

# Vertical Dispersion in a Stable Boundary Layer: A Numerical Experiment

Gervásio A. Degrazia and Osvaldo L.L. Moraes

Departamento de Física – UFSM

Radar Meteorológico – UFPEL

Haroldo F. de Campos Velho

Laboratório Associado de Computação e Matemática Aplicada

Instituto de Pesquisas Espaciais (INPE)

Julio C.R. Claeysen

Instituto de Matemática e PROMEC

Universidade Federal do Rio Grande do Sul

## Abstract

Expressions for the vertical and lateral diffusivity coefficients were obtained from the Local Similarity Theory and the Statistical Diffusion Theory, using the spectral density energy for the turbulent velocities. The expressions here derived are compared with the diffusivity coefficients for momentum and heat suggested by Sorbjan (from the Minnesota experiments) and Nieuwstadt (from the Cabauw experiments). This comparison allows to conclude that turbulence is equally efficient in transporting momentum, heat and contaminants in an idealized stable boundary layer.

In contrast to the time dependent part of the vertical diffusivity  $K_{zz}$ , the asymptotic values of  $K_{zz}$  for large  $t$ , is of use in modelling area source dispersion in the stable boundary layer. We use the asymptotic value of  $K_{zz}$  in the simple one-dimensional diffusion equation to investigate the form of the vertical concentration distribution of pollutants released by area sources.