Forecasting CMB x Euclid constraints : Outline and current state

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Euclid CMBX SWG meeting @ Ferrara, 04/10/2018

Foreword

- To keep in mind :
  - Not completely independent: inputs from IST
  - Not completely free on our side

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Recipe for Euclid x CMB forecasts

- Main ingredient : likelihood

$$\mathcal{L}(M|\mathcal{O})$$

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- Euclid: GCp/s, WL, GCp×WL, (secondary ?)
- CMB: T, E, Φ, T×E, T×Φ, E×Φ, (B ? t/kSZ ?)
- Euclid x CMB: GCp×T, GCp×Φ, GCp×E
  GCs×T, GCs×Φ, GCs×E
  WL×T, WL×Φ, WL×E

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  GCs×T, GCs×Φ, GCs×E
  WL×T, WL×Φ, WL×E

Let's converge on the ones agreed upon:
after that, the sky is the limit !

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- Good old ΛCDM
- Neutrinos : 2 choices of non-zero $\sum m_\nu$
- w0/wa parametrisation and/or curvature
- MG model: “gamma”

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Bonus issue :
choice of the parameter basis

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- W ... re
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Bonus issue :
choice of the parameter basis

- Theta versus H_0
- A_s versus sigma_8
- "Small" versus "Big" omegas

- C
- M
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+ "Survey model": n(z), bias, z bins,... → IST

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Gaussian likelihood

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Gaussian likelihood

$$\mathcal{L}(M|\mathcal{O}) = \det\left(2\pi\Sigma_M\right)^{-1/2} \exp\left(-\frac{1}{2}(\mathcal{O}-\mu_M)^T\Sigma_M^{-1}(\mathcal{O}-\mu_M)\right)$$

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Two points :

- Is a Gaussian likelihood OK ? (low ells)

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Two points :

- Is a Gaussian likelihood OK ? (low ells)
- Choice of covariance matrix ?
  → Pure analytic "Gaussian" or beyond ? (cf. Fabien's talk)
  → Accounting for incomplete sky ? (insight from estimators)
  → Planck-like ? Or next-gen-like ?

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Two point

- Is a Gau
- Choice
  → Pure
  → Accou
  → Planc

s talk)

imators)

Again: bound by some of IST's choices

- Gaussian likelihood at all ell
- Simple analytical covariance
- fsky approximation
- Do Planck-like and next-gen-like

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- Produce forecasts from the likelihood

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Fisher matrices

$$F_{\alpha\beta} = \left\langle -\frac{\partial^2 \ln \mathcal{L}}{\partial\theta_\alpha \theta_\beta} \right\rangle = \frac{1}{2} \Sigma_{ab}^{-1} \frac{\partial \Sigma_{bc}}{\partial \theta_\alpha} \Sigma_{cd}^{-1} \frac{\partial \Sigma_{da}}{\partial \theta_\beta} + \Sigma_{ab}^{-1} \frac{\partial \mu_a}{\partial \theta_\alpha} \frac{\partial \mu_b}{\partial \theta_\beta}$$

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Remarks:

- Lessons from IST: beware of derivatives
- Alternative: MCMC with “fake” data

Current status of forecasts

Current status of forecasts

Guidelines:

