

# *Empirical Modes of UV Variations*

Alexander Ruzmaikin

JPL, California Institute of Technology

# Empirical Mode Decomposition

(Huang et al., 1998)

## 1. FFT :

$$x(t) = \Re \sum_j a_j e^{i\omega_j t} \quad \Rightarrow \quad \phi(\omega)$$

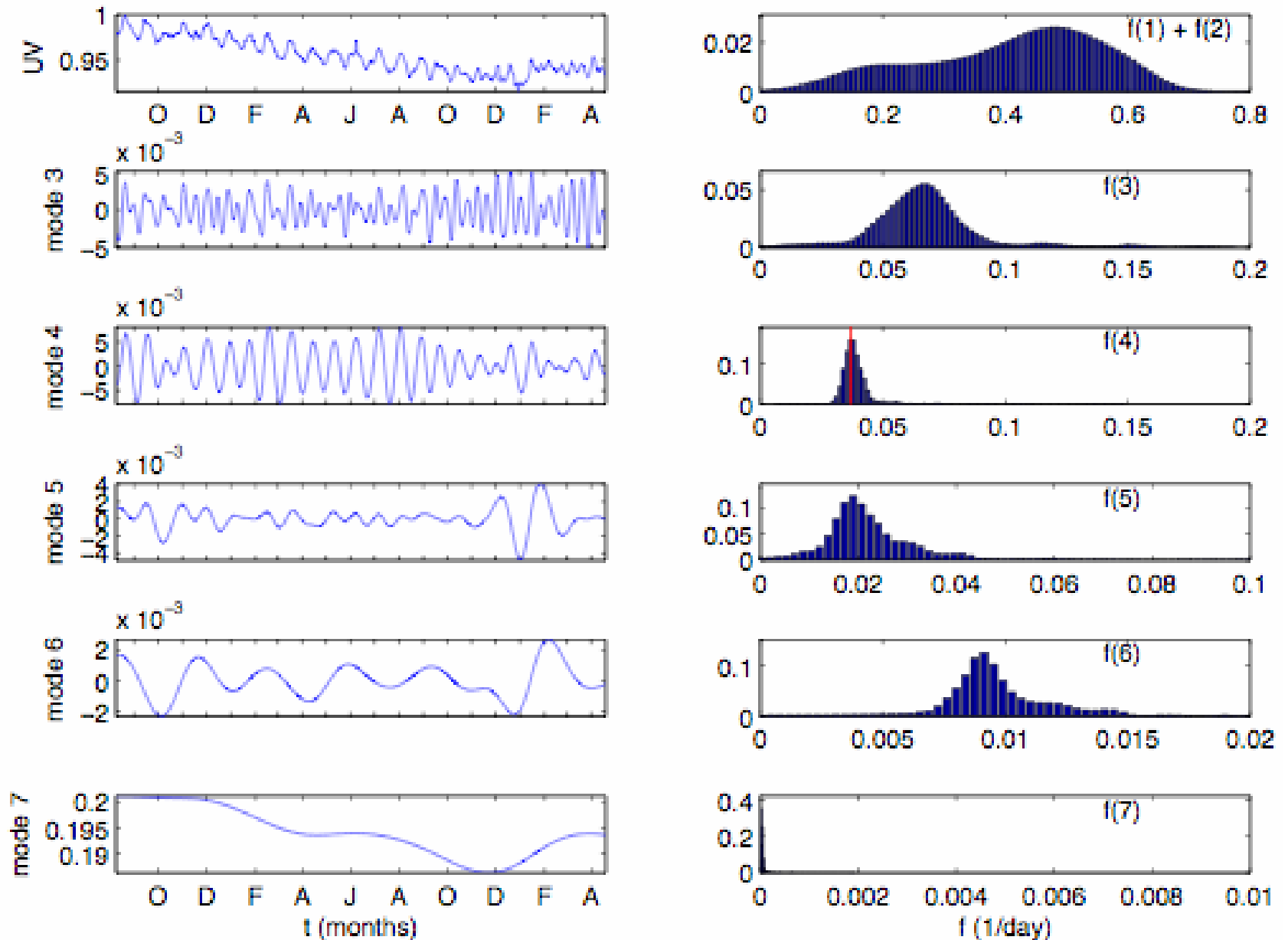
## 2. HHT :

$$x(t) = \Re \sum_j a_j(t) e^{i \int \omega_j(\tau) d\tau} \quad \Rightarrow \quad H(\omega, t)$$

