**Introduction**

With its 2578 channels having a spectral resolution ranging from 0.33 cm⁻¹ to 1.3 cm⁻¹, the high spectral resolution Advanced Infrared Sounder (AIRS), recently launched on board of EOS-Aqua, offers promising perspectives for remote sensing applications at the improvement of temperature and water vapor profile retrieval or retrieval of greenhouse gases (CO₂, N₂O, CO and CH₄, for example). In order to reduce the amount of data and calculation time needed by these applications, a subset of 324 channels has been extracted and is distributed by the NESDIS.

The key for all these applications is the availability of a fast forward radiative transfer model, much faster than the line by line models. Two such models are presented here.

**Neuronal model**

- **Multilayer Perceptron (two hidden layers)**
- **Supervised Learning on the TIGR database**

**Inputs:** temperature and mixing ratio (H₂O, O₃) profiles (324 channels for each viewing angle)

**Outputs:** 324 AIRS channels brightness temperatures

Computation time: 0.001 s/atm

**Jacobian model**

- **Pattern recognition within the TIGR thermodynamical database**
- **Linearization of the radiative transfer equation use of Jacobians**

**Inputs:** emissivity, viewing angle, temperature and mixing ratio

**Outputs:** - 324 AIRS channels brightness temperatures

Computation time: 0.1 s/atm

**Radiative database:**

**Transmission functions**

- Temperature Jacobian
- Mixing ratio (H₂O, CO₂, O₃, N₂O, CH₄ and CO) Jacobians
- Emissivity Jacobian
- AIRS brightness temperatures

**Statistics on the TIGR database**

Comparison with the line-by-line model 4A

**Mean thermodynamic profiles of the 372 tropical TIGR situations**

**Comparison with observations using ECMWF analyses**

19 September, 2003

**Statistical database**

Comparison with the line-by-line model 4A

**Conclusion**

**Neuronal Model**
- Computation of Jacobian functions available
- Relatively fast
- No learning process
- Good treatment of the CO₂ channels
- Poor treatment of the H₂O channels (would require higher order corrections or better sampling of the database)
- Able to take into account greenhouse gases profiles

**Jacobian Model**
- Computation of Jacobian functions still difficult
- Extremely fast
- Long learning process (50000 iterations at least)
- Appropriate treatment of the CO₂ channels
- Good treatment of the H₂O channels
- Unable to take into account greenhouse gases profiles