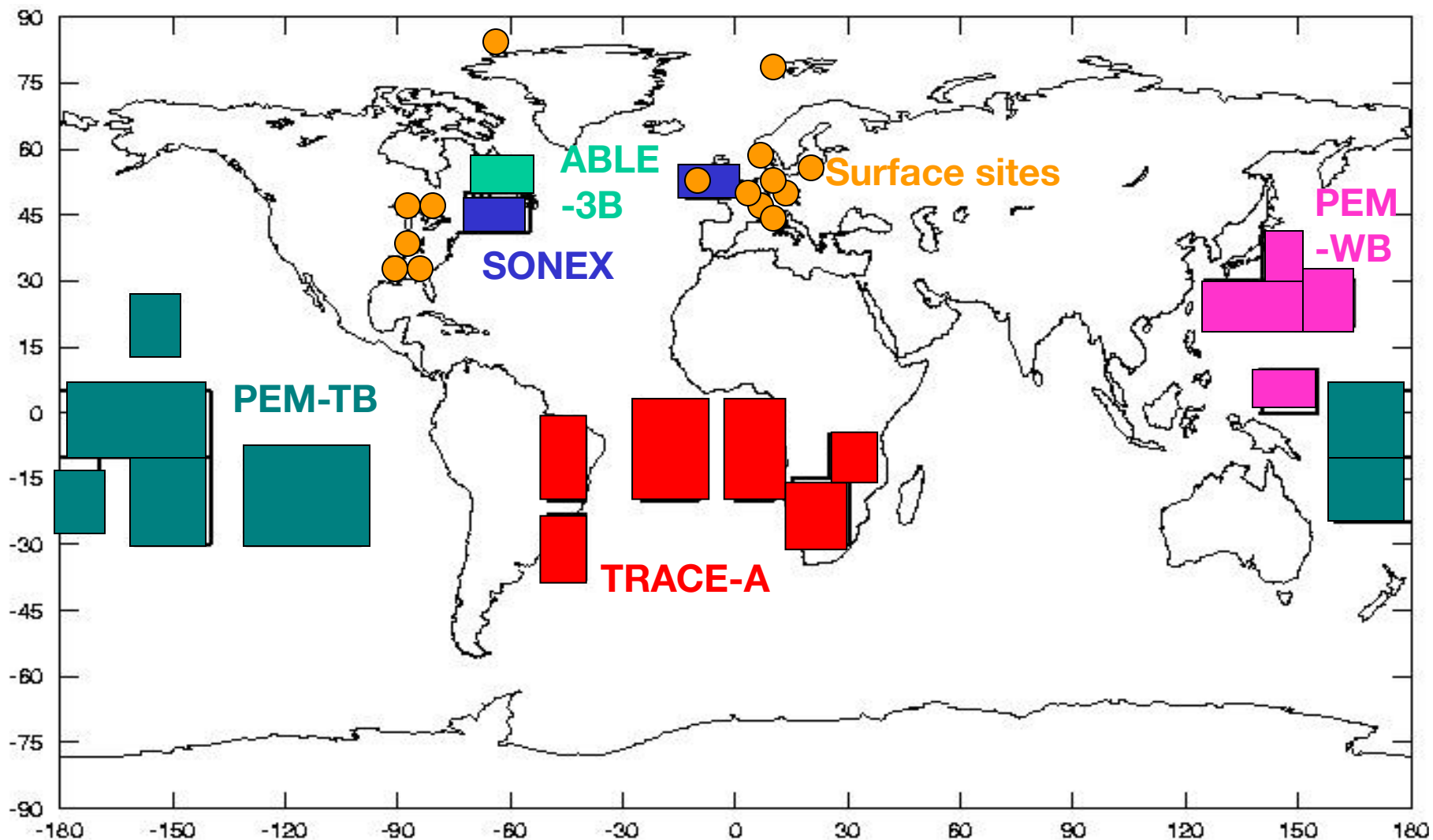


# GLOBAL BUDGET OF ATMOSPHERIC ACETONE

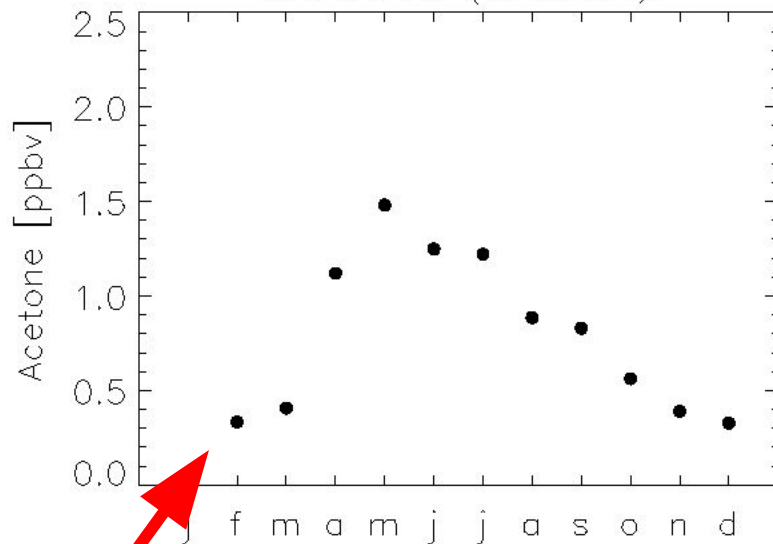
	Singh et al. [2000]	This work (a priori)	This work (optimized)
<b><i>SOURCES</i> (<math>Tg\ yr^{-1}</math>)</b>	<b>56 (37-80)</b>	<b>78 (49-105)</b>	<b>95 (80-110)</b>
Terrestrial vegetation	15 (10-20)	26 (0-52)	33 (24-42)
Plant decay	6 (4-8)	9 (0-18)	2 (-3-7)
Biomass burning	5 (3-10)	3 (2-5)	5 (3-7)
Industry	2 (1-3)	1 (1-2)	1 (1-2)
Oceans	0	10 (0-20)	27 (21-33)
