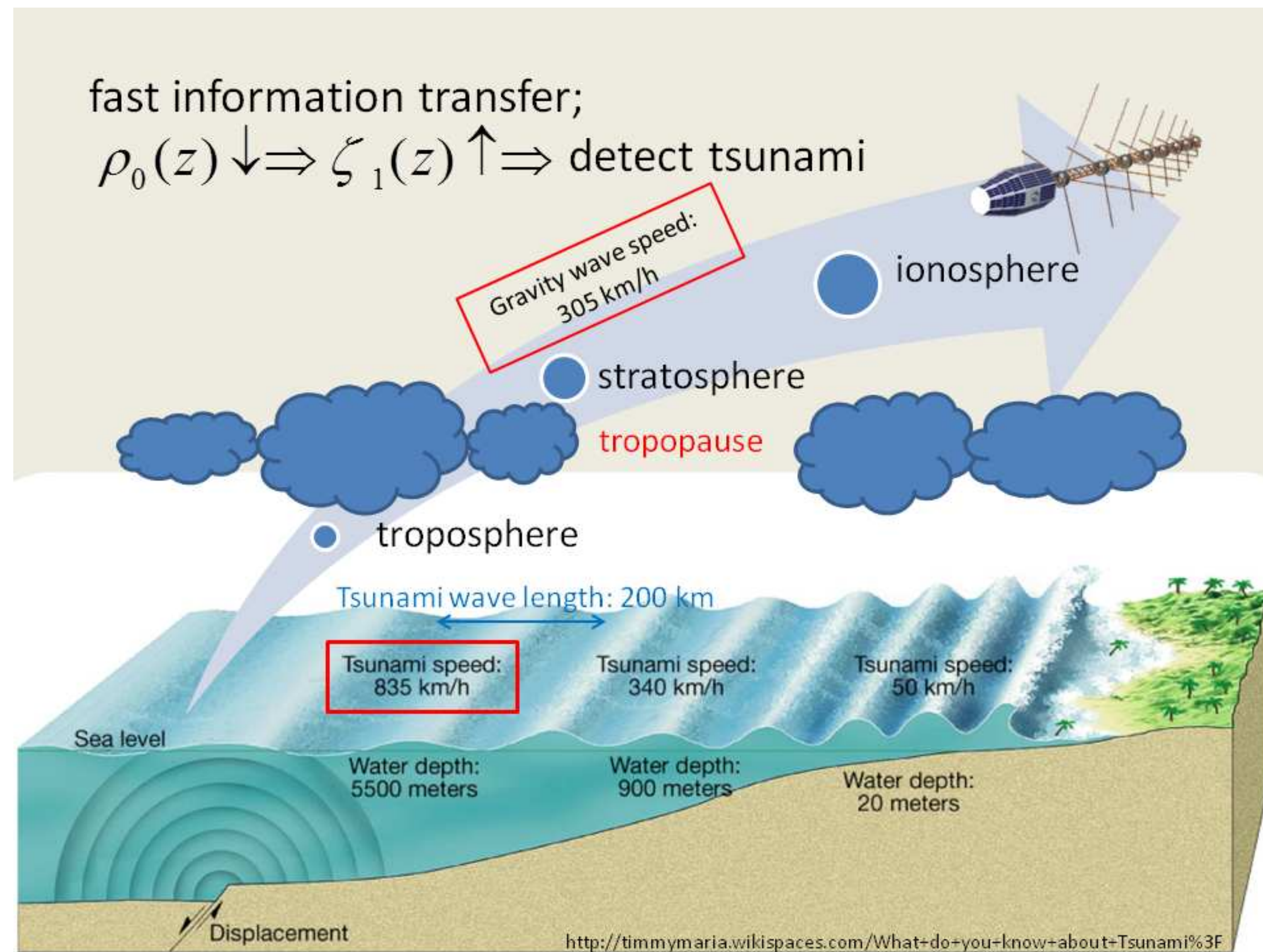


# TIME-RESOLVING MODEL FOR GRAVITY WAVES IN NON-UNIFORMLY STRATIFIED ATMOSPHERE

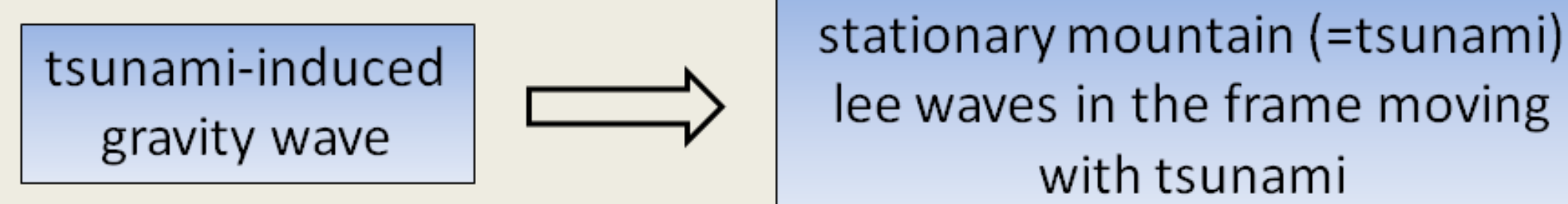


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## Motivation



## Restrictions of current gravity wave modeling approach



- Stationary solution omits time-dependent details in middle atmosphere.
