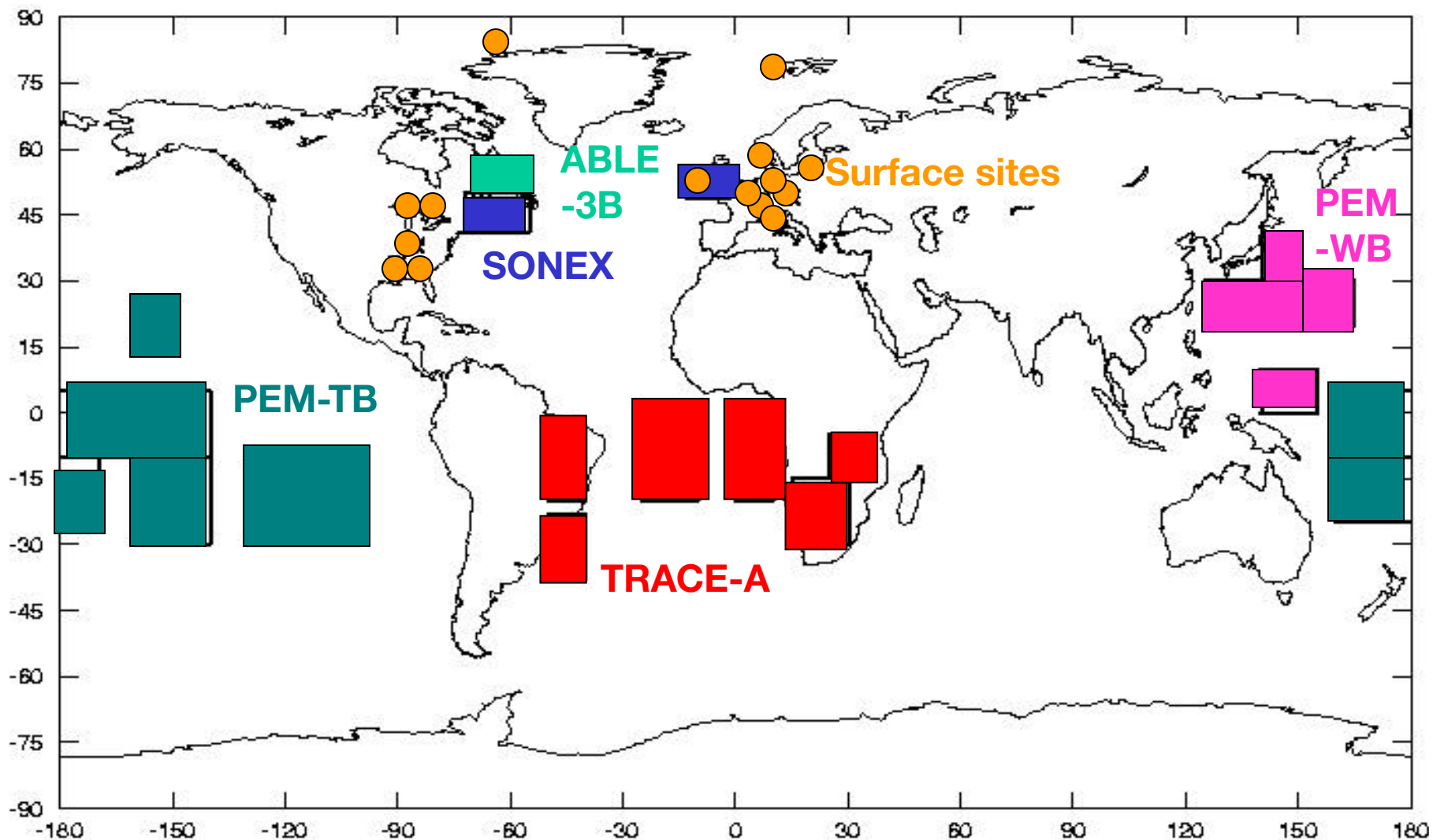


GLOBAL BUDGET OF ATMOSPHERIC ACETONE

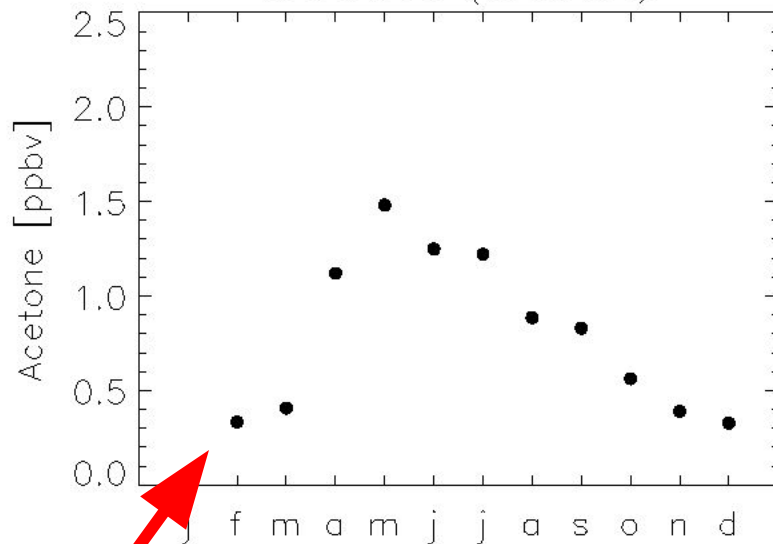
	Singh et al. [2000]	This work (a priori)	This work (optimized)
SOURCES ($Tg\ yr^{-1}$)	56 (37-80)	78 (49-105)	95 (80-110)
Terrestrial vegetation	15 (10-20)	26 (0-52)	33 (24-42)
Plant decay	6 (4-8)	9 (0-18)	2 (-3-7)
