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NATURAL ENVIRONMENT RESEARCH COUNCIL

Trace Gas Deposition:
The Land/Atmosphere Interface

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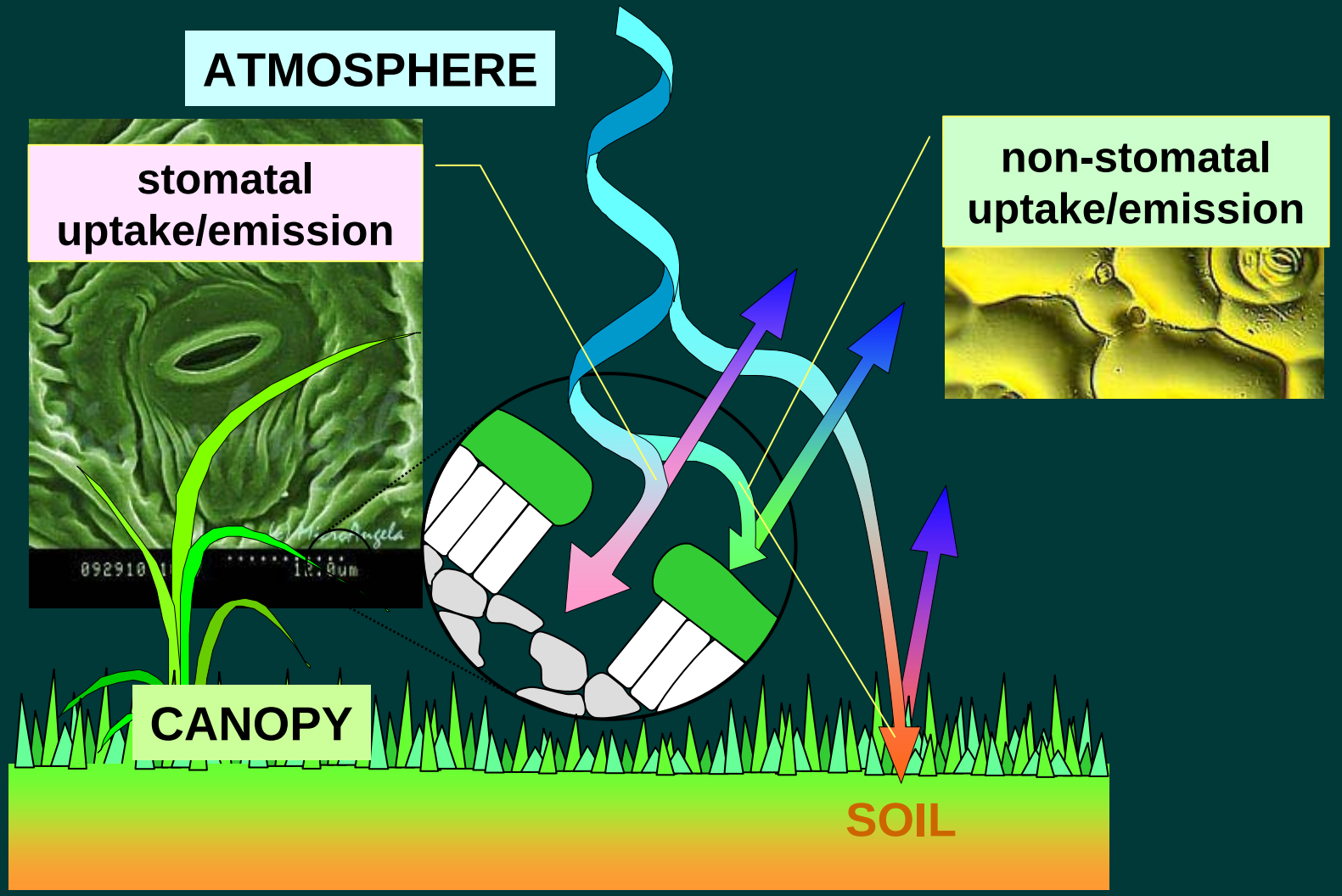
QUAAC
QUEST Atmospheric Aerosols and Chemistry
http://quest.bris.ac.uk/

