



Universiteit Utrecht



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

Pinatubo project update

Narcisa Bândă

Maarten Krol

Twan van Noije

Thomas Röckmann

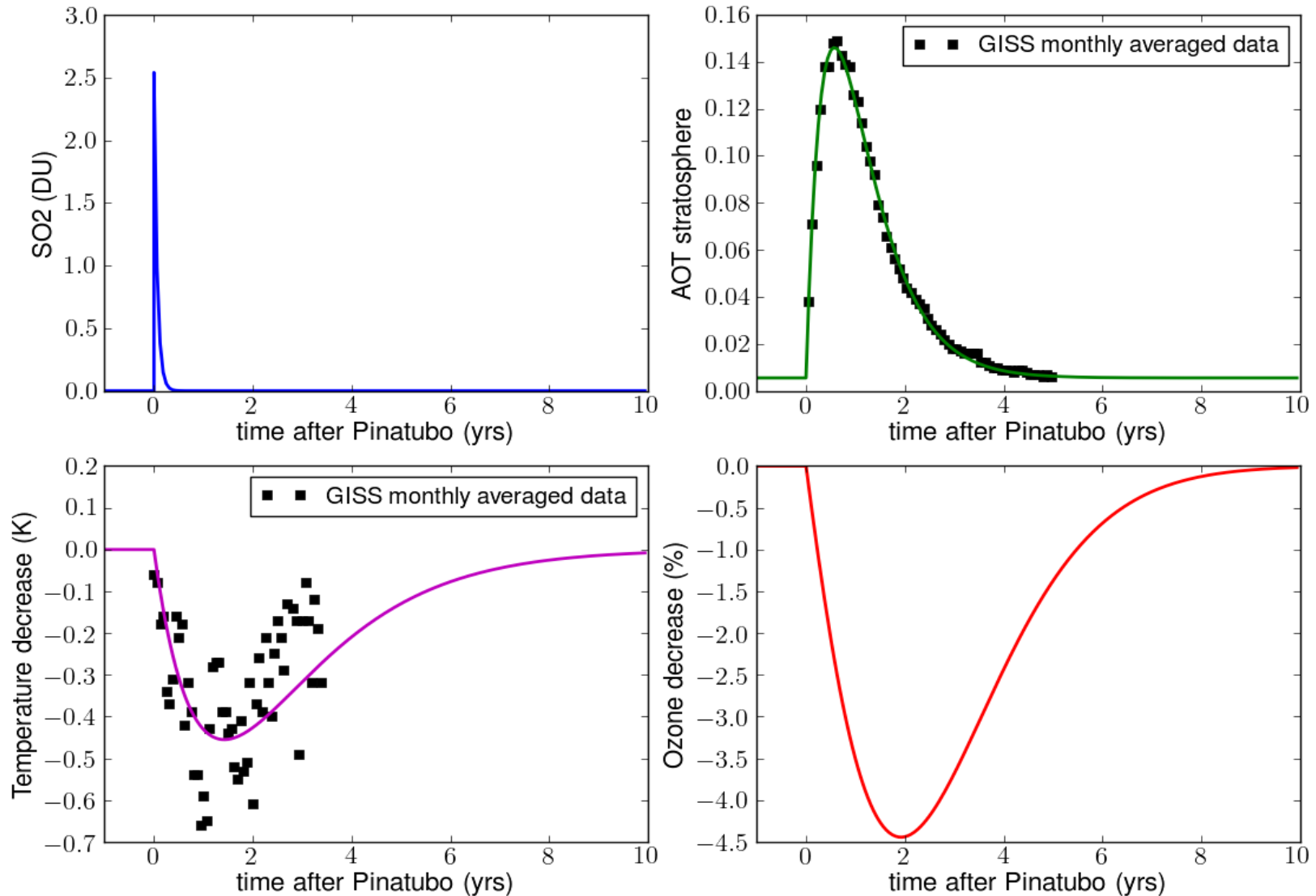
Michiel van Weele

10 May 2011

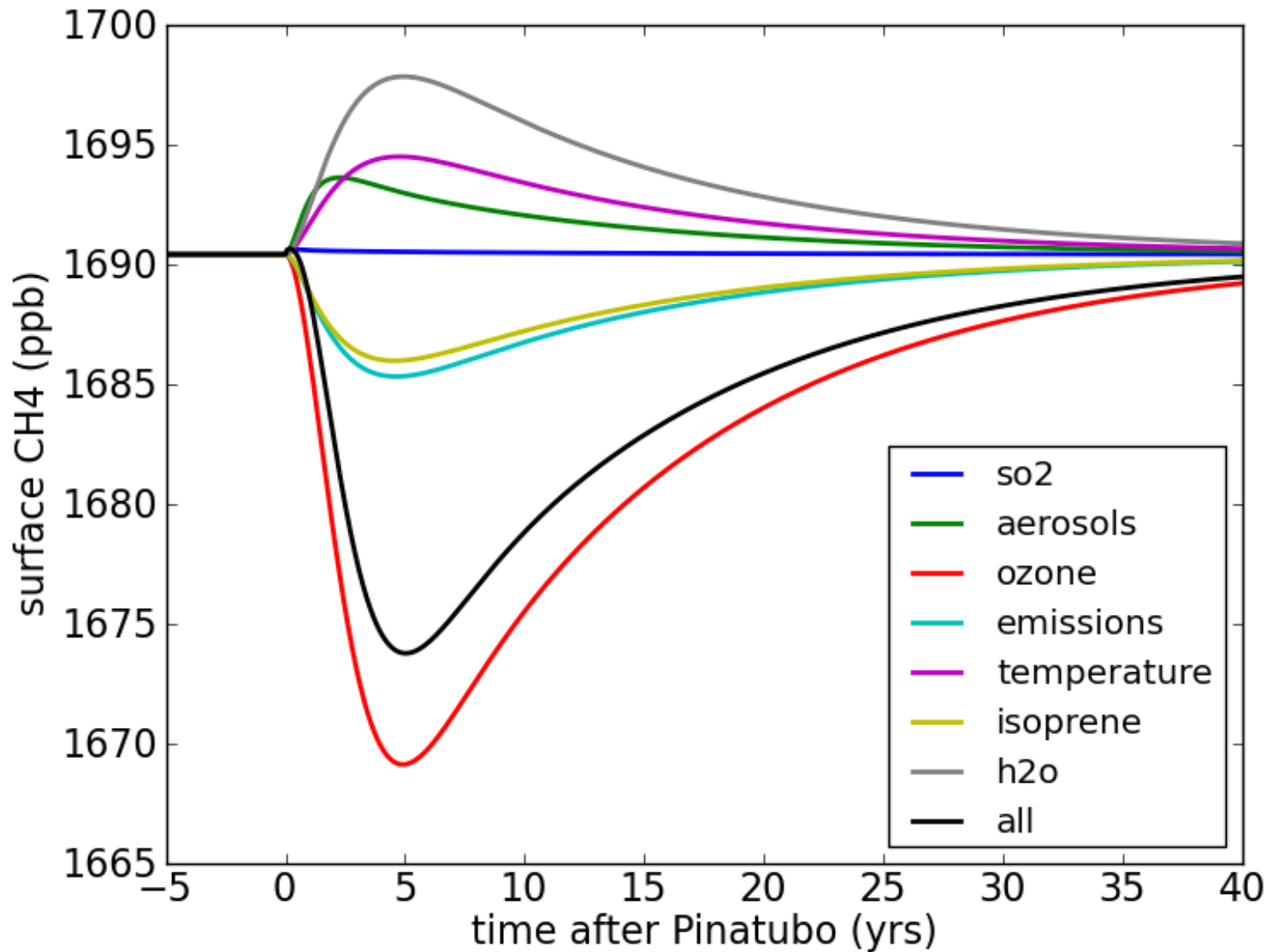
| Process | E_{CH_4} | k | UV | OH | CH ₄ |
|---|-------------------|-----|----|----|-----------------|
| UV absorption by SO ₂ | | | ↘ | ↘ | ↗ |
| Aerosol scattering of radiation | | | ↘ | ↘ | ↗ |
| Stratospheric ozone depletion | | | ↗ | ↗ | ↘ |
| Reduced CH ₄ wetland emissions | ↘ | | | | ↘ |
| Slower reaction with OH | | ↘ | | | ↗ |
| Reduced isoprene emissions | | | | ↗ | ↘ |
| Less water vapour | | | | ↘ | ↗ |