Biomass burning	5 (3-10)	3 (2-5)	5 (3-7)
Industry	2 (1-3)	1 (1-2)	1 (1-2)
Oceans	0	10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



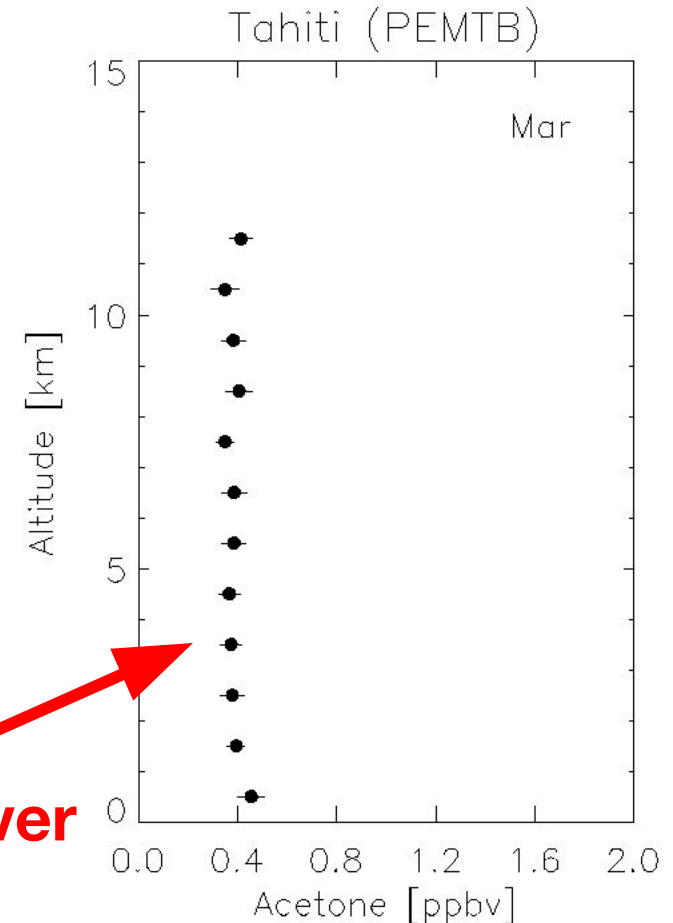
OCEANIC SIGNATURE IN ATMOSPHERIC ACETONE OBSERVATIONS?

southern Sweden
[Solberg et al., 1996]
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?