- Neglects partial back-reflection in the non-uniformly stratified atmosphere.

## Modeling

## Time-resolving model allowing jump in buoyancy frequency

T-G equation: initial/boundary value problem

Laplace transform

ODE: boundary value problem

$$(\partial_t + U\partial_x)^2 \zeta_{zz} + N^2(z)\zeta_{xx} = 0$$

$$\zeta(t=0^-) = \zeta_t(t=0^-) = 0$$

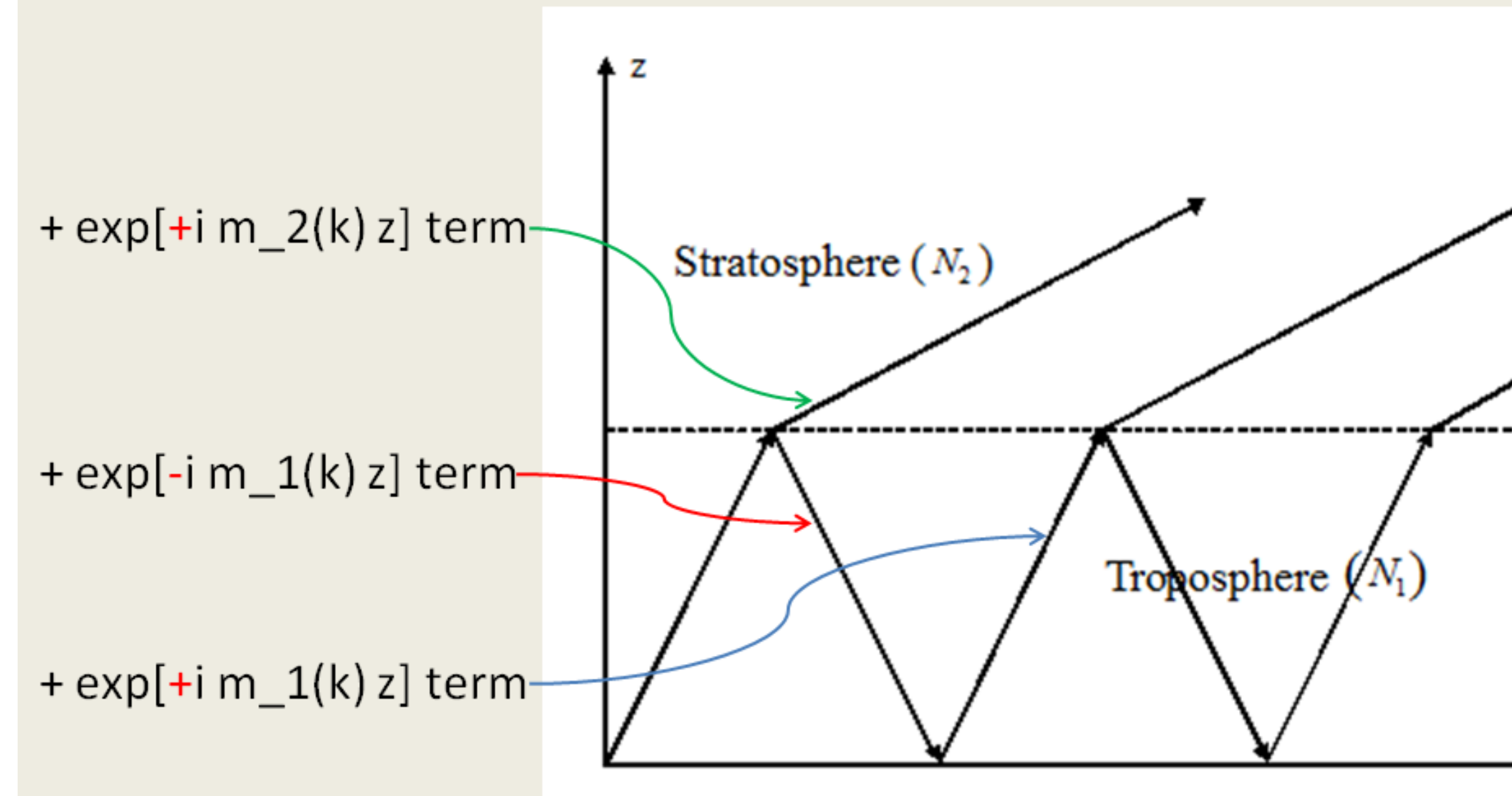
$$\zeta(z=0) = h(x), \zeta(z=\infty) = 0.$$