QUEST
Quantifying and Understanding the Earth System

JULES Science Meeting, University of Exeter, 28th June 2007

Trace Gas Deposition/Emission



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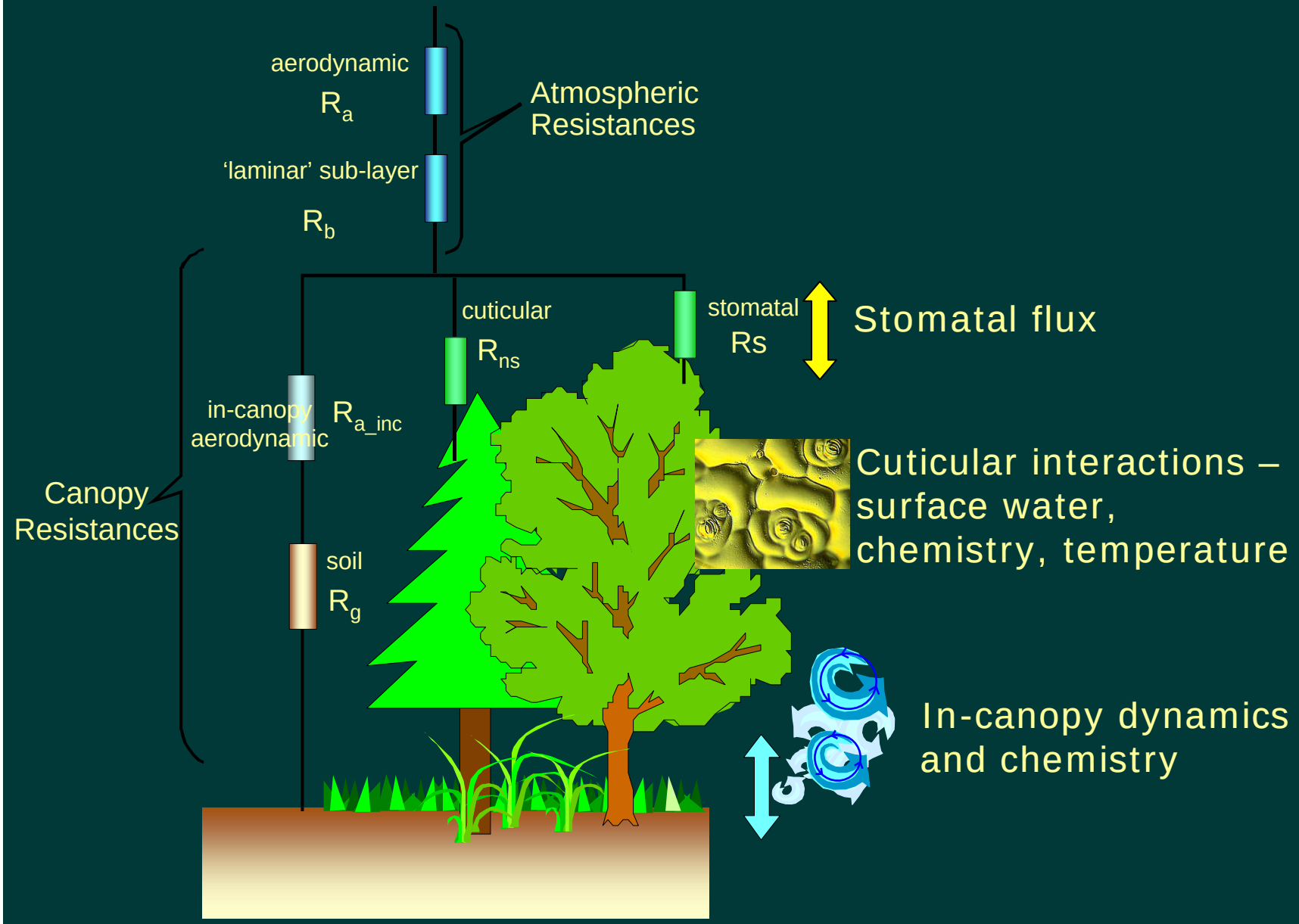

