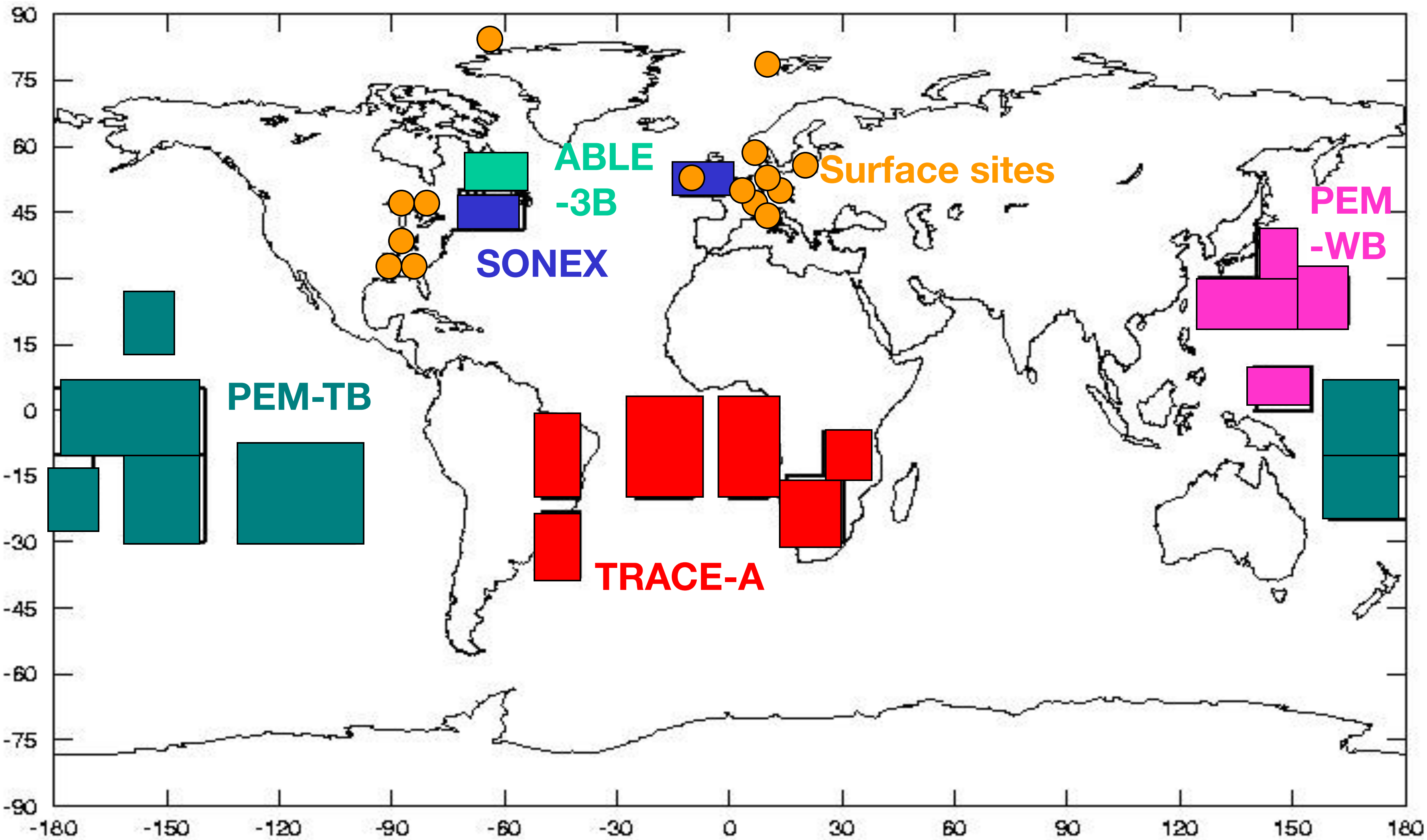
GLOBAL BUDGET OF ATMOSPHERIC ACETONE

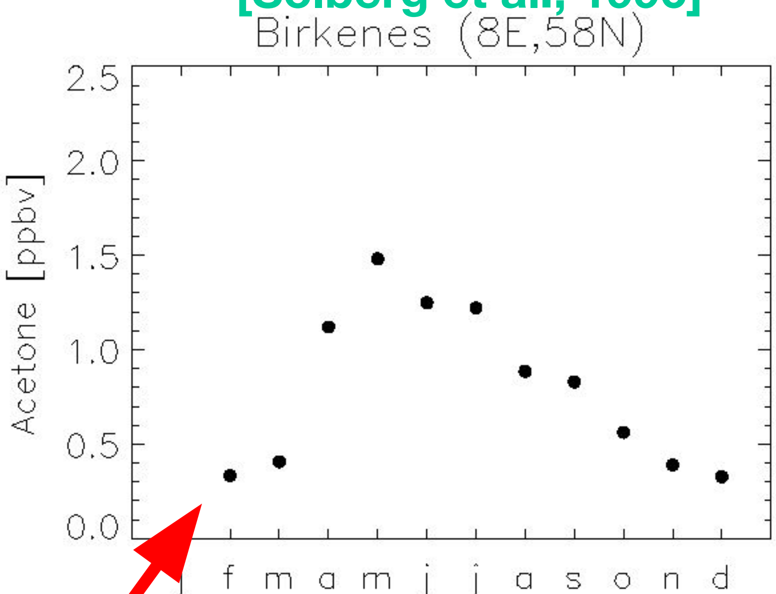
	Singh et al. [2000]	This work (a priori)	This work (optimized)
SOURCES (Tg yr^{-1})	*56 (37-80)*	*78 (49-105)*	*95 (80-110)*
Terrestrial vegetation	15 (10-20)	26 (0-52)	33 (24-42)
Plant decay	6 (4-8)	9 (0-18)	2 (-3-7)
Biomass burning	5 (3-10)	3 (2-5)	5 (3-7)