Oxidation of isoalkanes	17 (12-24)	20 (10-30)	21 (16-26)
Oxidation of terpenes, MBO	11 (7-15)	9 (3-15)	7 (3-11)
<b><i>SINKS</i> (<math>Tg\ yr^{-1}</math>)</b>	<b>56 (37-80)</b>	<b>78</b>	<b>95</b>
Photolysis	36 (24-51)	44	46
Oxidation by OH	13 (9-19)	25	27
Deposition to land	7 (4-10)	9	9
Uptake by ocean	0	0	14
<b>LIFETIME</b>	<b>16 days</b>	<b>20 days</b>	<b>15 days</b>

# ATMOSPHERIC OBSERVATIONS OF ACETONE (0.2-3 ppbv)



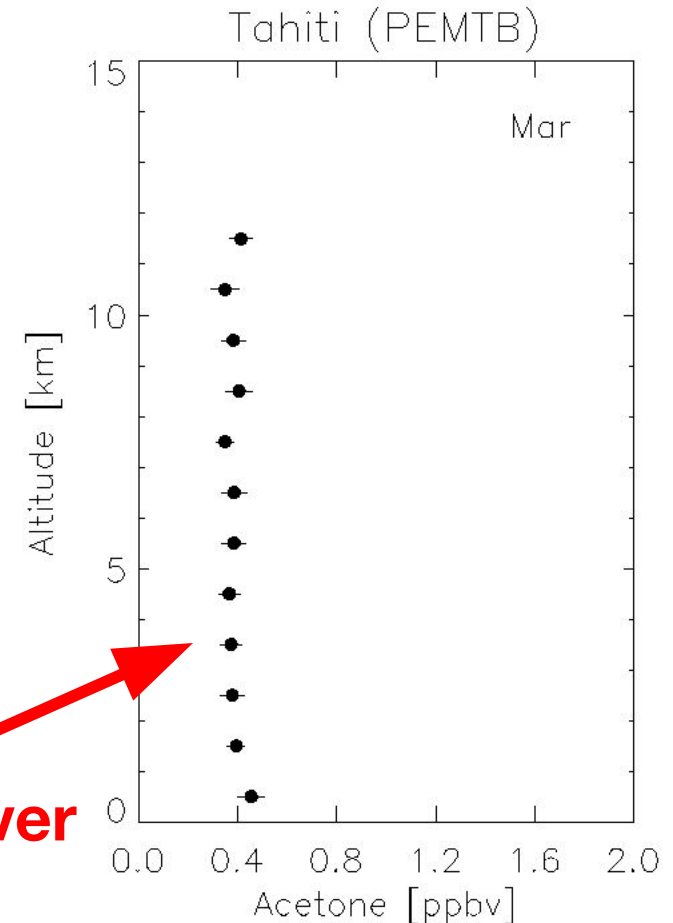
# OCEANIC SIGNATURE IN ATMOSPHERIC ACETONE OBSERVATIONS?