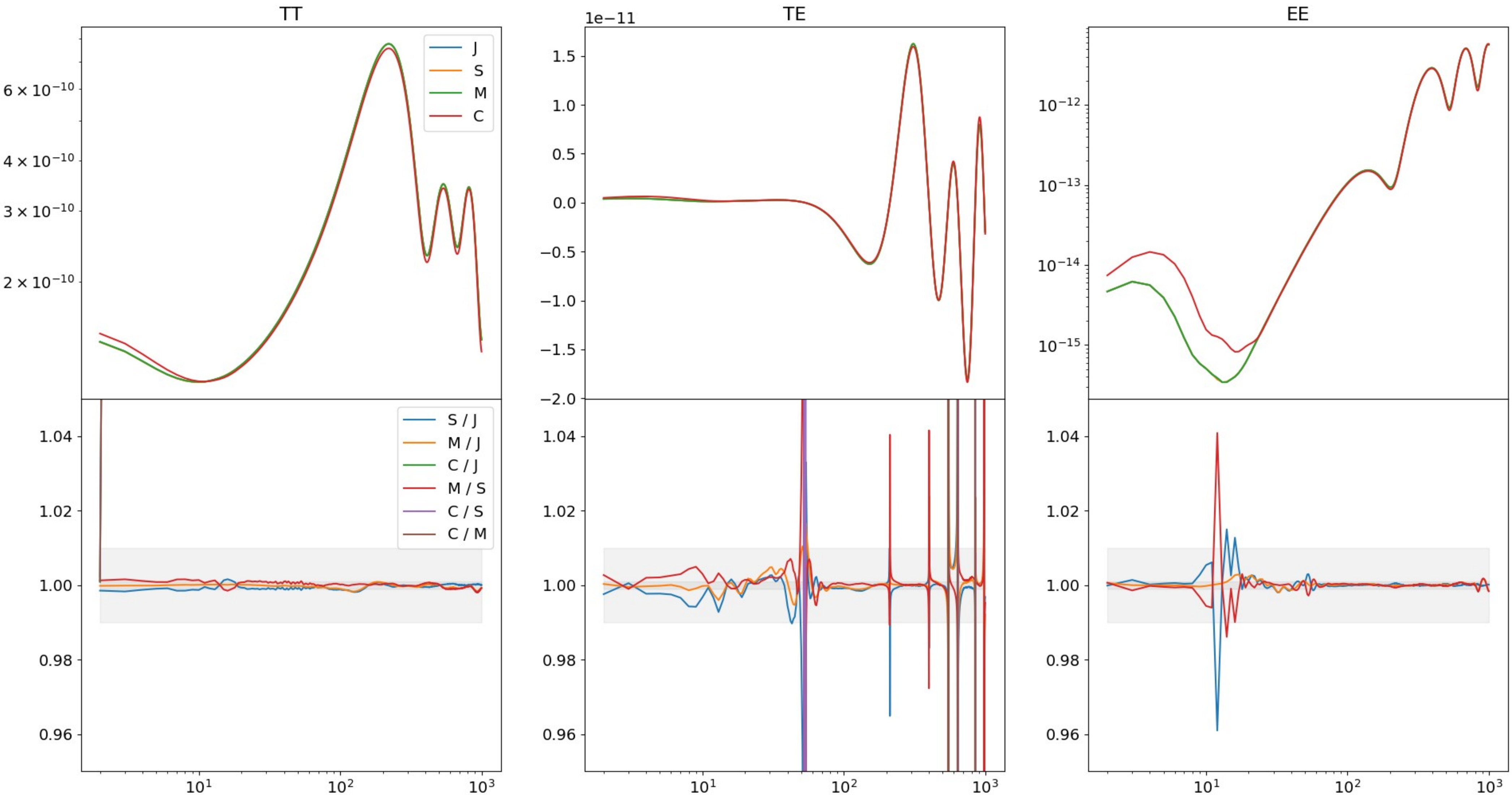
- Get the best accuracy/agreement on Cells
- No need to redo the IST's work
- Use Euclid probes as benchmark
- Involve IST people
- Always at least 2 codes