Industry	2 (1-3)	1 (1-2)	1 (1-2)
Oceans	0	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)
SINKS (Tg yr-1)	*56 (37-80)*	*78*	*95*
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
LIFETIME	16 days	20 days	15 days

ATMOSPHERIC OBSERVATIONS OF ACETONE (0.2-3 ppbv)



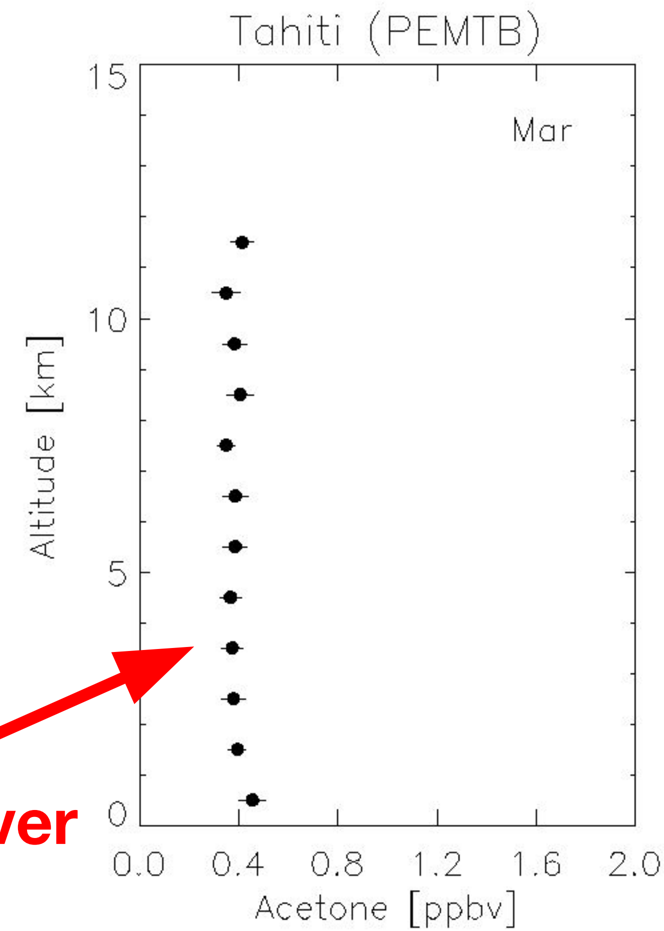
OCEANIC SIGNATURE IN ATMOSPHERIC ACETONE OBSERVATIONS?

