Electromagnetism

Imagine two small bodies are at the same horizontal level in a vacuum. They both have a mass of m and have equal electrical charges. The latter results in an electrostatic repulsion between the bodies of E. If the bodies fall downwards at a velocity of v there will be also be a magnetic attraction between them. This can be expressed as vM as the magnetic force varies with v. The net repulsion is then F = E - vM. So the instantaneous horizontal acceleration, as seen by an observer at rest, equals **(E - vM)/γm**. As usual γ (gamma) is $1/\sqrt{(1 - v^2/c^2)}$ and c is the speed of light. γ reflects special relativity's prediction about the effect of a mass that moves in relation to an observer.

For an observer who also moves down at a velocity of v the two bodies are at rest, so there is no magnetic force and the acceleration is just **E/m**. If the moving and stationary observers are to measure the same acceleration then γE = E-vM (after multiplying the equations in bold by γm) but if $v>0$ the left side of the equation exceeds E and the right is less than E. So why is it claimed that special relativity produces the same electromagnetic effects for all inertial observers? It seems what matters is the relative motion of the charges and the Earth, not the observers who have no effect on the charges.

(Each observer is predicted to see the same time dilation of the other observer's frame, but this does not affect the observations made in each frame. Similarly, multiplying the acceleration predicted to be seen in the other frame by γ^2 (or γ) does not equalize the accelerations measured in the two frames. The electric charge is also meant to be the same for both observers.)