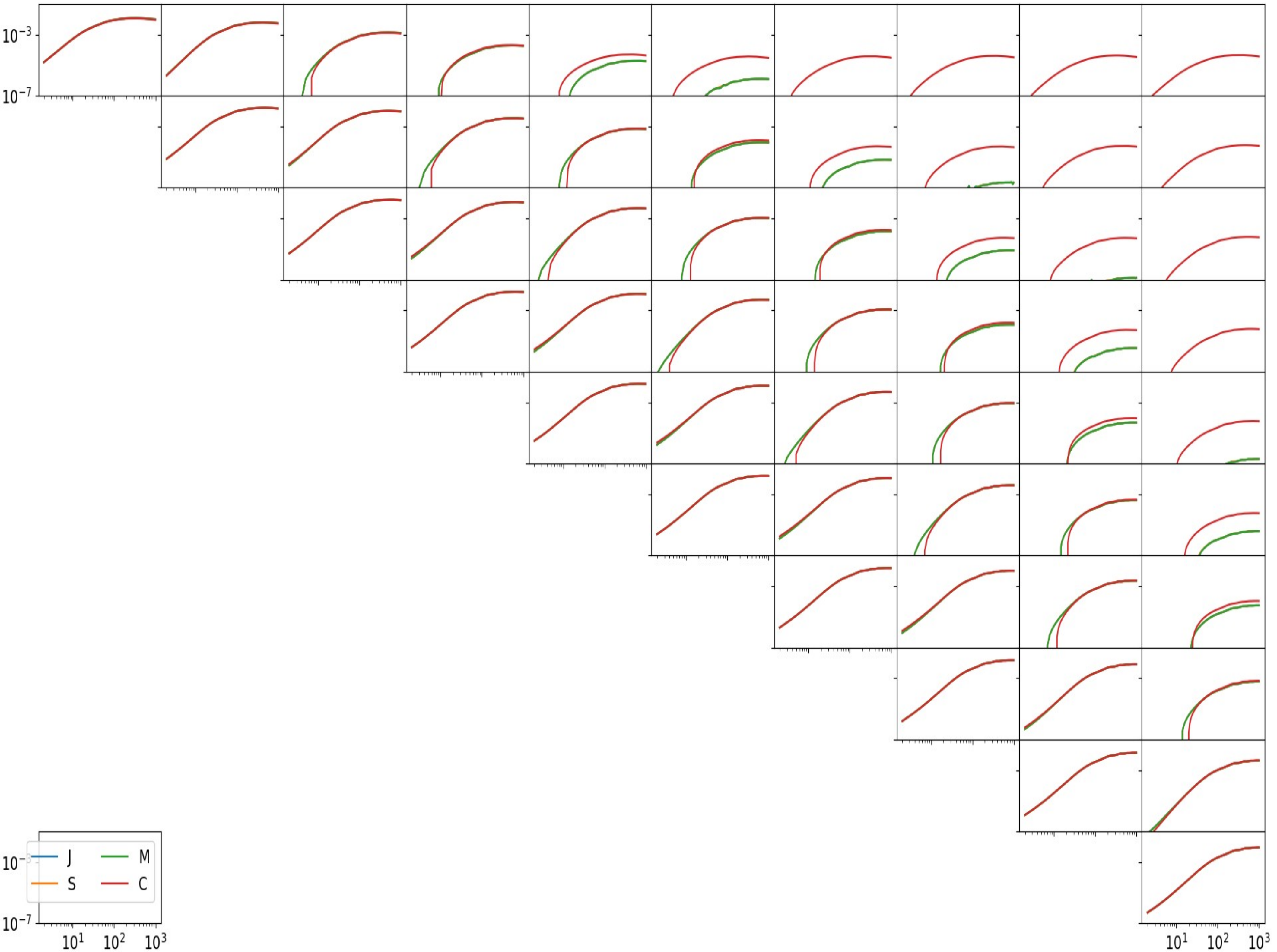
Current status of forecasts

- **People:** José, Stéphane, Matteo, Carlos, Marco
- **Codes**: CAMB sources-based, or CLASS/CAMB + custom
- Successful convergence on GC, Limber case (<~0.1 %)
- Individual progress in parallel (cf. José's talk)