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List for compounds

1. Ozone
2. Nitrogen compounds
   - NOx
   - NH_3
   - aerosol NO_3^-/NH_4^+
   - PAN
3. Others (SO_2, organics, ...)

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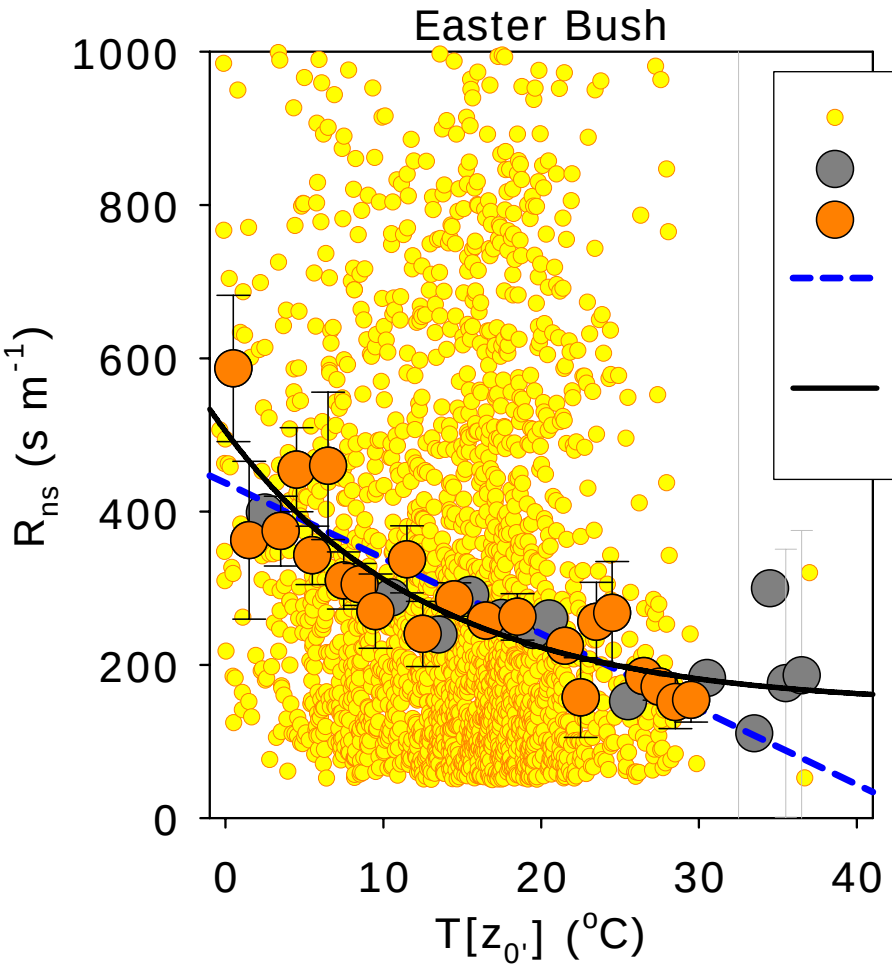
Easter Bush R_{ns}