$H_{298} = 30 \text{ M atm}^{-1}$;
physical uptake limited
by both gas- and
aqueous-phase
transfer




Biological uptake
(Kieber et al., 1990)

**Model sink as
adjustable
saturation ratio R**

SOURCE?

Zhou and
Mopper (1997)



Organic microlayer



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

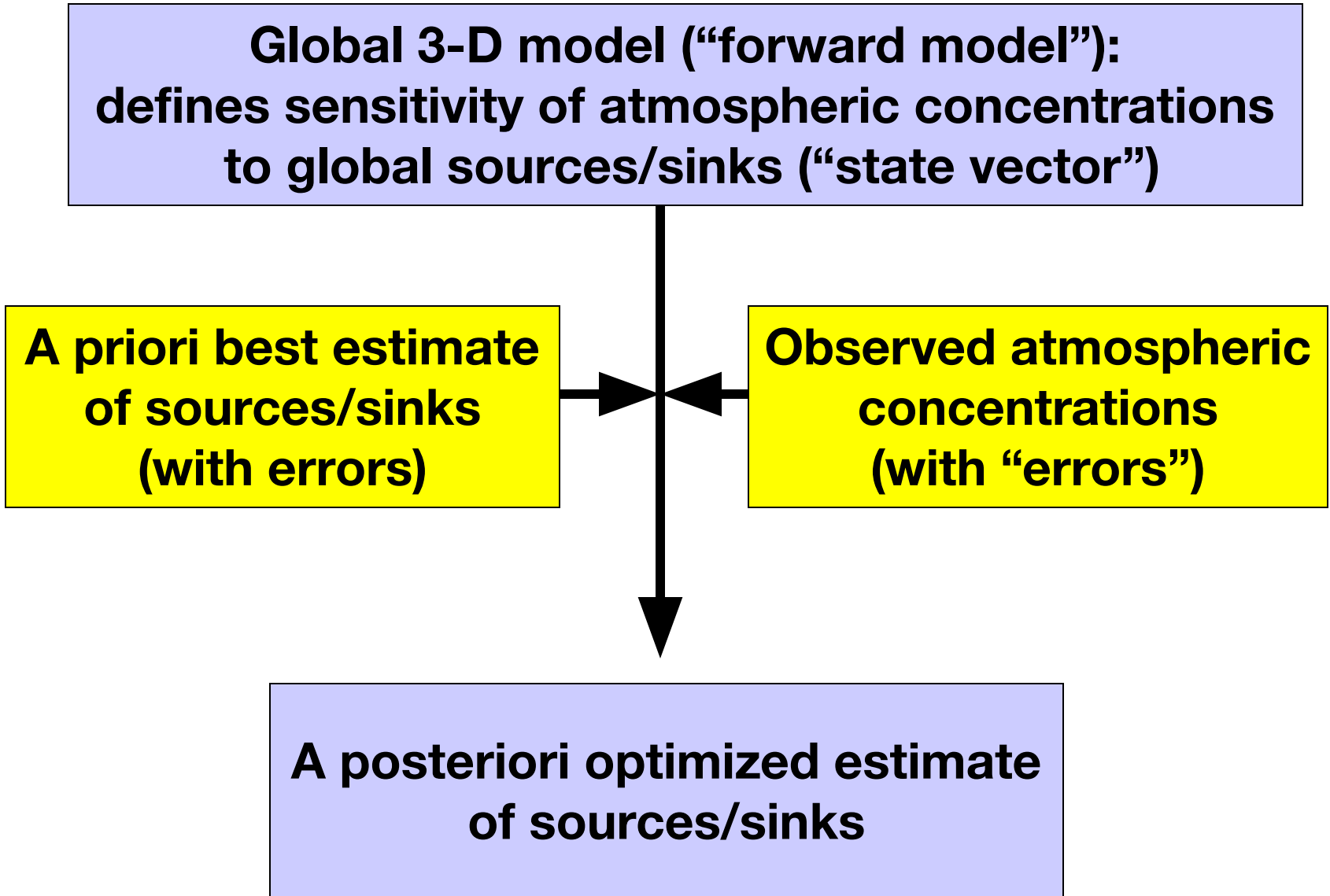
INVERSE MODEL ANALYSIS OF ACETONE BUDGET