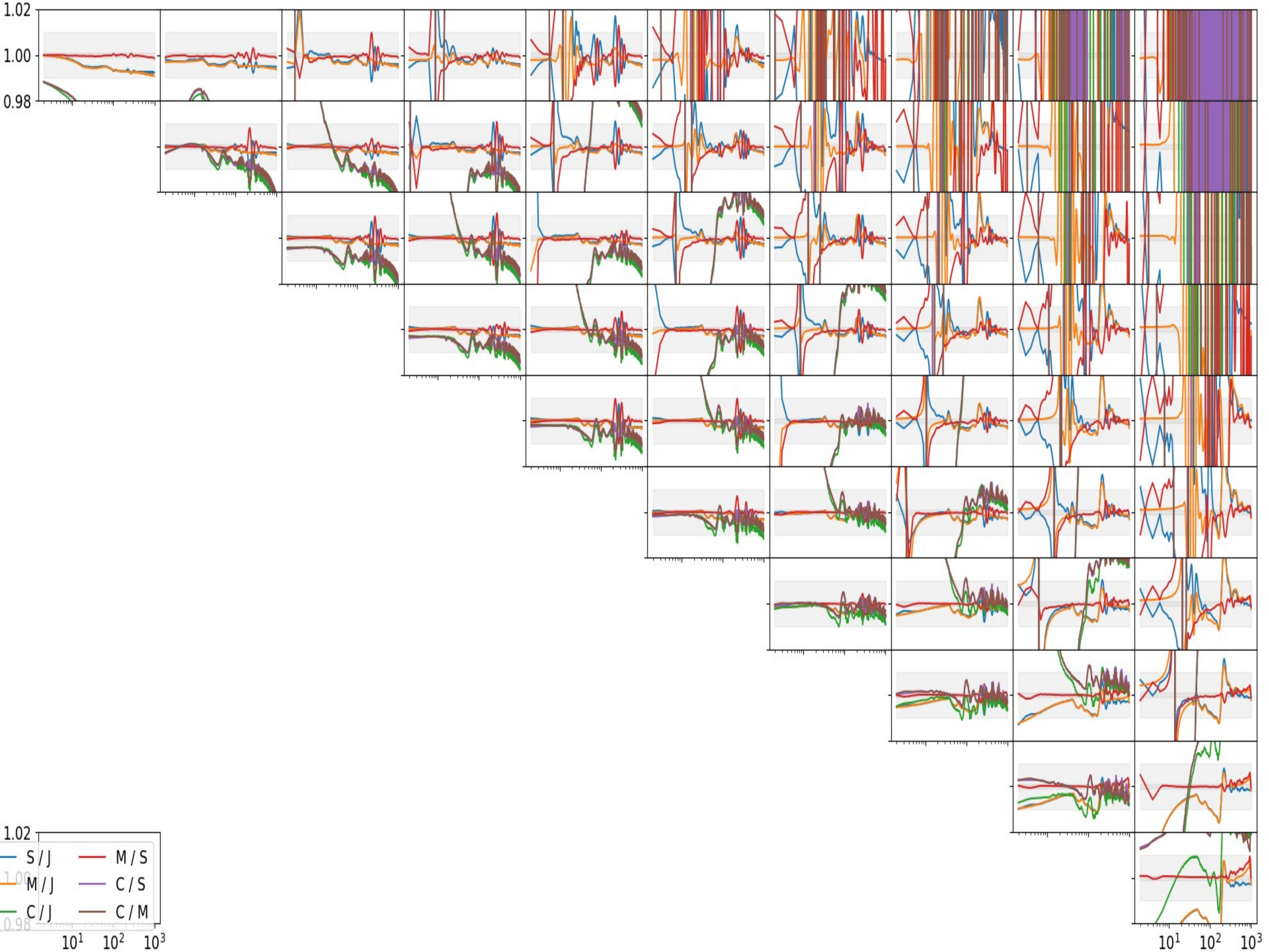
Current status of forecasts

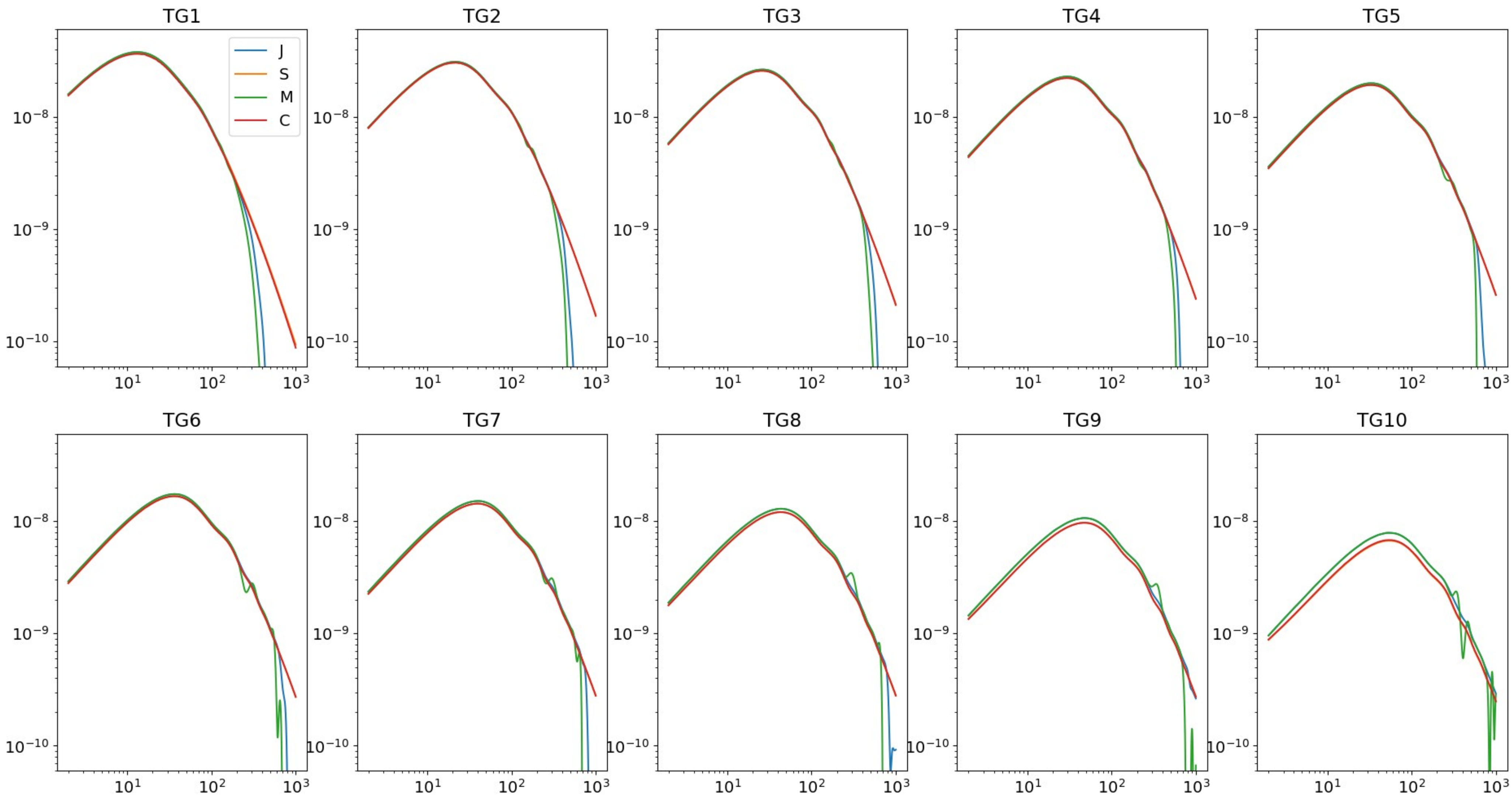
Fresh results
(03/10/2018)


TT
TE
EE
1e−11
J
S
M
C
S / J
M / J
C / J
M / S
C / S
C / M
6×10^{-10}
4×10^{-10}
3×10^{-10}
2×10^{-10}
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
10^{-12}
10^{-13}
10^{-14}
10^{-15}
1.04
1.02
1.00
0.98
0.96
10^1
10^2
10^3