$$R_{ns} = \left[\frac{1}{R_c} - \frac{1}{R_s}\right]^{-1}$$

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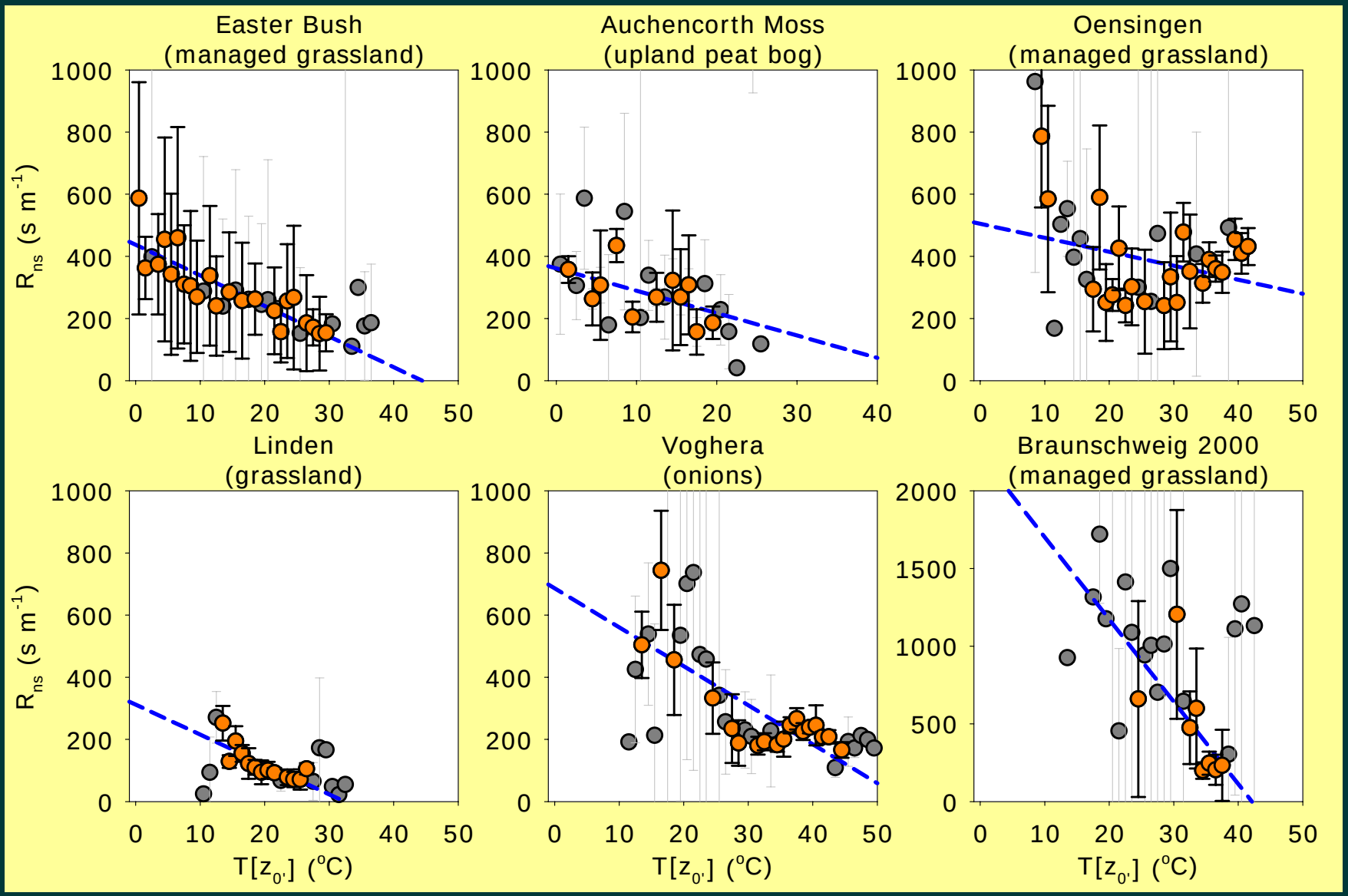
R_{ns} vs $T_{z0'}$ Dry Surfaces – short canopies