southern Sweden  
[Solberg et al., 1996]  
Birkenes (8E,58N)



**Low winter values  
over Europe:  
ocean sink?**

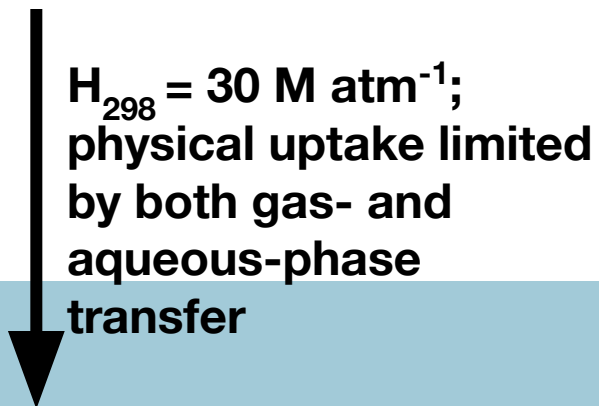
South Pacific  
[Singh et al., 2001]



**High values over  
South Pacific:  
ocean source?**

# ROLE OF OCEAN IN ATMOSPHERIC BUDGET OF ACETONE

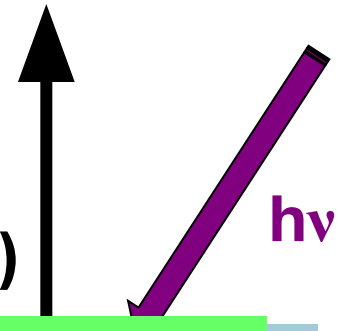
**SINK?**



**Biological uptake  
(Kieber et al., 1990)**

**SOURCE?**

**Zhou and  
Mopper (1997)**



**Organic microlayer**

**Model sink as  
adjustable  
saturation ratio  $R$**

**Model source as  
proportional  
To UV-B flux**

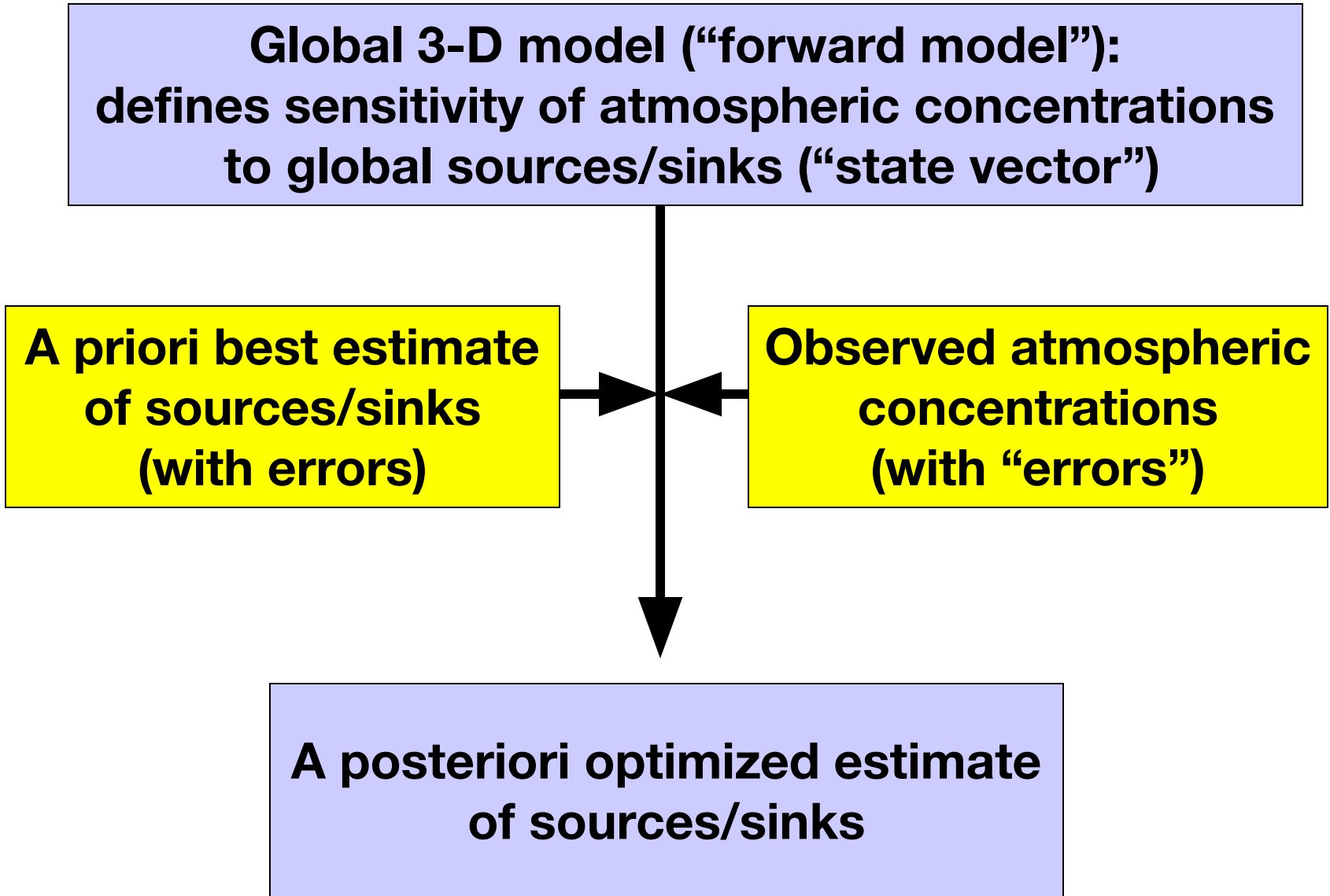
# INVERSE MODEL ANALYSIS OF ACETONE BUDGET