southern Sweden
[Solberg et al., 1996]



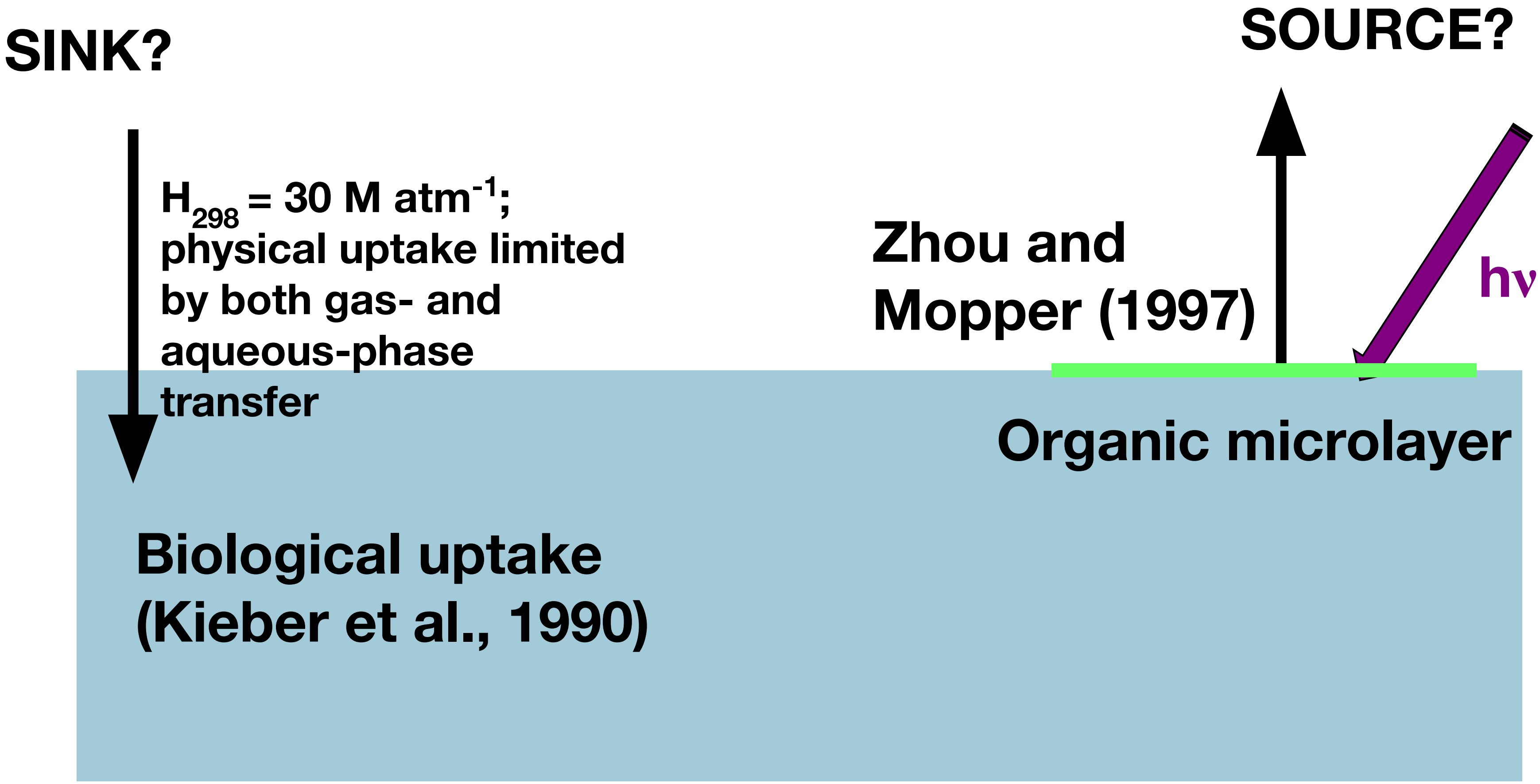
Low winter values over Europe: ocean sink?