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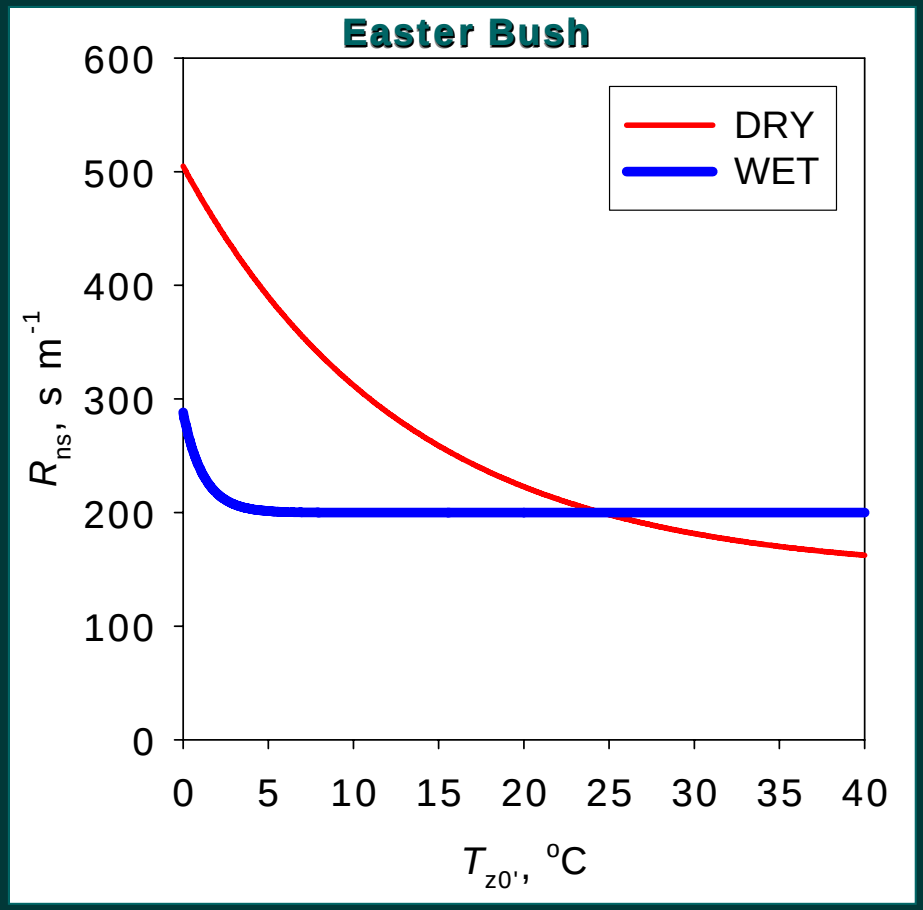
O_3 Deposition



	DRY	WET	Δ%
Easter Bush	242	177	-27%
Braunschweig	1282	1125	-12%
Oensingen	371	277	-25%

- Scheme for wet and dry surfaces with RH dependant transition
- Landcover specific parameters for
  - Grasslands
  - Coniferous
  - Deciduous (?)
  - Moorland (?)
  - Crops (?)
  - ……