**Global 3-D model (“forward model”):  
defines sensitivity of atmospheric concentrations  
to global sources/sinks (“state vector”)**

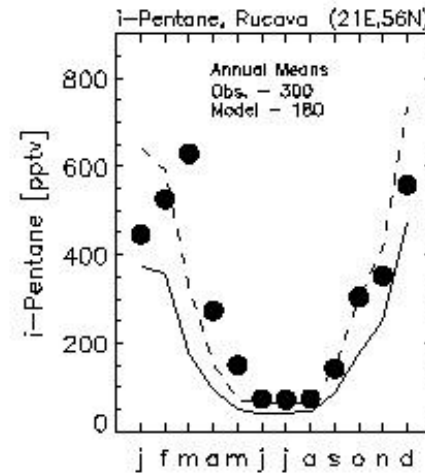
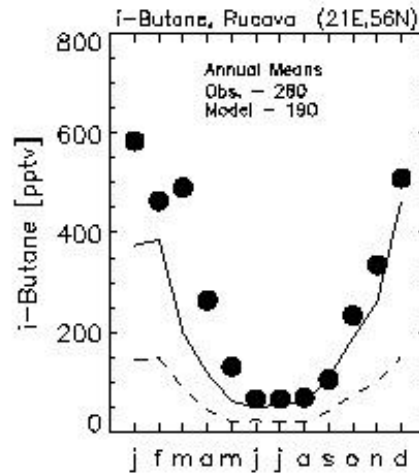
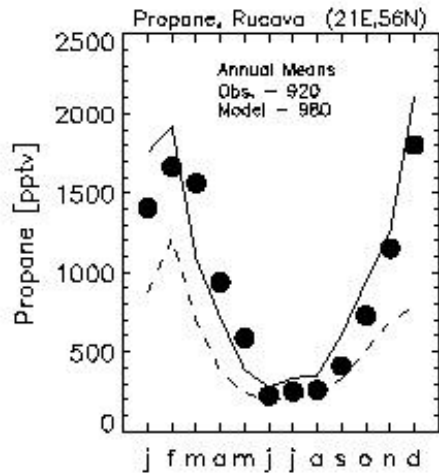
**A priori best estimate  
of sources/sinks  
(with errors)**