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

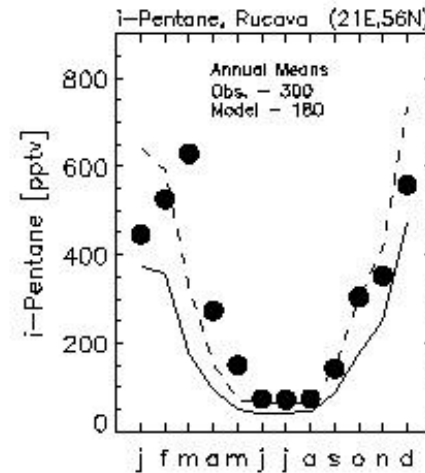
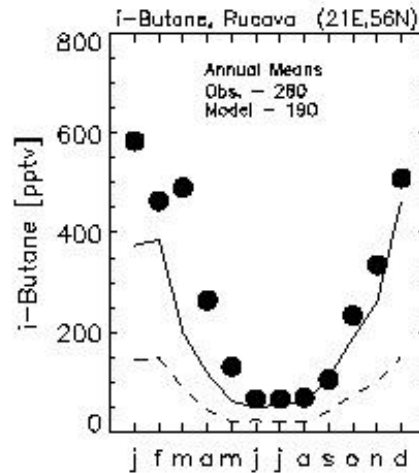
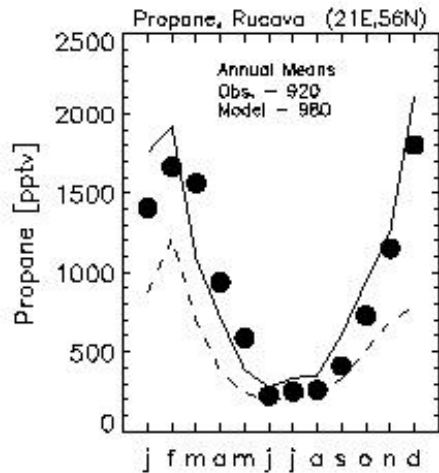
**A priori best estimate
of sources/sinks
(with errors)**

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

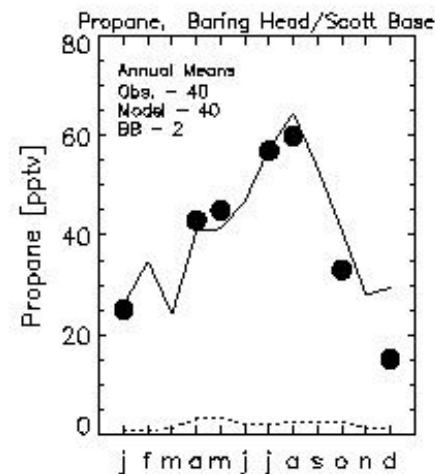
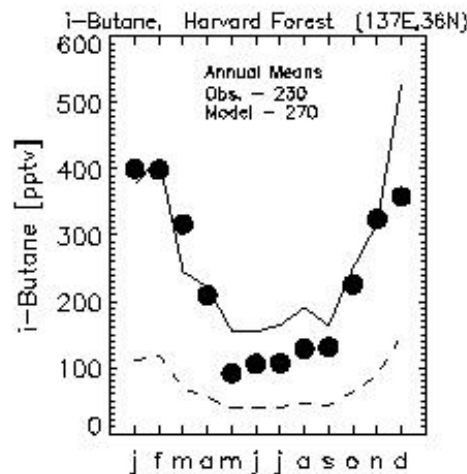
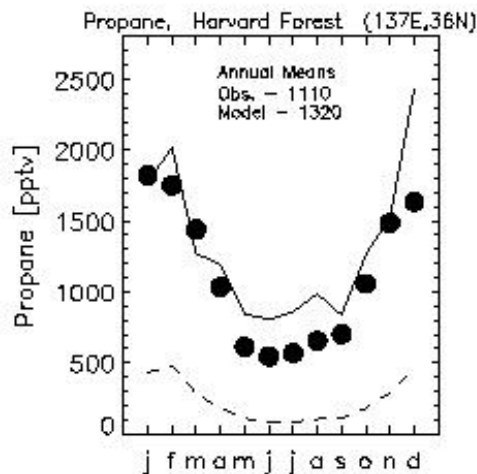
**A posteriori optimized estimate
of sources/sinks**