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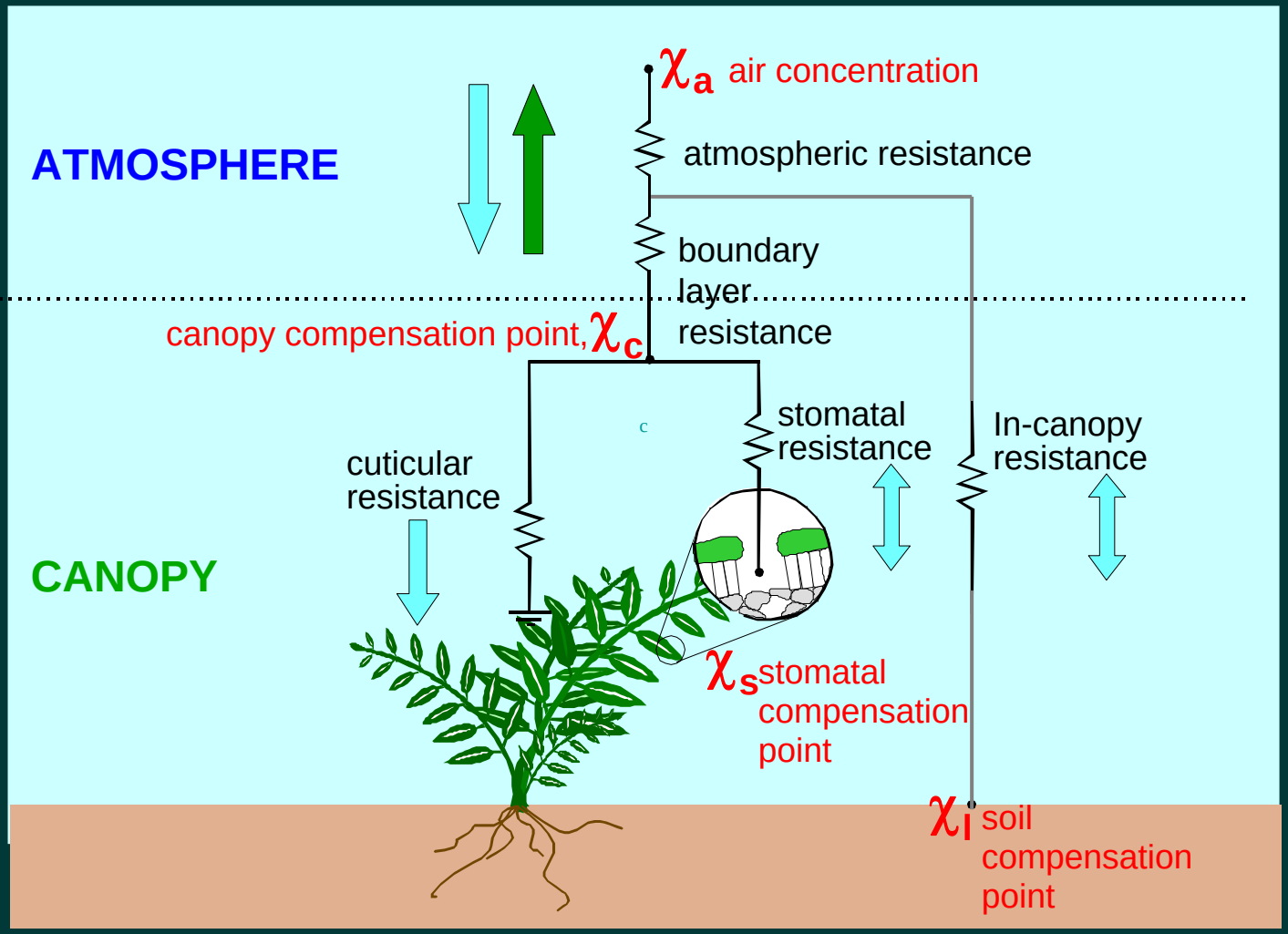
NH_3 Canopy compensation point model

$$\chi_s = f(T, \Gamma)$$

$$\Gamma = \frac{[NH_4^+]_{apo}}{[H^+]_{apo}}$$



Nemitz, Milford & Sutton (Quart. J. Royal Meteor. Soc. 2000)