$$(s + ikU)^2 \hat{\zeta}_{zz}^T - k^2 N^2(z) \hat{\zeta}^T = 0$$

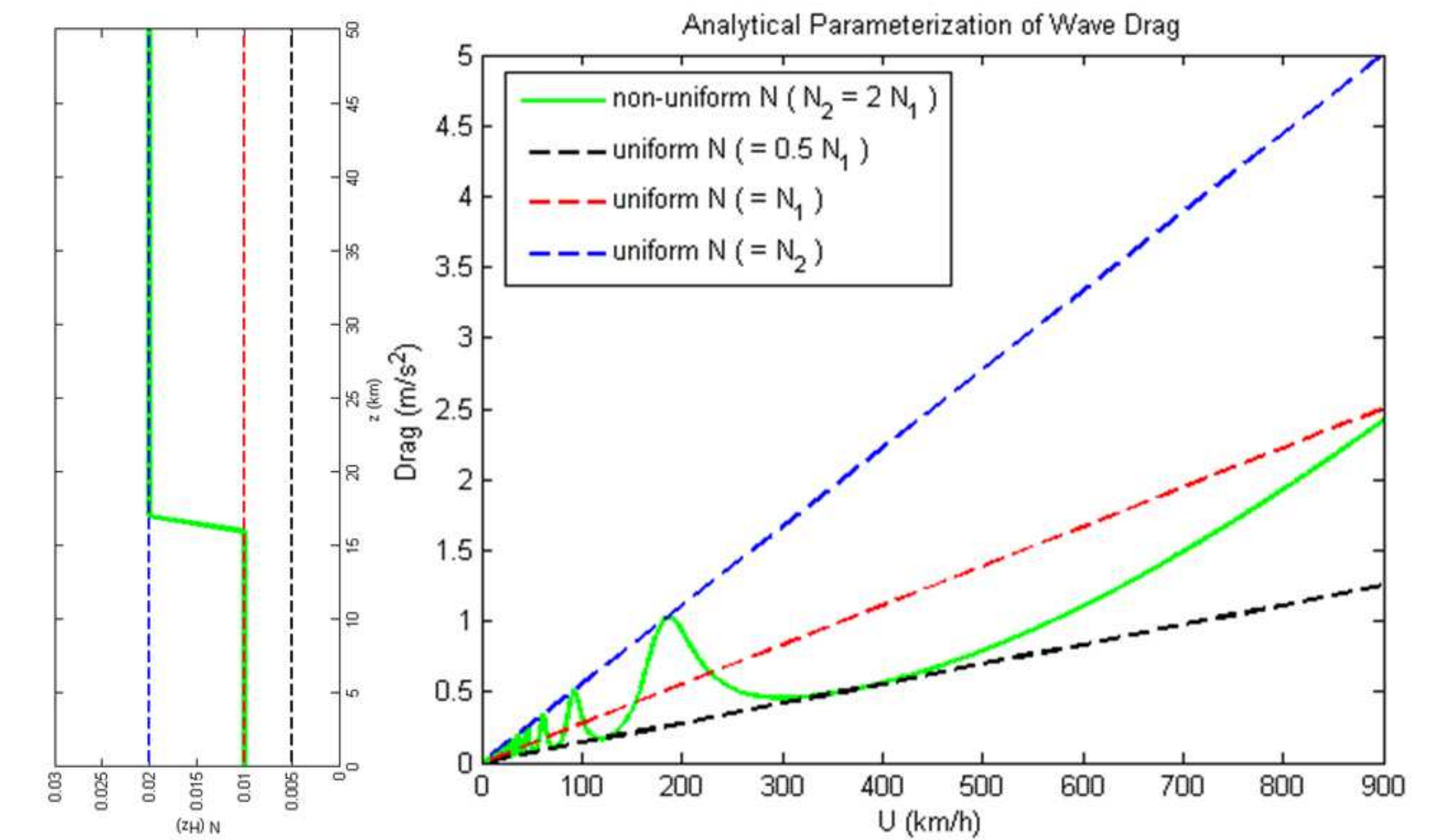