CONSTRUCTING THE A PRIORI: SIMULATION OF C₃₋₅ ISOALKANES TO IMPROVE CONSTRAINT ON EMISSIONS

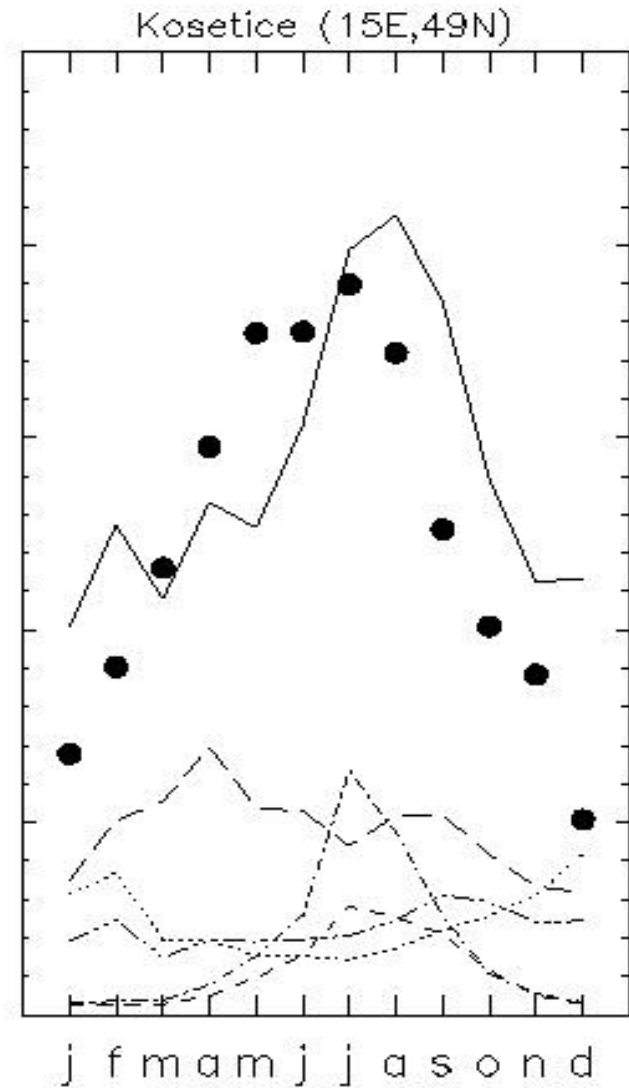
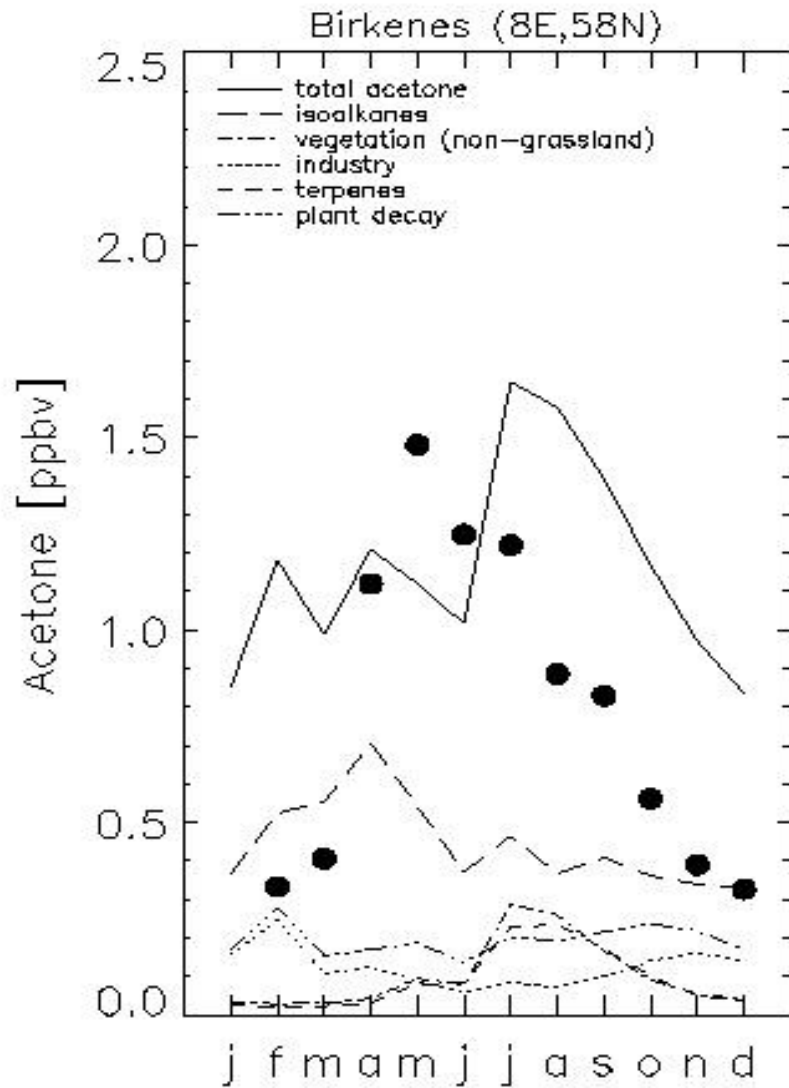