South Pacific
[Singh et al., 2001]



High values over South Pacific: ocean source?

ROLE OF OCEAN
IN ATMOSPHERIC BUDGET OF ACETONE



Model sink as
adjustable
saturation ratio *R*

Model source as
proportional
To UV-B flux

INVERSE MODEL ANALYSIS OF ACETONE BUDGET

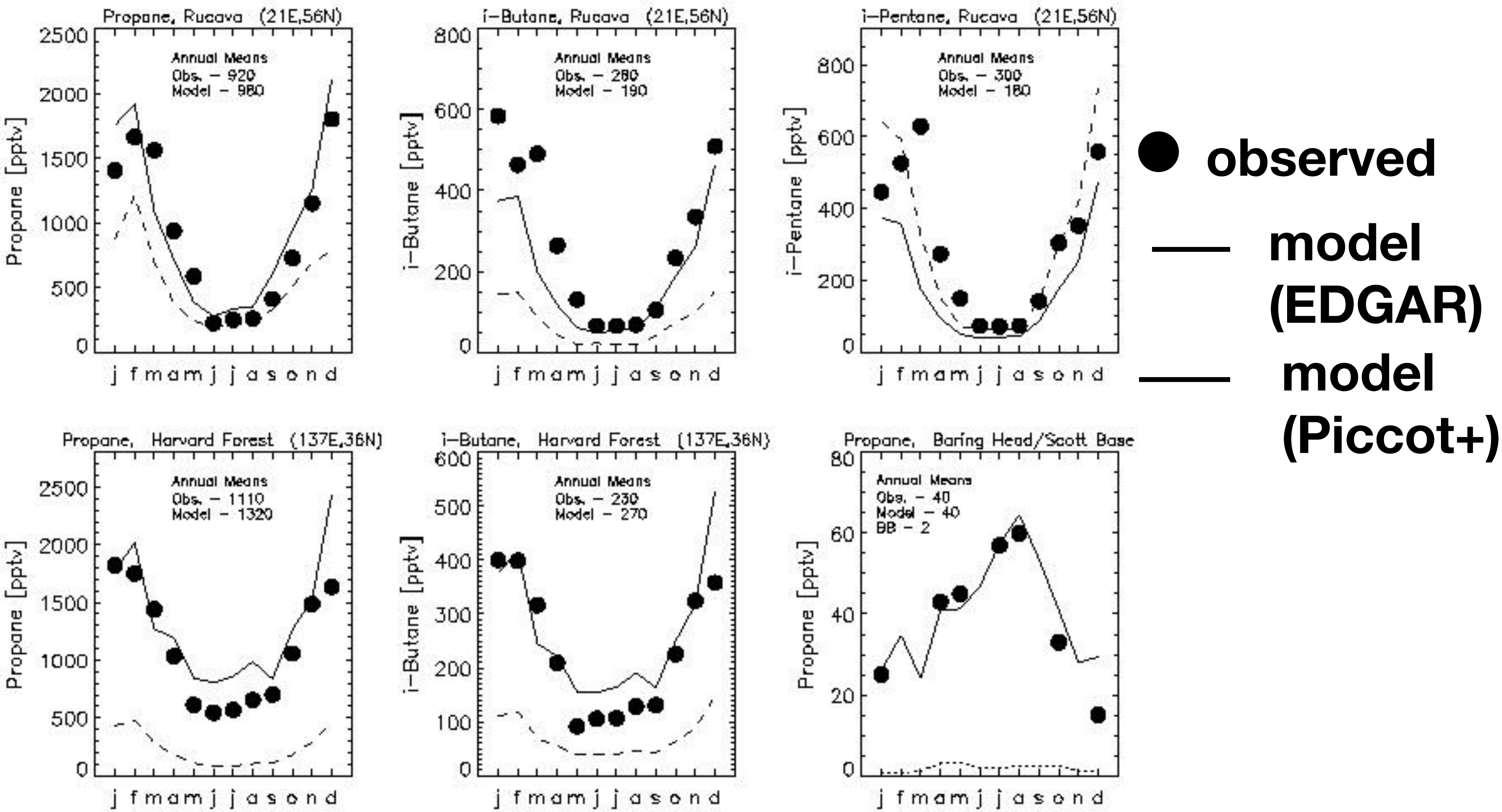
Global 3-D model ("forward model"):
defines sensitivity of atmospheric concentrations to global sources/sinks ("state vector")