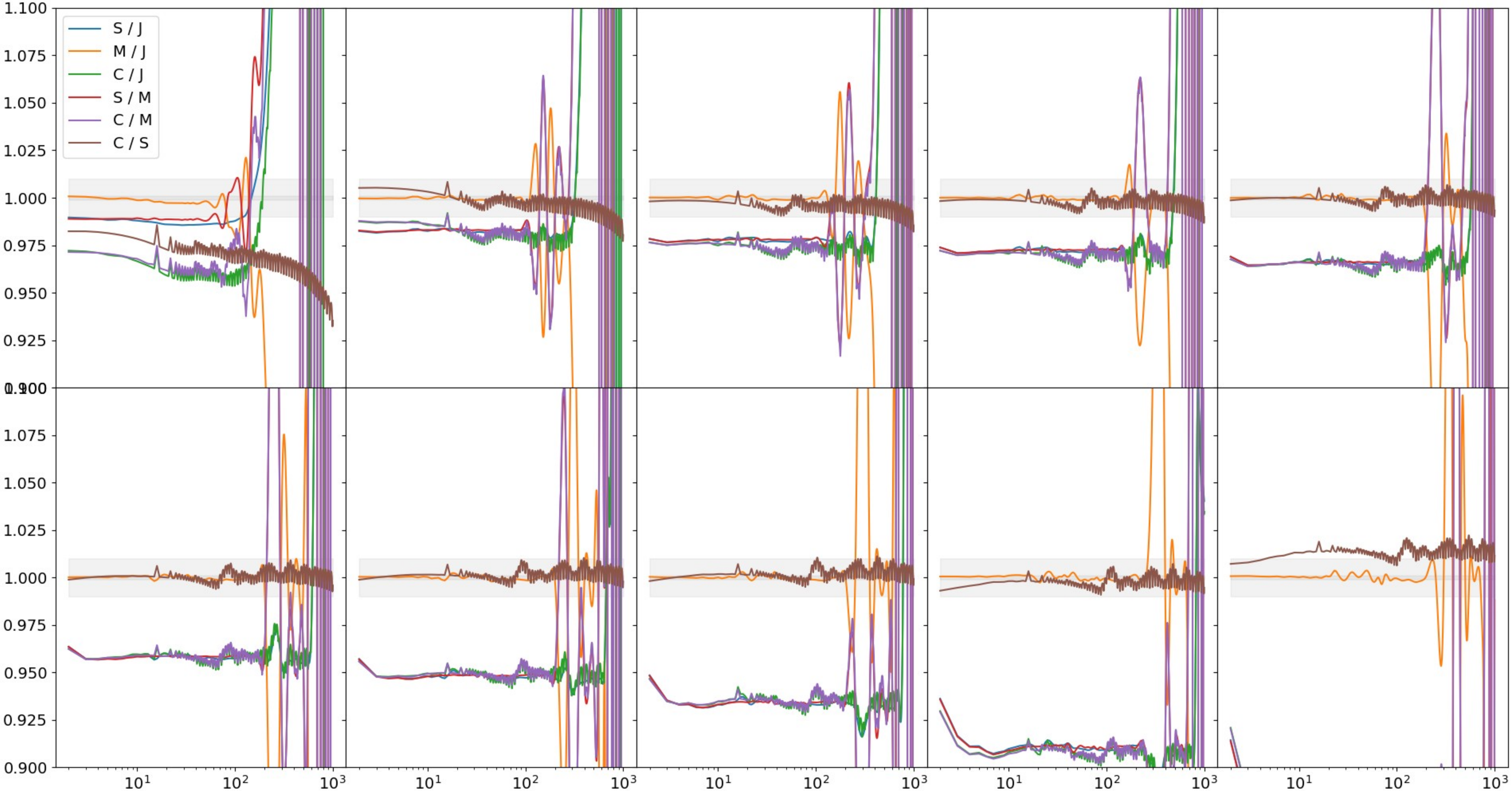


10^-3
10^-7
10^1
10^2
10^3
J
S
M
C


1.02
1.00
0.98
1.02
1.00
0.98
S / J
M / J
C / J
M / S
C / S
C / M
10^1
10^2
10^3
10^1
10^2
10^3



TG1
TG2
TG3
TG4
TG5
TG6
TG7
TG8
TG9
TG10
J
S
M
C
10^{-8}
10^{-9}
10^{-10}
10^1
10^2
10^3



1.100
1.075
1.050
1.025
1.000
0.975
0.950
0.925
0.900
S / J
M / J
C / J
S / M
C / M
C / S
10^1
10^2
10^3

The end (for now)

Thank you for
your attention !