**Observed atmospheric  
concentrations  
(with “errors”)**

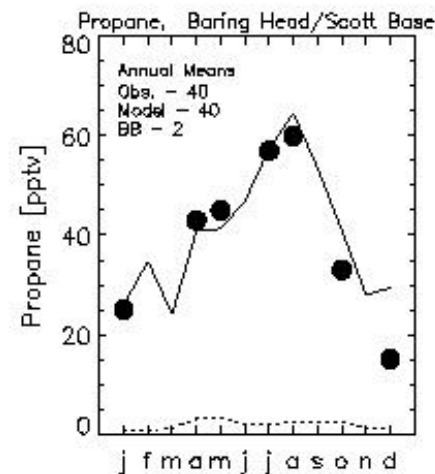
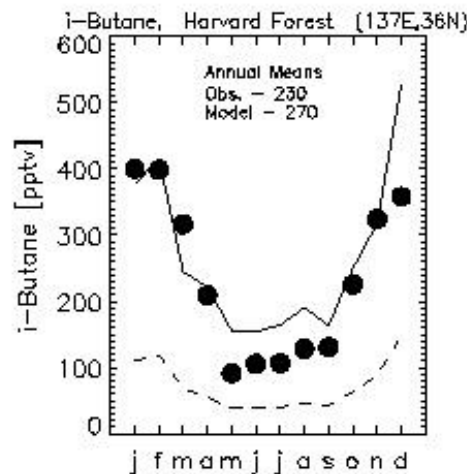
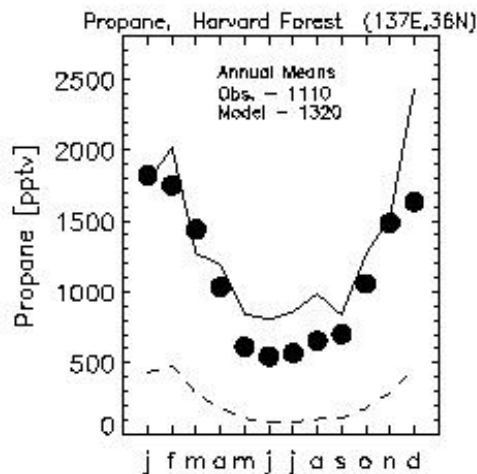
**A posteriori optimized estimate  
of sources/sinks**