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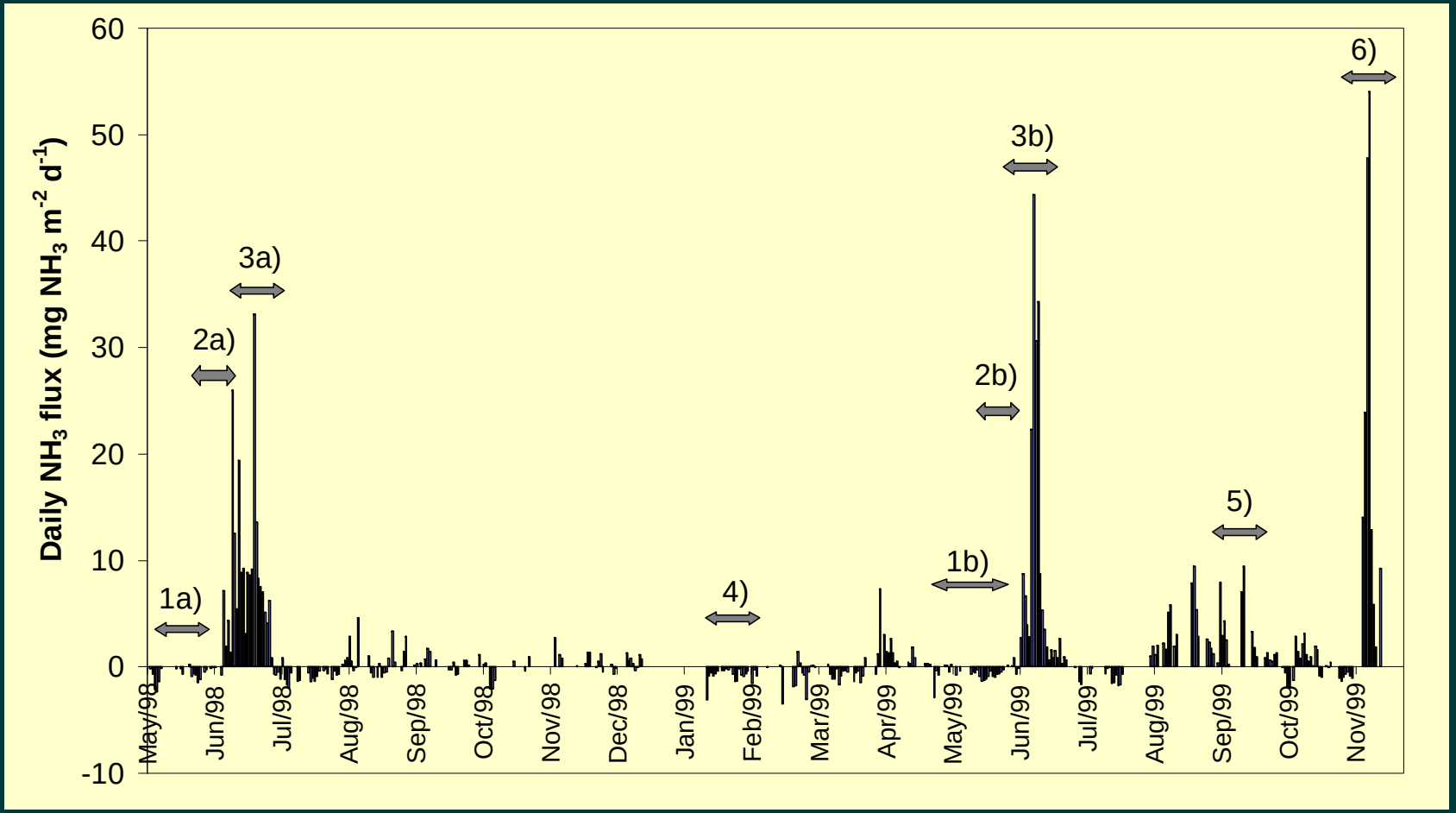

Daily fluxes of NH_3 at Easter Bush (only presenting daily fluxes where data capture > 65%). Arrows indicate key periods of NH3 exchange: 1) Pre-cut, 2) Post-cut, 3) Post-fertilisation, 4) Winter, 5) Grazing and 6) Urea application, a and b indicate periods in 1998 and 1999, respectively.