● observed
— model (EDGAR)
— model (Piccot+)

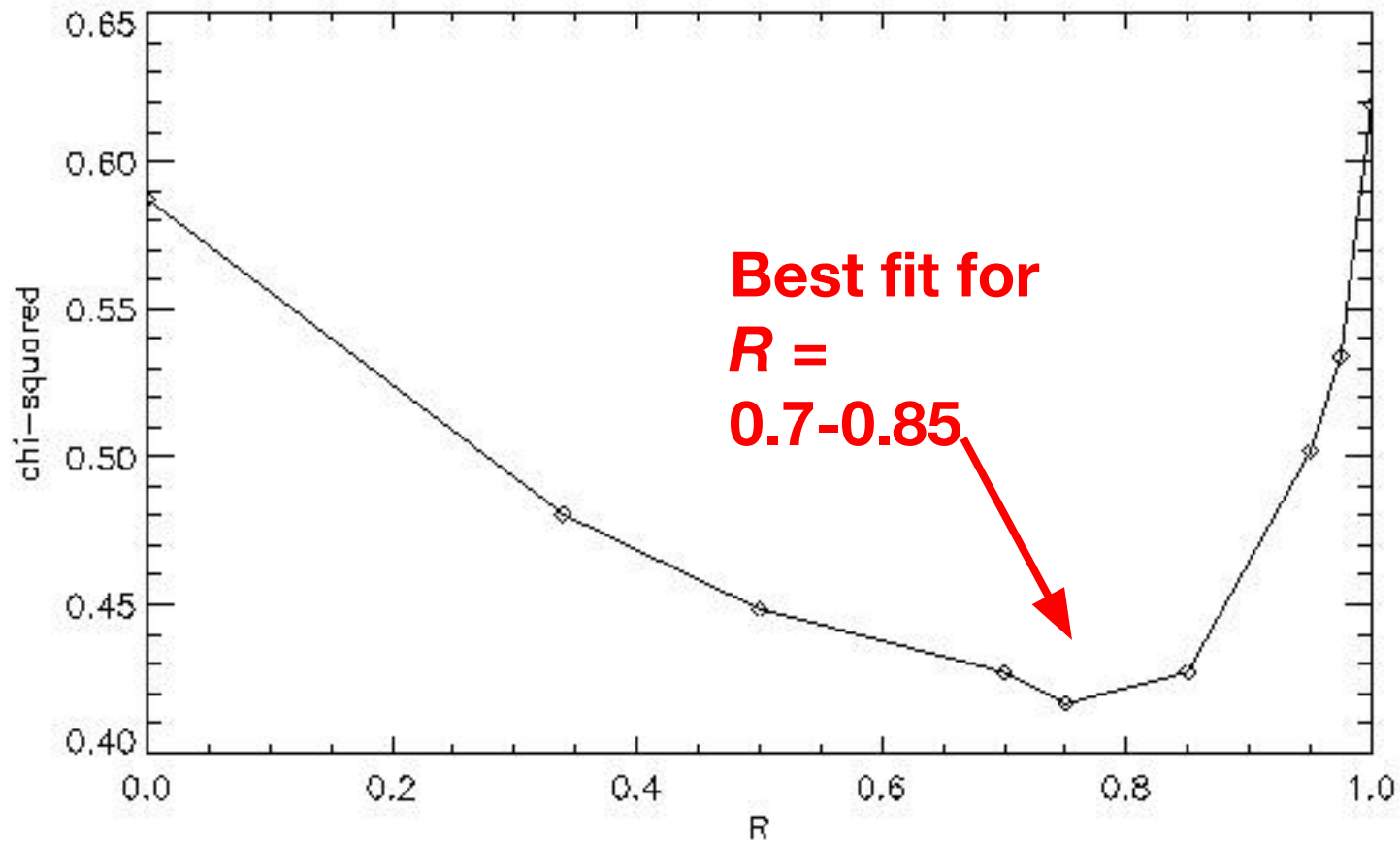


Global propane source of 12 Tg C yr⁻¹, mainly natural gas