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

Observed atmospheric concentrations (with "errors")

A posteriori optimized estimate of sources/sinks

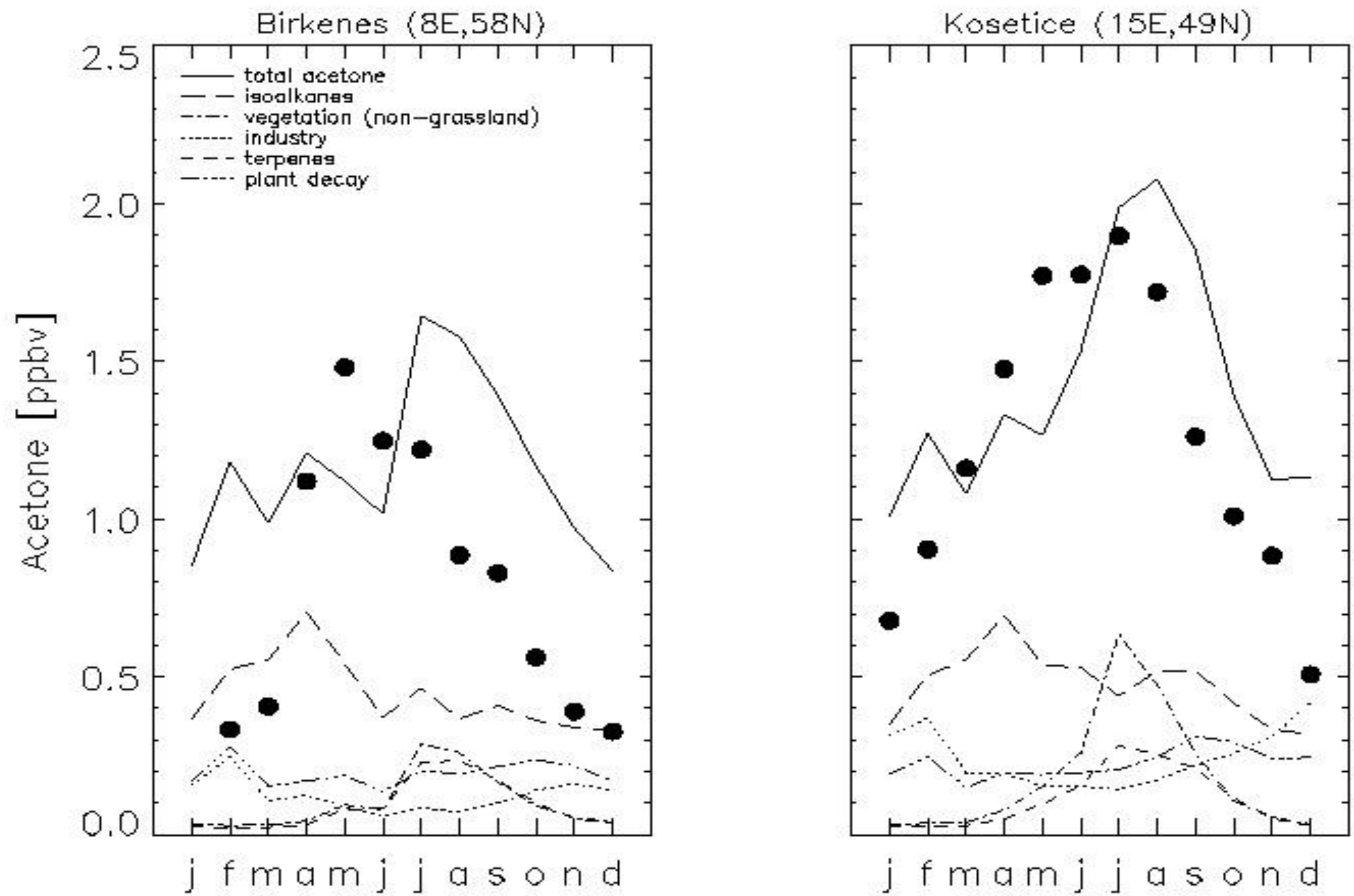
CONSTRUCTING THE A PRIORI: SIMULATION OF C_{3-5} ISOALKANES TO IMPROVE CONSTRAINT ON EMISSIONS