# CONSTRUCTING THE A PRIORI: SIMULATION OF C<sub>3-5</sub> ISOALKANES TO IMPROVE CONSTRAINT ON EMISSIONS

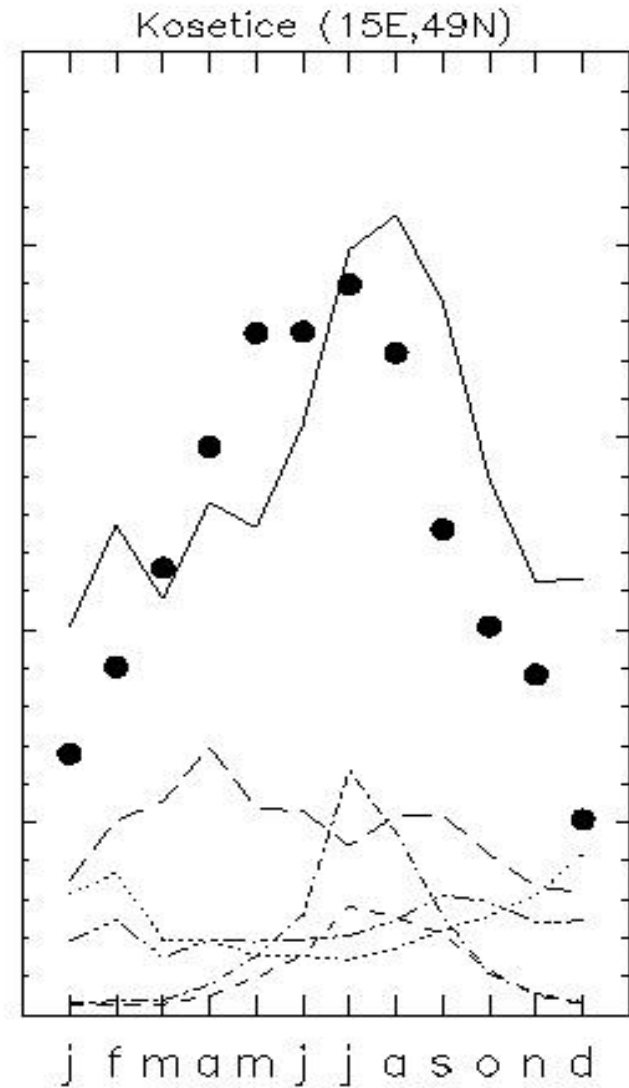
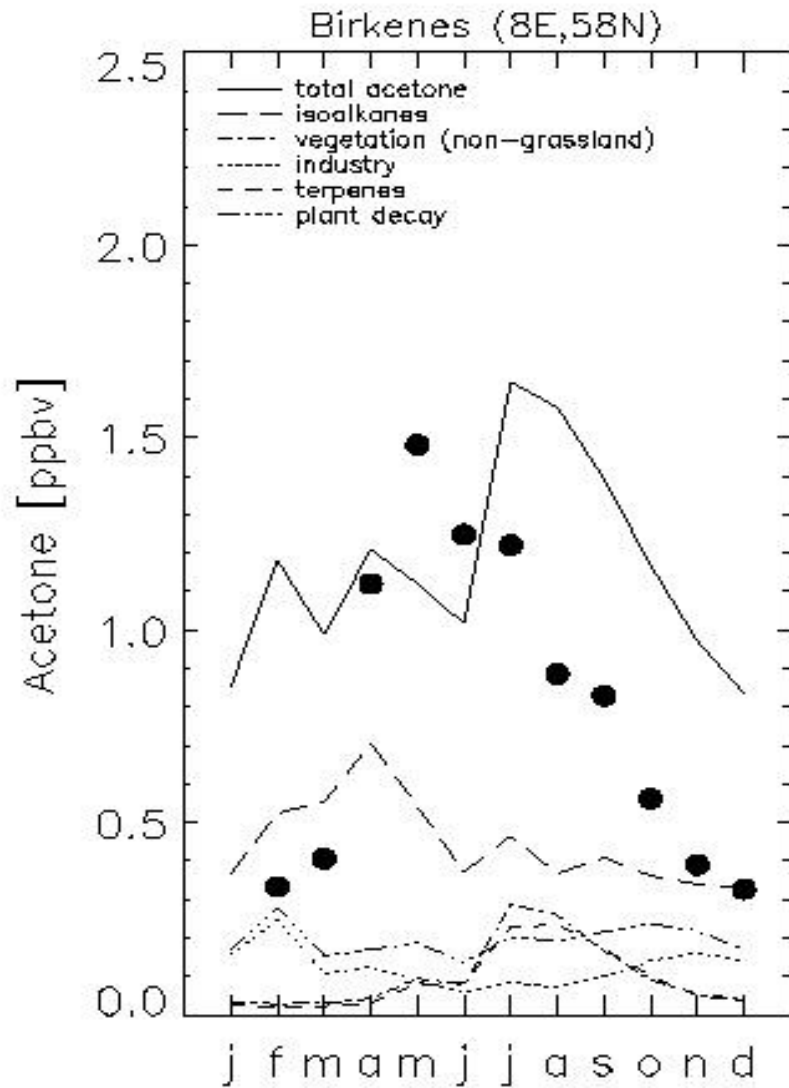


● observed  
— model (EDGAR)  
— model (Piccot+)