$$d\text{CH}_4 / dt = E_{\text{CH}_4} - k \times \text{OH} \times \text{CH}_4$$

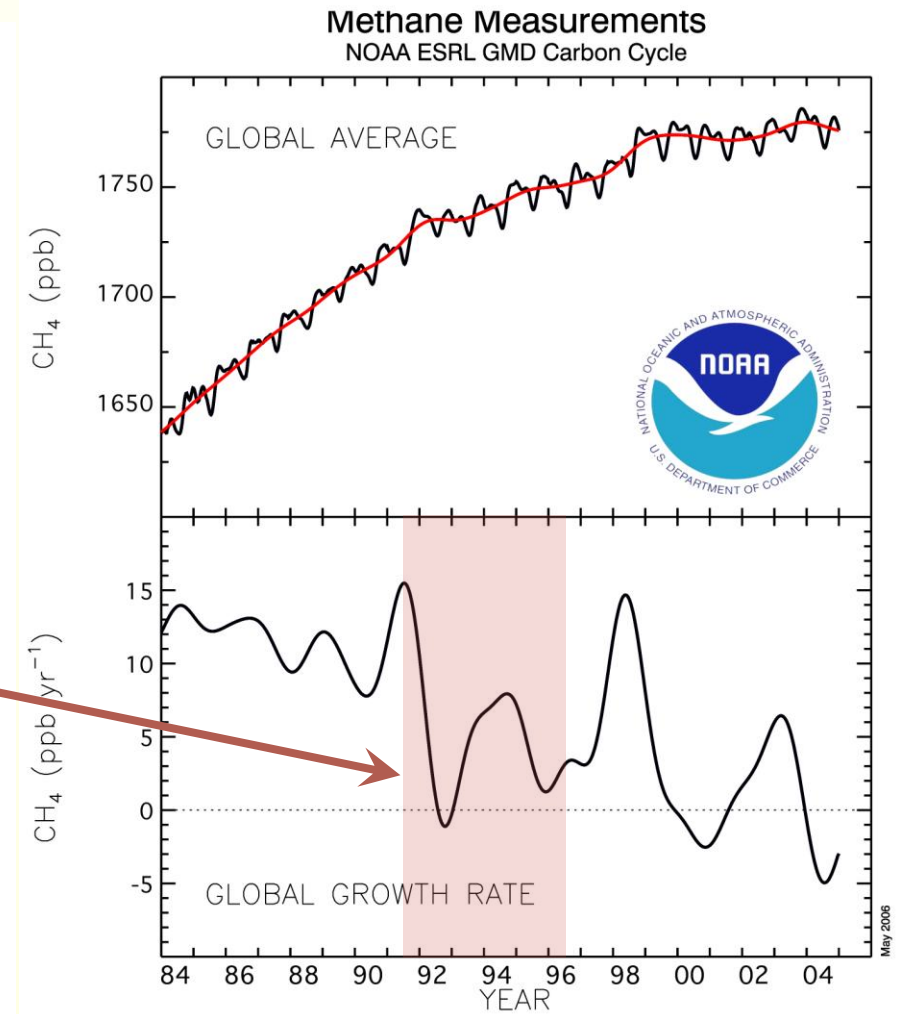
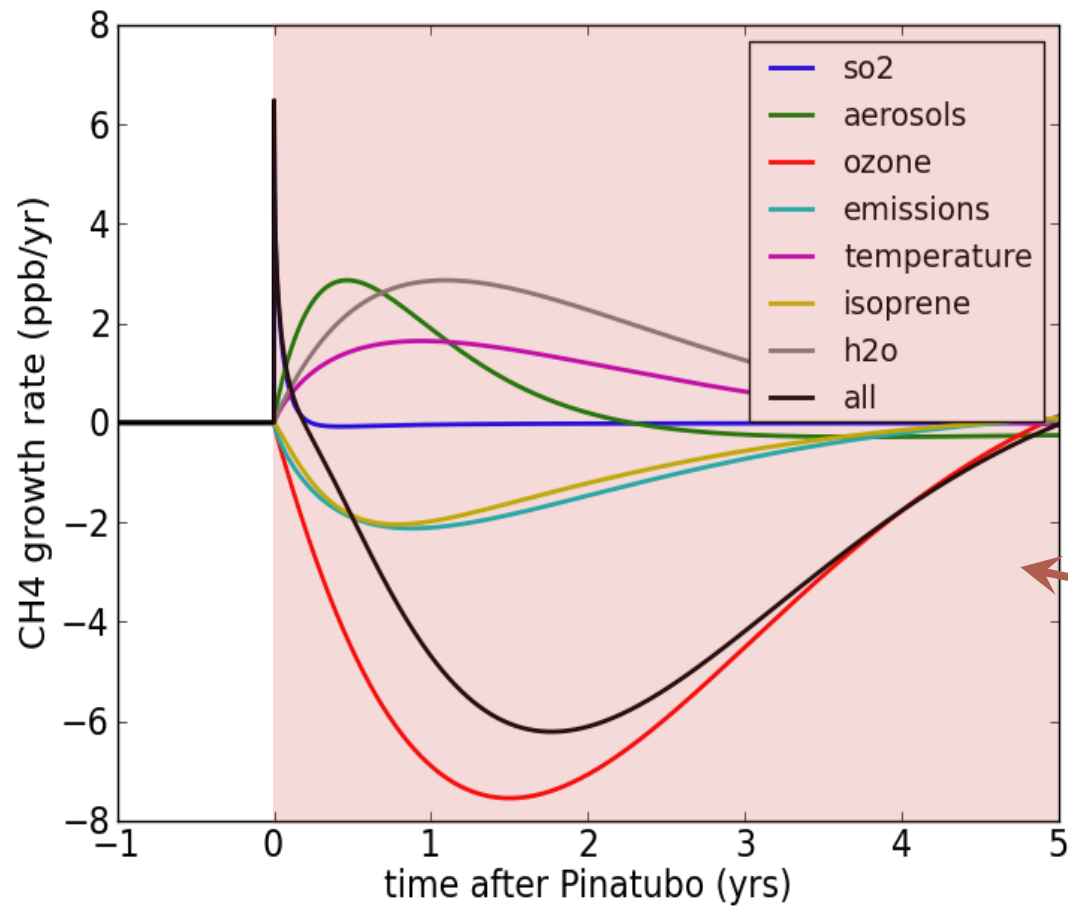
Time evolution of the forcings