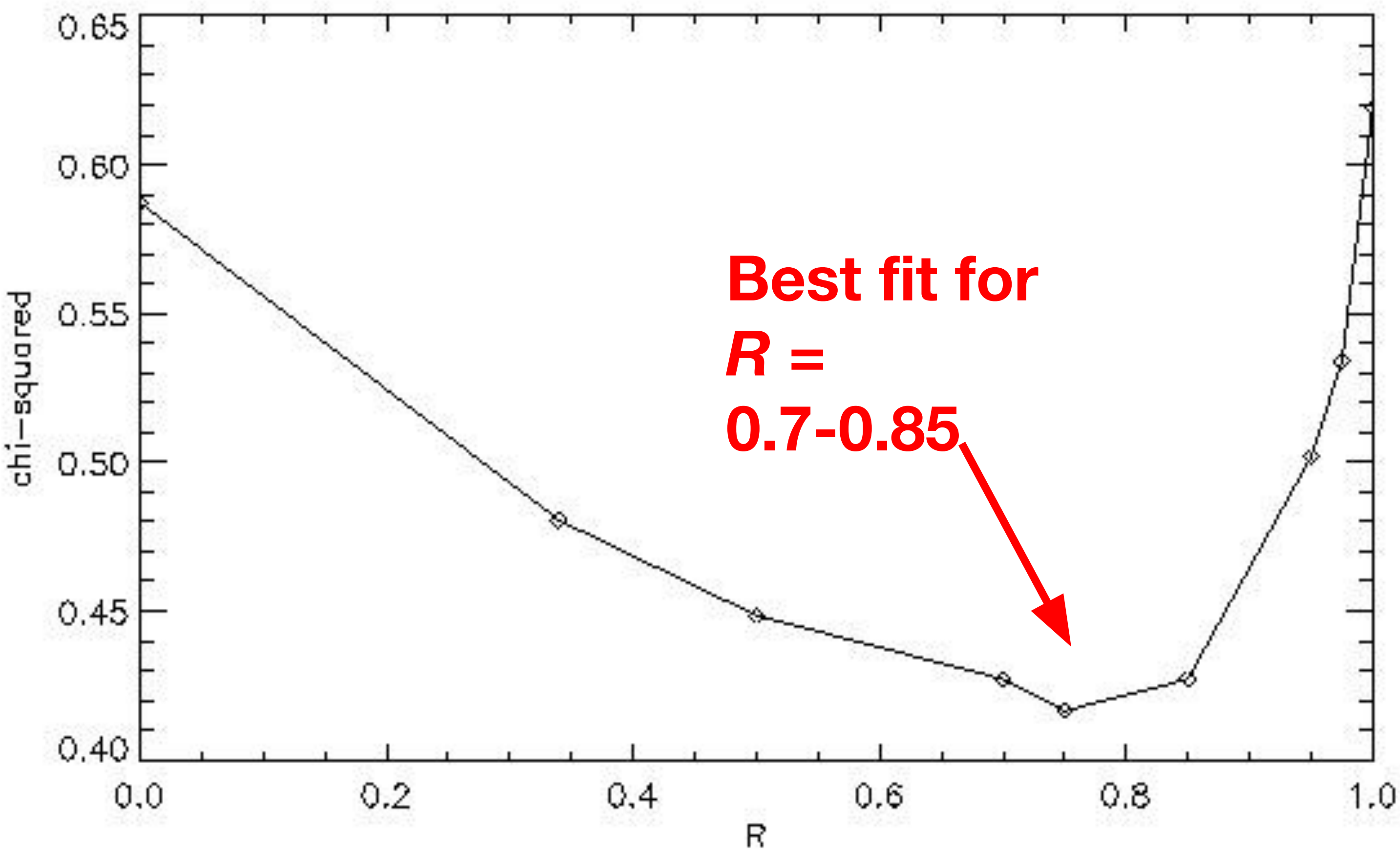
Global propane source of 12 Tg C yr^{-1}, mainly natural gas