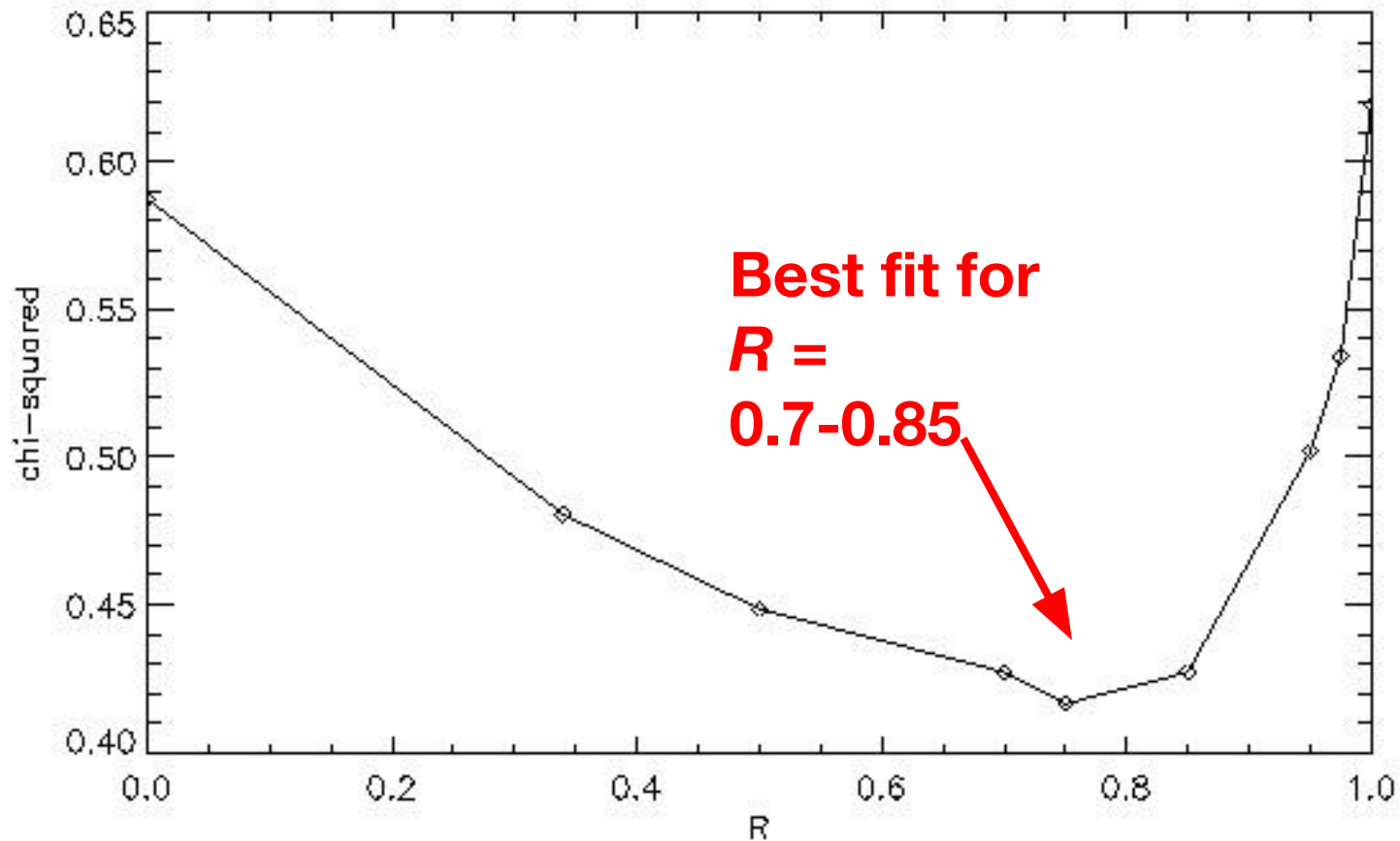


Global propane source of 12 Tg C yr<sup>-1</sup>, mainly natural gas

# CONTRIBUTION OF DIFFERENT SOURCES TO A PRIORI BUDGET OF ACETONE (symbols: observations    lines: model)

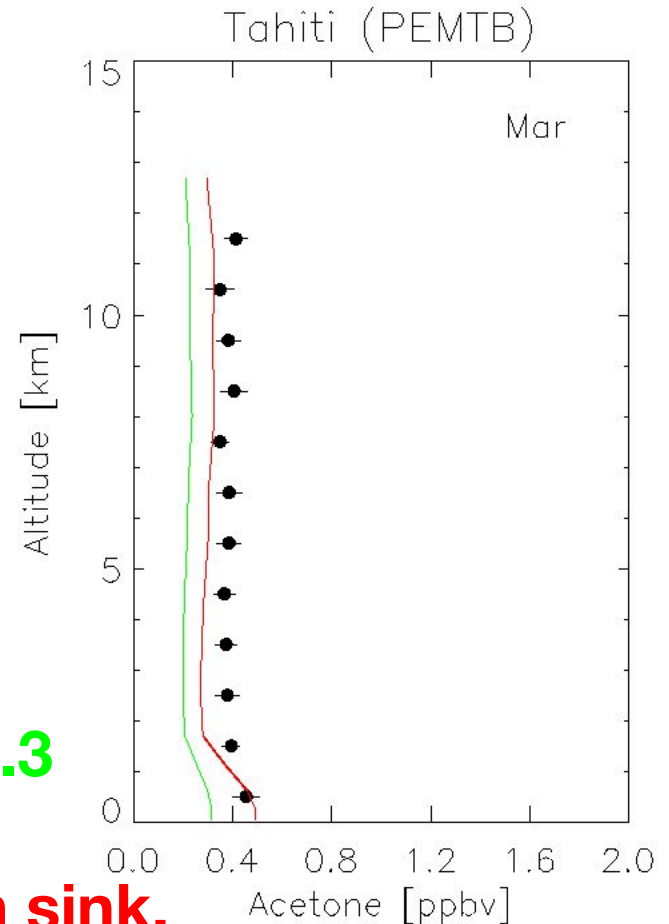
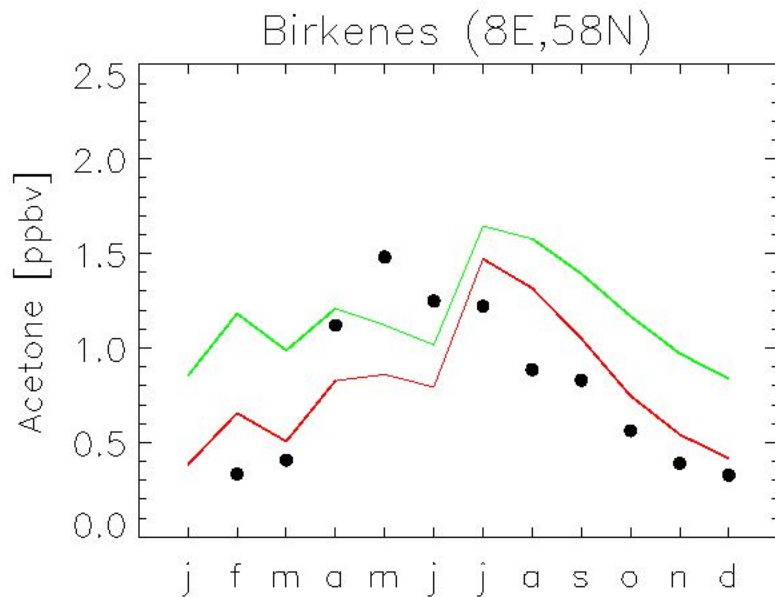