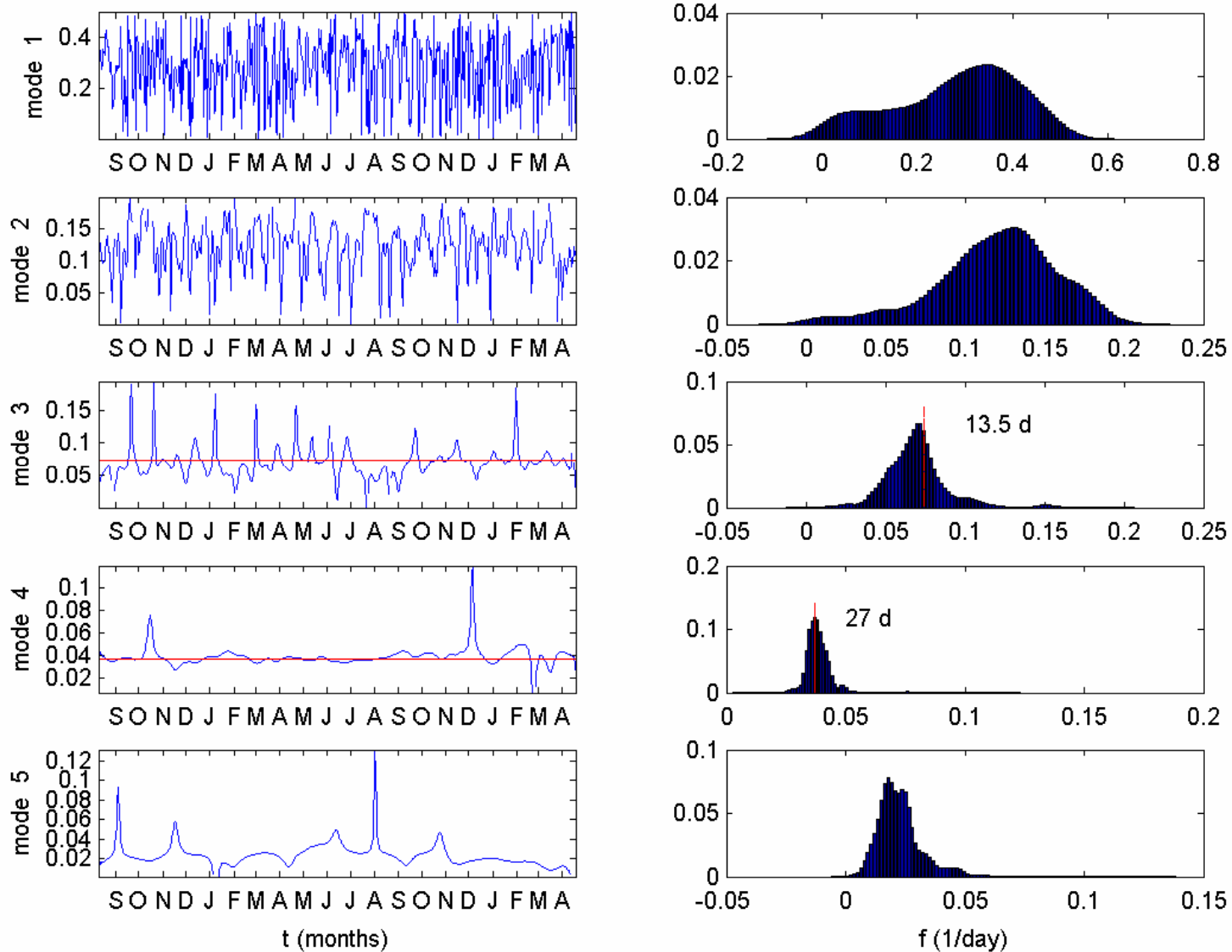
Can be treated as:

1. mode decomposition (like Fourier or wavelet)
2. natural filter

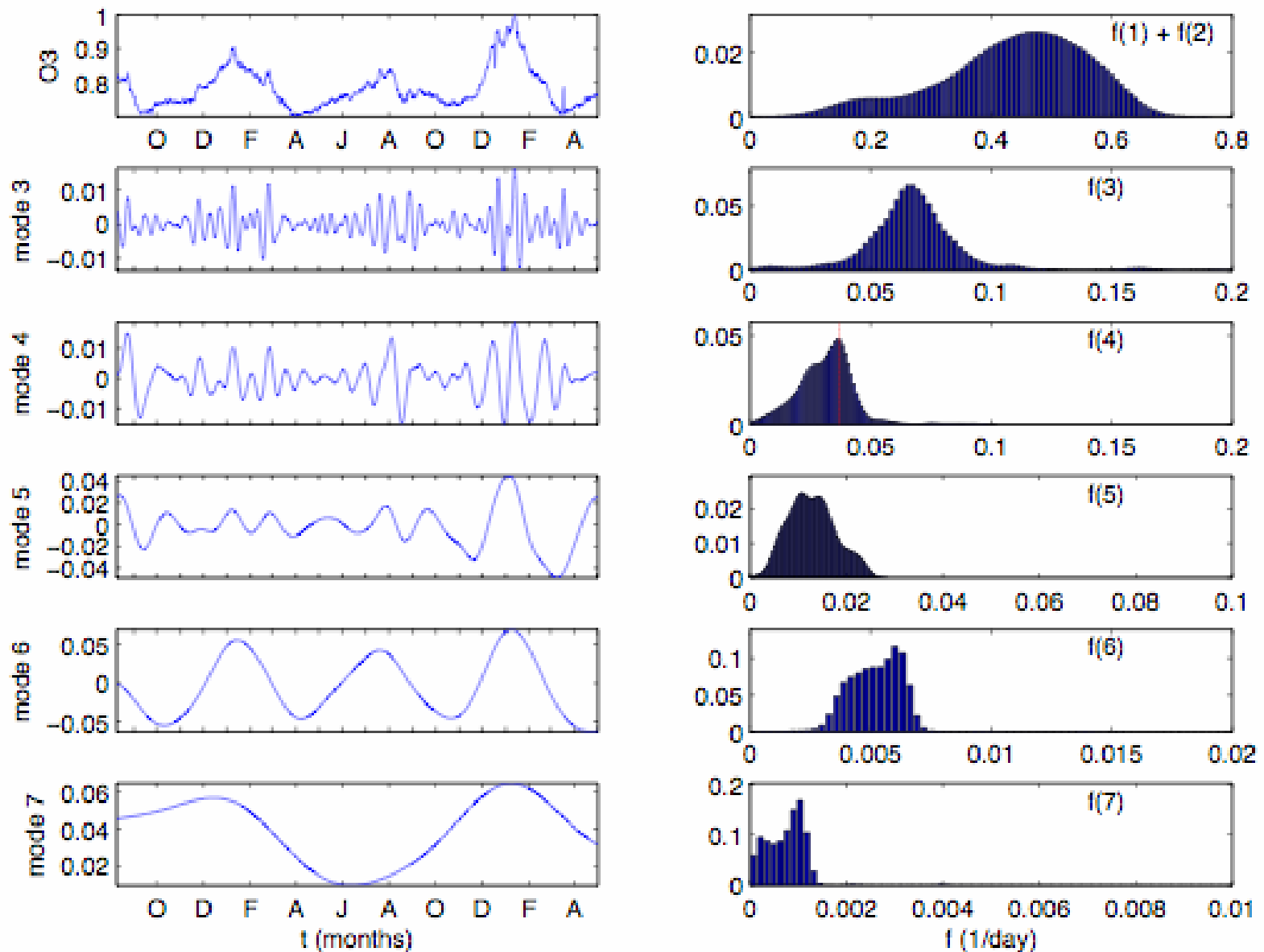
# UV 205 nm Modes (2004-2006)