CONTRIBUTION OF DIFFERENT SOURCES TO A PRIORI BUDGET OF ACETONE

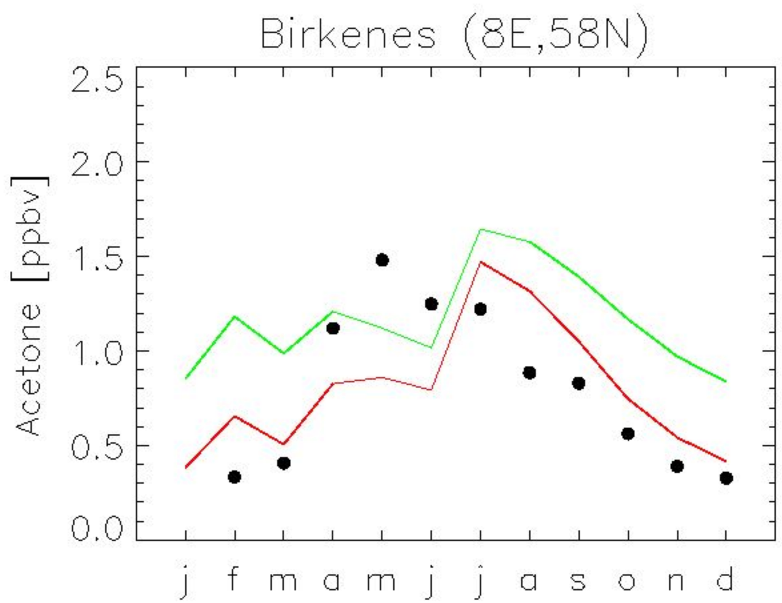
(symbols: observations   lines: model)

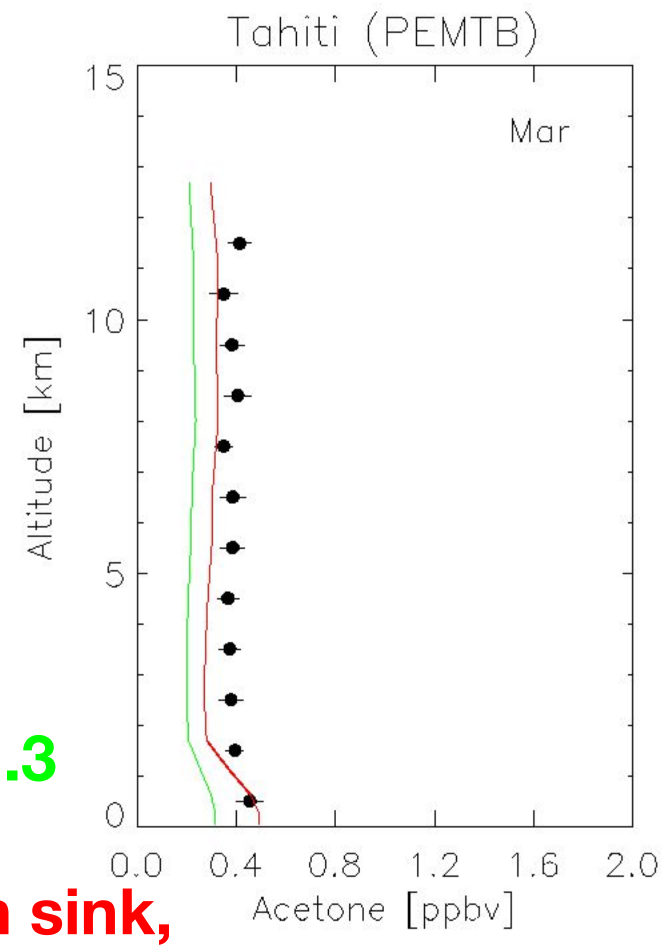


FITTING OF OCEAN SATURATION RATIO *R* TO MINIMIZE MODEL vs. OBSERVED CHI-SQUARE IN A POSTERIORI OPTIMIZED SOURCES



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