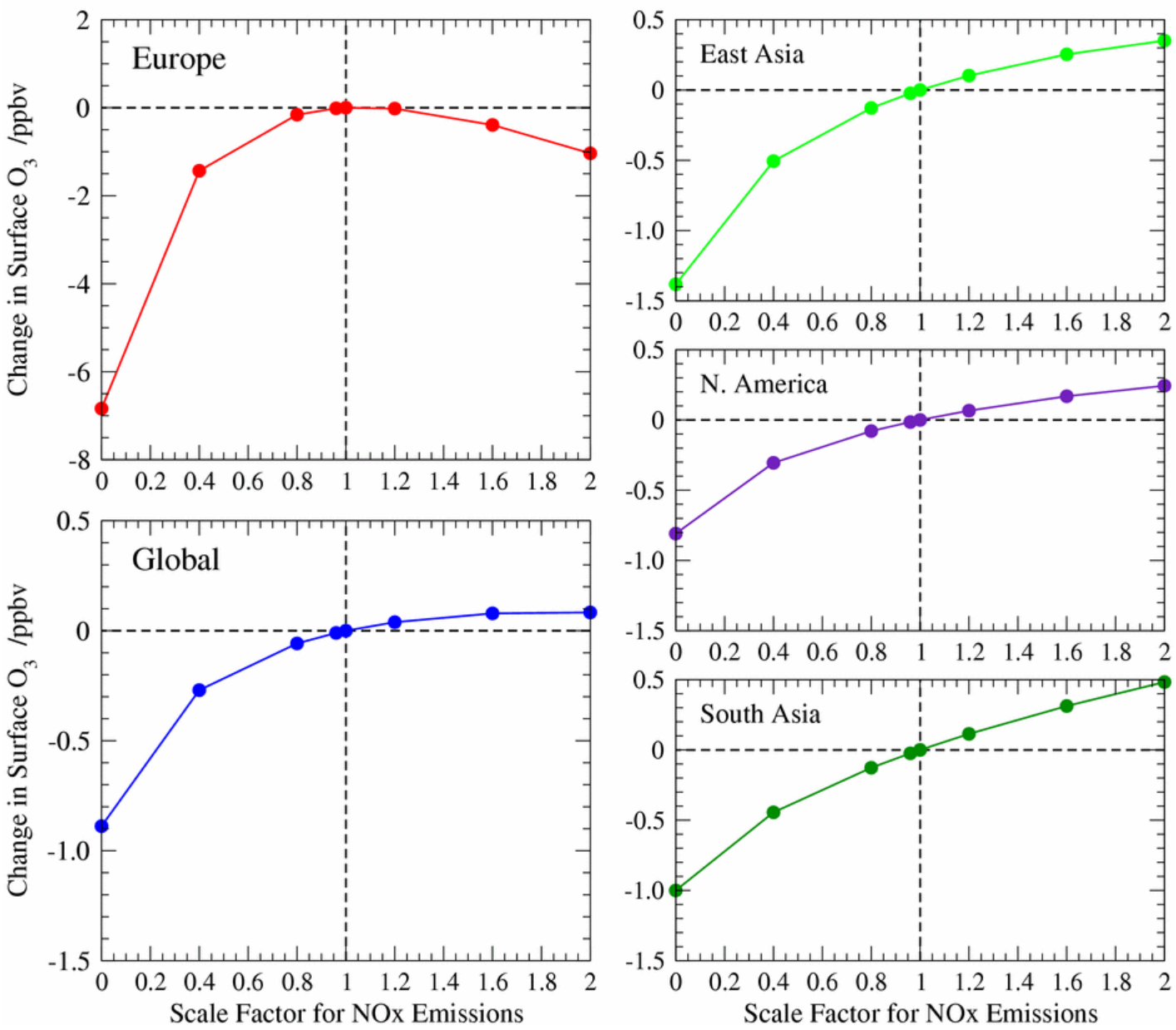