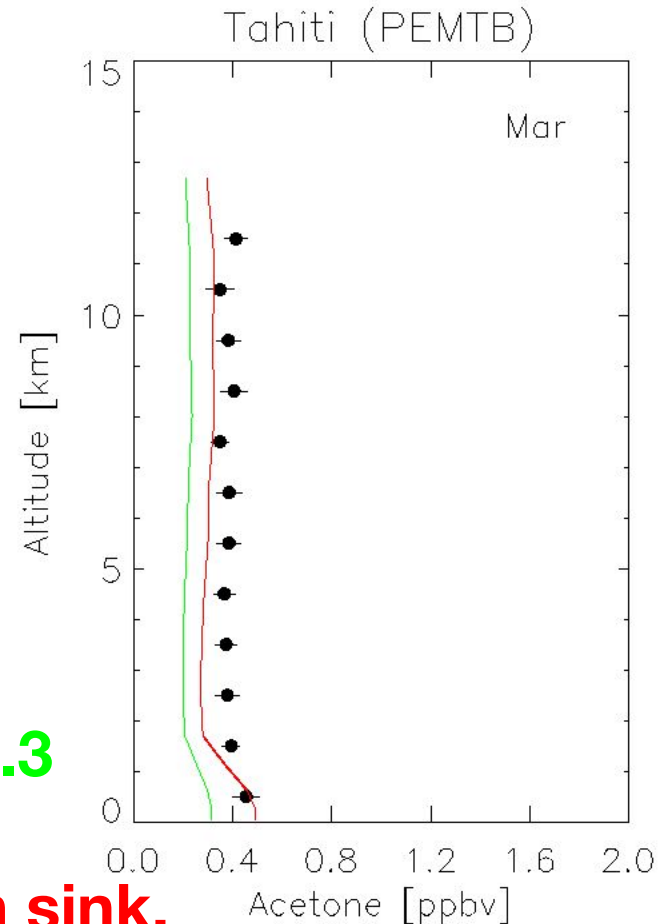
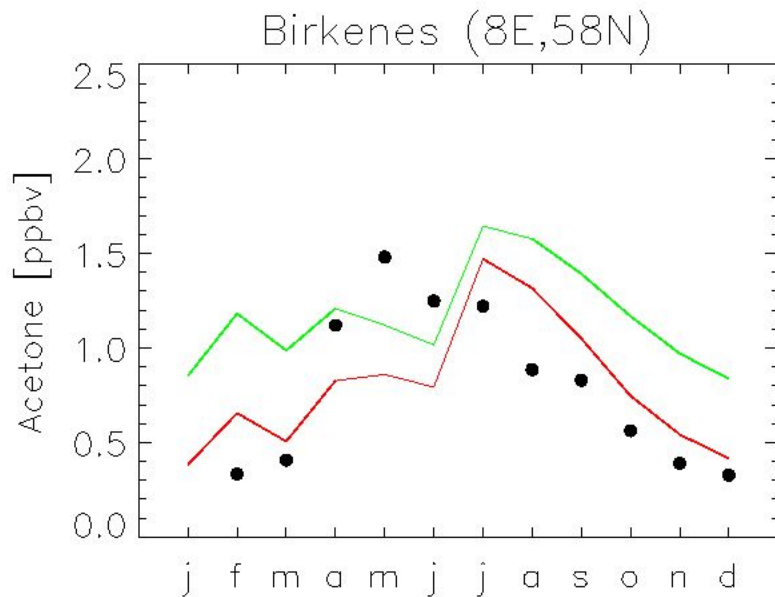
CONTRIBUTION OF DIFFERENT SOURCES TO A PRIORI BUDGET OF ACETONE (symbols: observations lines: model)