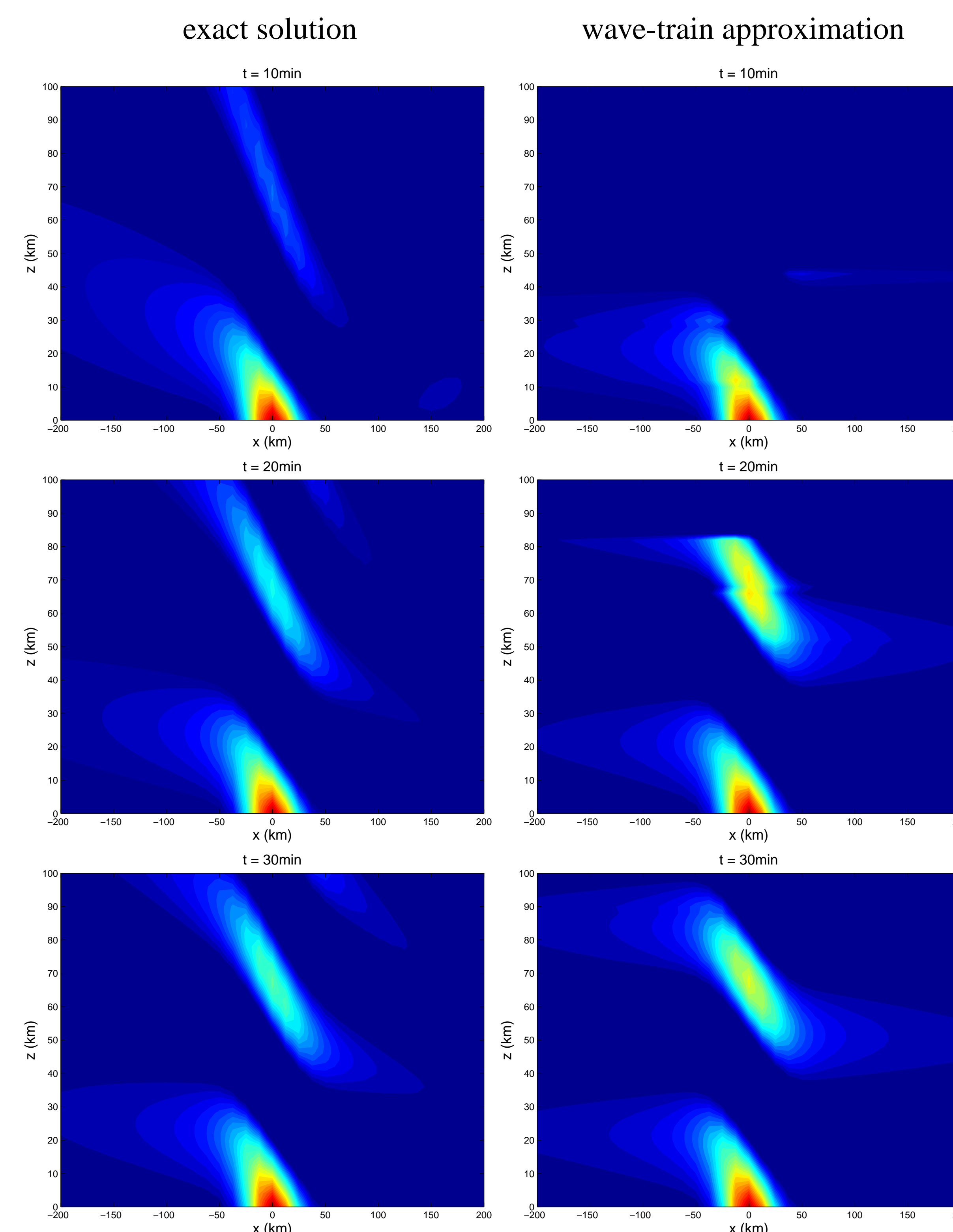
$$\hat{\zeta}^T(z=0) = \hat{h}(k) / s$$