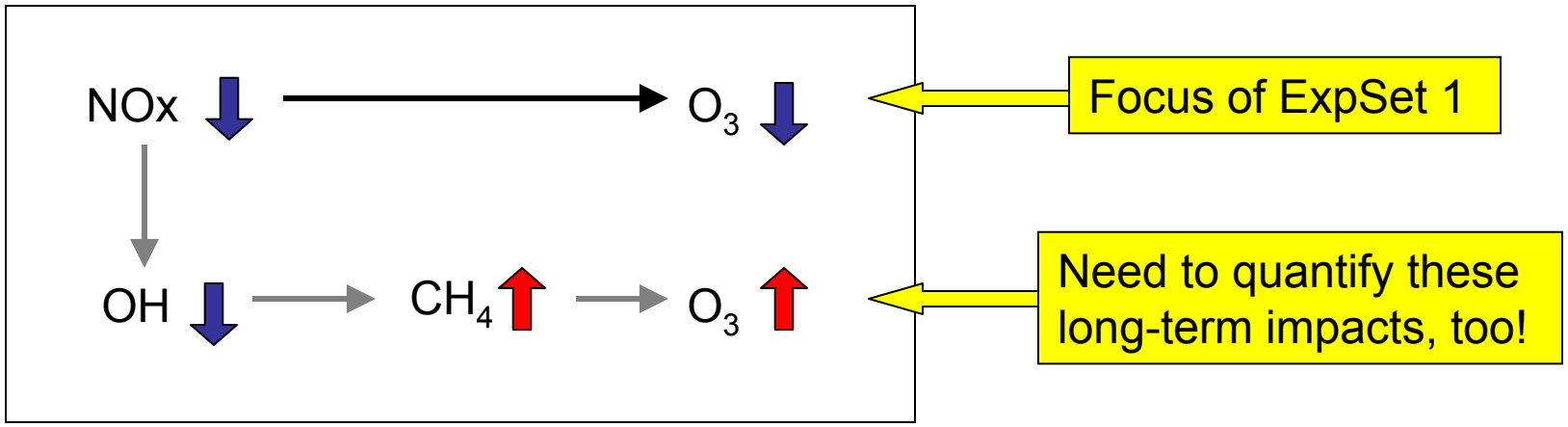
Lessons for Experiment Set 4