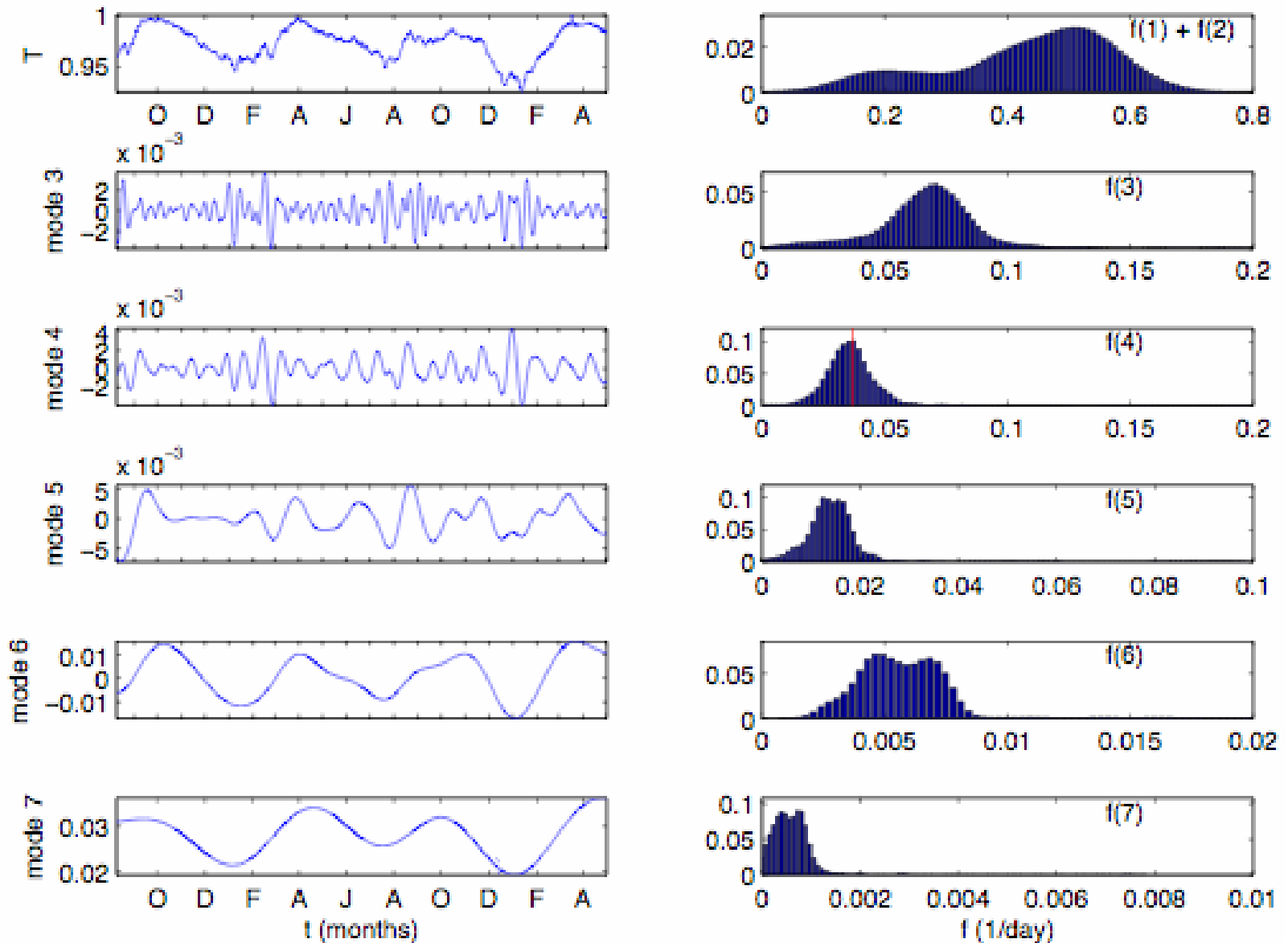
# UV 205 nm Frequencies (2004-2006)



# EMD of O3 at 2hPa in Tropics



# EMD of T at 2 hPa in Tropics



# Benefits

- Nonstationarity and nonlinearity are well treated
- No leaks from one mode to another
- 27-day mode and other modes are naturally extracted
- Nonlinear trend comes out as the last mode