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



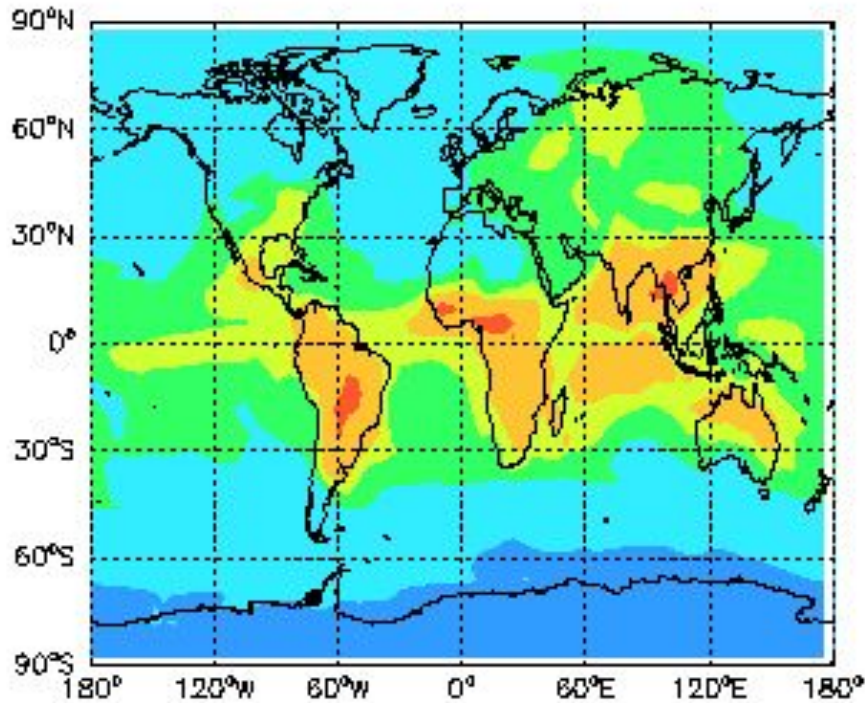
OPTIMIZED GLOBAL 3-D MODEL SIMULATION OF ATMOSPHERIC ACETONE



- 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

Surface Acetone in January a-posteriori



Surface Acetone in July a-posteriori