- Non-linearity in chemistry
  - Test model responses from EU perturbations
- Long-term responses through CH_4
  - Requirement for all models to do a ΔCH_4 run (viz. SR2)
  - Characterization of model feedback factors from SR1/SR2
  - Focus on SR6 (combined impacts) rather than SR3 (NO_x only)
- Additional diagnostics
  - e.g., stratospheric O_3, additional tendencies

Annual Mean Surface ΔO_3 from European NO_x Emissions



Responses through CH_4

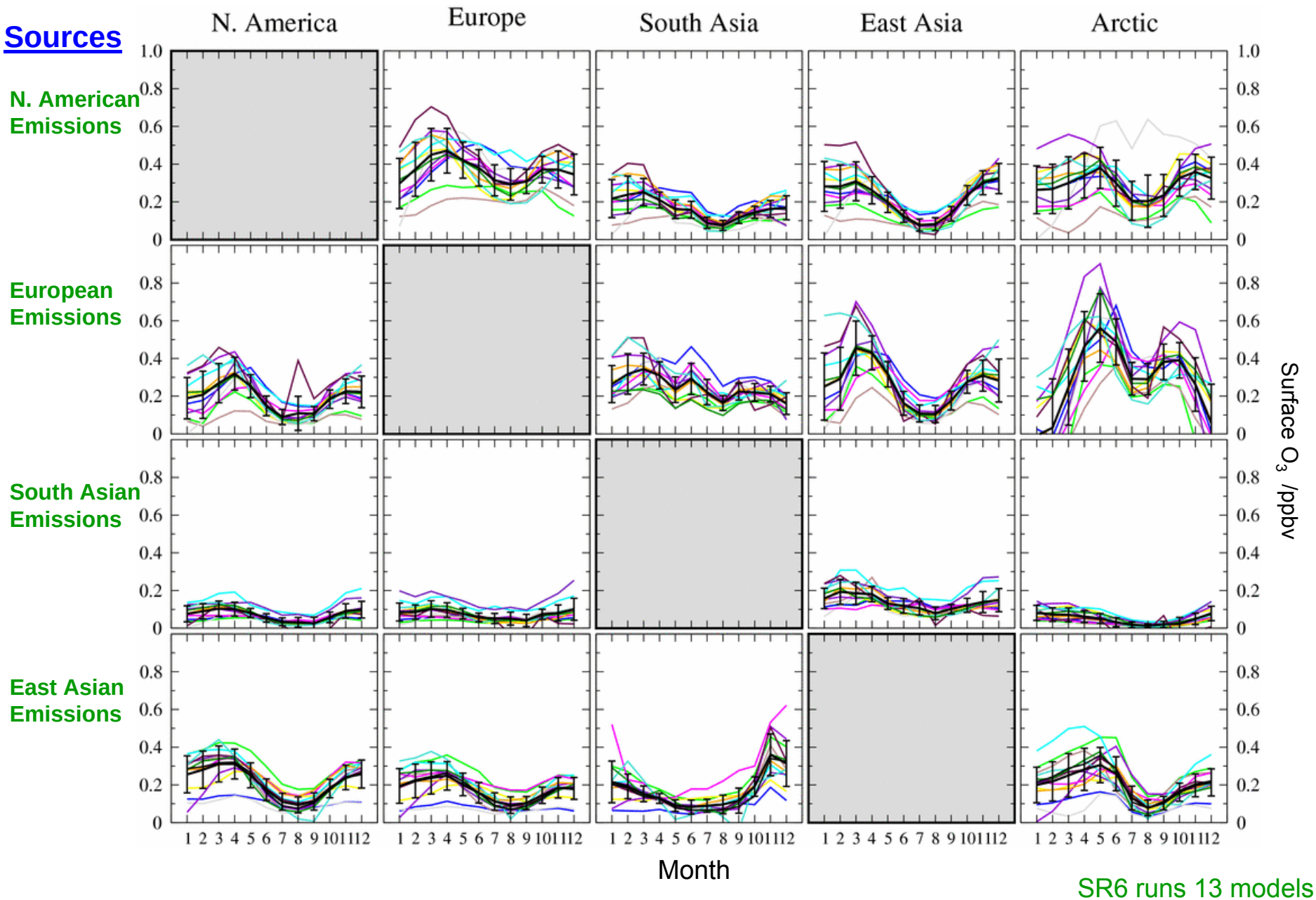


- We used the ΔCH_4 run to estimate effects of 20% anthrop CH_4 emissions changes, but we should also use it to evaluate the long-term O_3 changes
- How? For each SR* perturbation
  - Calculate $\Delta\tau_{CH4}$ based on new CH_4 loss rate
  - Derive steady-state ΔCH_4
  - Scale ΔO_3 from SR2 by ratio of ΔCH_4 to 20% change used in SR2

Responses through CH_4

- For FRSGC/UCI CTM on SR3EU:
  - Mean ΔO_3 response from ΔCH_4 (global): +0.05 ppbv
  - ΔO_3 over European emission region: -0.46 ppbv
  - ΔO_3 over Asia/US receptor region: -0.08 to -0.15 ppbv
  - Long-term CH_4 response wipes out most of gain!
- Effect is opposite for CO/VOC runs (SR4/SR5)
- Effectively cancel for combined runs (SR6)
  - But different models may respond a bit differently!