# FITTING OF OCEAN SATURATION RATIO $R$ TO MINIMIZE MODEL vs. OBSERVED CHI-SQUARE IN A POSTERIORI OPTIMIZED SOURCES





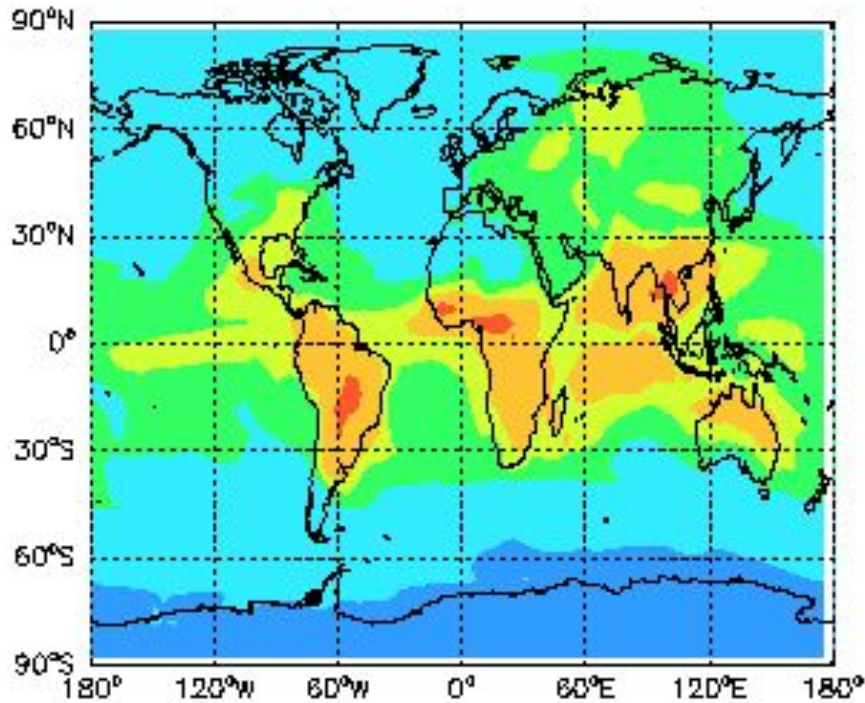
# OPTIMIZED GLOBAL 3-D MODEL SIMULATION OF ATMOSPHERIC ACETONE



- a priori sources/sinks;  $\chi^2 = 1.3$**
- Optimized sources/sinks (including “microbial” ocean sink, photochemical ocean source);  $\chi^2 = 0.39$**

# SURFACE AIR ACETONE CONCENTRATIONS IN OPTIMIZED SIMULATION

Surface Acetone in January a-posteriori



Surface Acetone in July a-posteriori