$$\hat{\zeta}^T(z=\infty) = 0$$

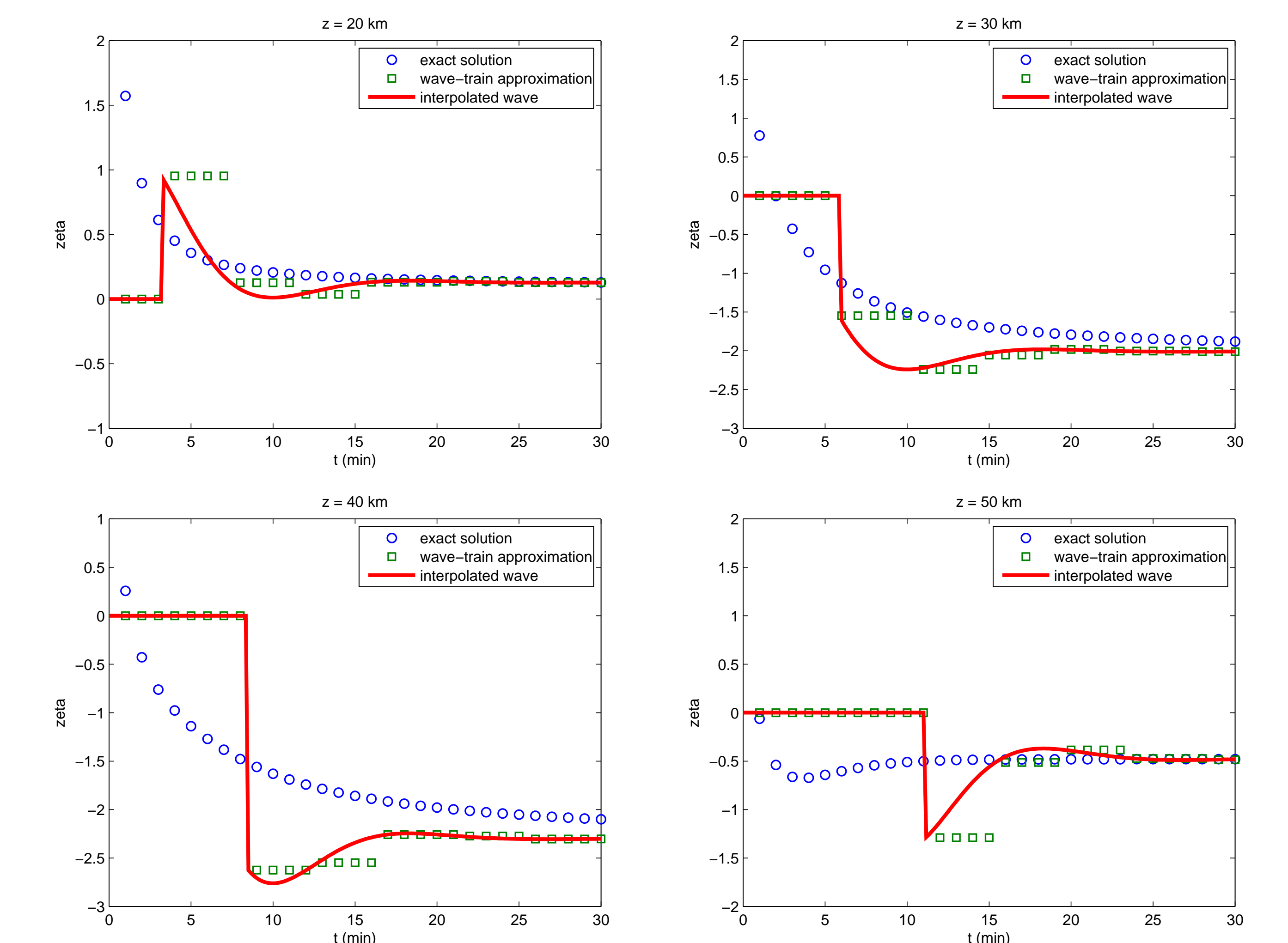
## Wave-train approximation



## Results



## Time evolution of the wave field at different levels



## Summary

- Develop a time-resolving model while allowing jump in stratification
- Construct a wave-train approximation including reflections and transmissions
- Recover the gravity wave propagation scheme in the middle and low atmosphere