

# 1 Overall Recommendation: Minor Revisions

This paper investigates the role of angular momentum (AM) conservation in the CAM6 model using the finite-volume (FV) dynamical core option. It is demonstrated that the existing FV dycore has significant angular momentum conservation errors, which have noticeable effects on the simulated climate. The principal source of these errors is shown to be the discretization of the kinetic energy term in the shallow water velocity equation. Two numerical methods are introduced to fix the errors: a "correction" to the kinetic energy term that makes it approximately angular momentum conserving in a zonal average, and a global "fixer" that enforces angular momentum conservation. These two approaches are shown to improve the simulation of climate.

The paper is well-written and structured, and the results are clearly presented. I have only some minor comments relating to the effects of the new numerical methods on other invariants (such as energy), and the effects of increased vertical resolution. Once these are addressed, I would be happy to see this work published.

My overall recommendation is: **Minor Revisions**

## 2 Major Comments

1. Angular momentum is not the only important invariant for climate-length simulations: two other important ones are mass and total energy. Do the correction and/or fixer affect the conservation of these invariants? If so, by how much?
2. It is clear that increased horizontal spatial resolution improves the conservation of AM. Did you explore the effects of increased vertical resolution ie additional levels?

## 3 Minor Comments

1. Page 10, Lines 232- 235: This sentence is unclear and a little too long.
2. Figure 9: This figure is missing a color scale.
3. Table 1: The caption is too short here, it should have enough detail to understand the table without referring to the text.

## 4 Typos

1. Page 2, Line 61: phase 6th → 6th phase
2. Page 4, Line 110: founf → found
3. Page 7, Line 152: be → by

4. Page 26, Line 485: local the → the local
5. Page 29, Line 561: cummunity → community
6. Page 35, Line 679: applies → applied
7. Supplementary Material, Page ii, Figure S1 Caption: countour → contour, synamical → dynamical, anaolgous → analogous
8. Supplementary Material, Page v, Figure S4 Caption: he → the