AHI Weighting Function Lab Questions

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Use this web page (or a locally saved version) to investigate clear-sky forward model calculations:

http://cimss.ssec.wisc.edu/goes/wf/AHI/

Q1: What is the equivalent clear-sky brightness temperature for the AHI Imager band 14 infrared window (11.2 μm) when looking at nadir for the standard tropical atmosphere?

Q2: For the standard tropical atmosphere, is the AHI Imager band 15 (e.g., 12.4 μm) colder or warmer than the IR window band 14 (11.2 μm)? By how much? Why?

Q3: In general, what might three "mid-level" water vapor band images add, over having just one band?

Q4: For the standard tropical atmosphere (at nadir), which AHI IR band is the coldest (in clear skies)? Why?

Q5: How many AHI IR bands are there? On the MTSAT imager?

Q6: If you change the skin temperature by 10K when nadir-viewing, how much does the AHI "water vapor" band 8 (6.2 μm) change? Why?

Q7: For the standard tropical atmosphere (when nadir-viewing), which AHI band has the largest sensitivity to an increase of 10K for the skin temperature? (Note that all the surface emissivities are assumed to be 1.)

Q8: Which AHI "water vapor" band, 8 (6.2 μm), 9 (6.9 μm), or 10 (7.3 μm), is coldest due to H2O absorption? Infer this from the weighting functions.

Q9: When the zenith angle is increased, do the AHI IR bands tend to cool? Why?

Q10: When increasing the amount of moisture in the (standard tropical) atmosphere for a nadir view, would you expect the IR window (band 14 at 11.2 µm) to cool or warm? By approximately how much? How does this differ from the same experiment using band 13 (10.4 µm)?

********** Bonus Questions **********

Q11: Why does one band have a greater temperature range than another? (For example, compare the 11.2µm IR window to a water vapor band such as the 6.2 µm).

Q12: Is the ozone band (12 at 9.6 µm) warmer or colder than the IR window (band 14 at 11.2 µm)? Why?

Q13: How might the brightness temperatures change for the IR window in the presence of thin or thick clouds compared to these clear-sky calculations?

Q14: In general, which AHI band has the warmest brightness temperature?

Q15: As a thought experiment, how would the water vapor band brightness temperatures change for a thick cloud vs these clear sky calculations?