Milford, 2003

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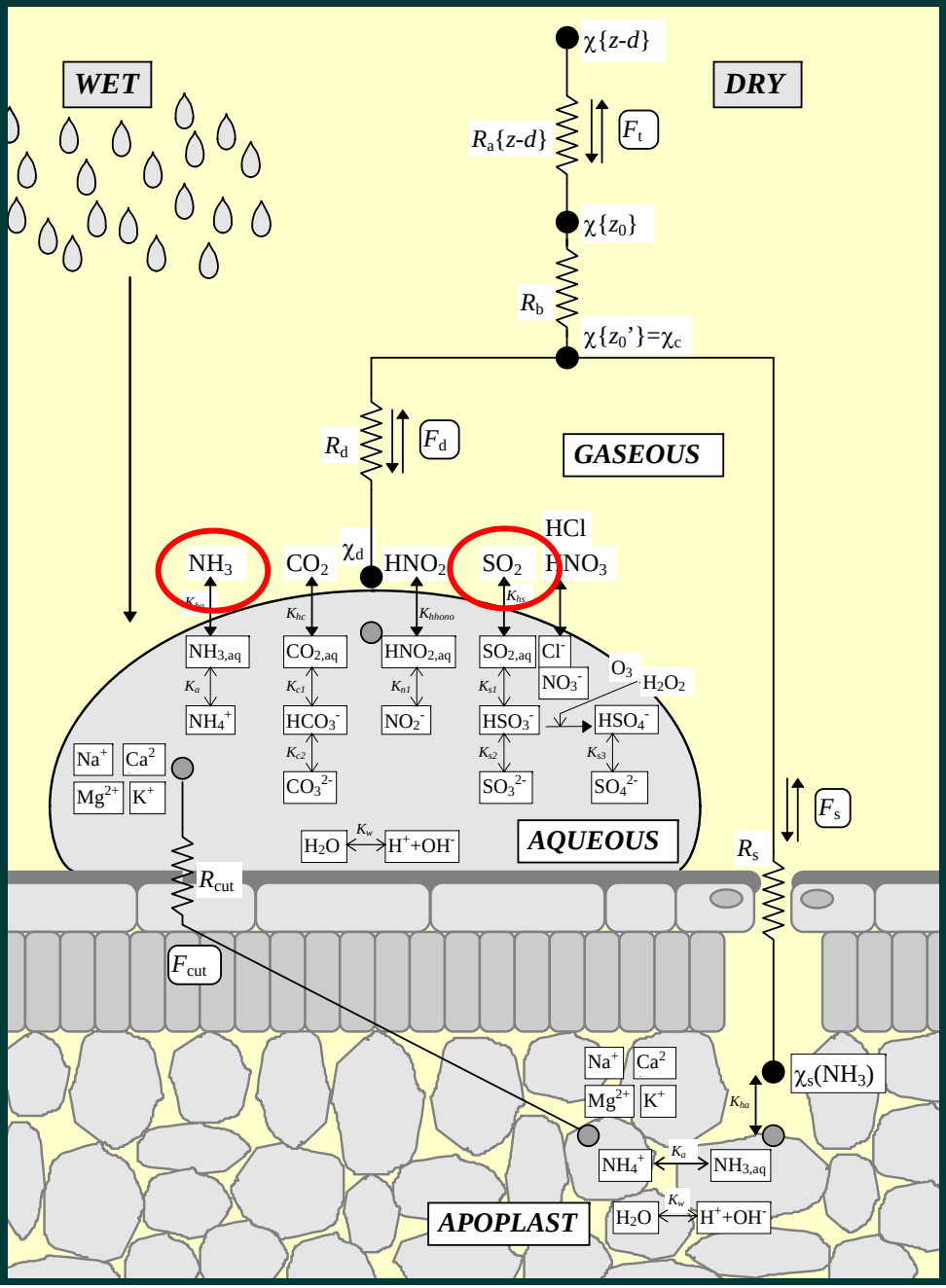

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Parameters needed from a vegetation model

- surface roughness, z_0
- canopy height
- LAI and SAI
- sensible heat flux
- latent heat flux
- friction velocity
- rainfall/snow cover
- surface wetness
- canopy temperature
- stomatal conductance
- relative humidity, solar radiation .....

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- Surface deposition to vegetation is a significant sink/source for some trace gases
- Making good predictions of atmospheric concentrations needs a good land/atmosphere transfer scheme
- For some species relatively detailed information on canopy structure maybe required (ie for in-canopy processes)
- Agricultural practice can have a major influence (tilling, sowing, fertiliser applications, harvest)

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