Source-Receptor Matrix

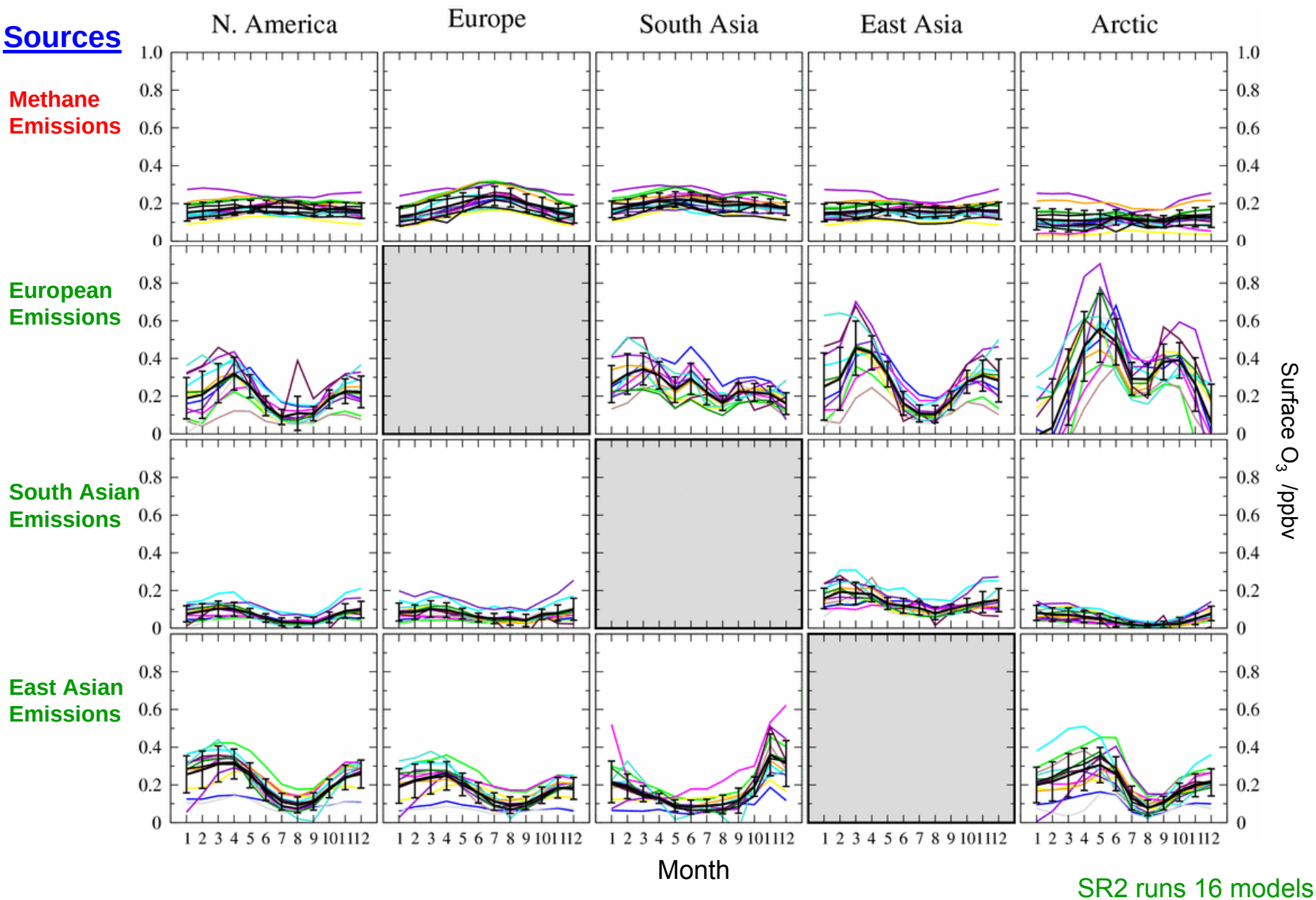


SR6 runs 13 models

Source-Receptor Matrix

Receptors

Sources



SR2 runs 16 models