Evolution of methane concentrations



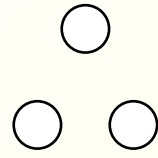
Methane growth rate



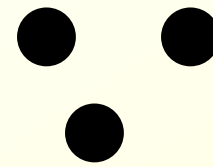
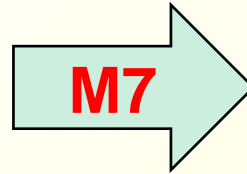
Conclusions

- Effect of the eruption is dominated by the SO₂ forcing in the first few months after the eruption, then by the ozone forcing
- Other effects are in the same order of magnitude but compensate each other
- Results for growth rate show remarkably good agreement with measurements, considering the simplicity of the model
- Spatial distributions also important => 3D simulations

Plans for TM5



SO₂



aerosol

stratosphere

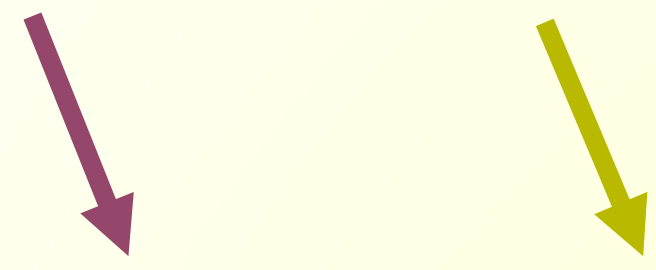
troposphere



SO₂

aerosol

stratosphere



troposphere

M7 + Jason's new photolysis
=> Effect on OH

| Process | E_{CH_4} | k | UV | OH | CH ₄ |
|---|------------|-----|----|----|-----------------|
| UV absorption by SO ₂ | | | ↘ | ↘ | ↗ |
| Aerosol scattering of radiation | | | ↘ | ↘ | ↗ |
| Stratospheric ozone depletion | | | ↗ | ↗ | ↘ |
| Reduced CH ₄ wetland emissions | ↘ | | | | ↘ |
| Slower reaction with OH | | ↘ | | | ↗ |
| Reduced isoprene emissions | | | | ↗ | ↘ |
| Less water vapour | | | | ↘ | ↗ |

$$dCH_4 / dt = E_{CH_4} - k \times OH \times CH_4$$

Plans for TM5

- Stratospheric ozone from satellite observations (MSR reanalysis)
- Meteo (including temperature, water vapour) from ERA-Interim
- Anthropogenic emissions Edgar 4.1
- Natural methane and NMVOC emissions from LPJ-WHyMe / ORCHIDEE / MEGAN (?)

Full chemistry run with free CH₄