We thank the referee for his constructive comments and respond in the following. Below, bold texts are the original referee comments.

***This paper provides an excellent review of techniques used to estimate smoke plume injection height. The advantages and disadvantages of each method are well described. The narrative is also well organized. I therefore find this paper appropriate for publication in ACP. However, several minor errors and omissions must first be addressed (see comments below).***

***General comments:***
***Minor grammar mistakes are found in all sections of the document. I have noted several of these errors in my specific comments below. Please preform a detailed check over the entire document. The pyroCb is the most extreme form of a high-altitude injection, and the most troubling situation for smoke transport modeling. I recommend adding a figure showing an active pyroCb (e.g. satellite image) and the resulting high-altitude smoke (e.g. CALIOP curtain). There is also a great deal of uncertainty surrounding the conditions that result in pyroCb development. Studies like Kahn et al. (2007) note that smoke above the boundary layer will concentrate at levels where there is increased stability. This should be mentioned in the text in an appropriate location. Also, can models accurately represent these small, weak layers of stability? Or would the smoke have to be mixed above the boundary layer? Are there any studies that discuss smoke plume altitude at night? Certain meteorological conditions may allow a fire to remain active during the nighttime (e.g. Santa Ana driven fires in southern California). Therefore, while rare, there is at least some potential for higher-altitude smoke at night. I believe Fromm et al., (2010) also mention pyroCb occurrence at night.***
***A brief description of potential improvements from the next generation of satellite sensors should be included, possibly in the last paragraph. For example, GOES-R and Himawari-8 will provide capabilities similar to MODIS, with a temporal frequency potentially as high as one minute (please check exact specifications). This will allow for detailed observations of pyroconvection during peak burning hours.***

-*Grammar*: We revised thoroughly the text and corrected its grammar.

-*Example of pyroCb*:
we refer to the website http://pyrocb.ssec.wisc.edu in section 3. This website has been reporting pyroCb event since May 2013.

-*Effect of stability layer?*:
The effect of stability layer was mentioned in the original manuscript in Section 3. We added another reference to the list of papers mentioning this behaviour.
"... the ambient atmospheric stratification which acts on the buoyancy of the initial updraft (Kahn et al., 2008) and also on the later level of the detrained smoke as smoke injected above the PBL tends to accumulate in layers of relative stability (Kahn et al., 2007; Val Martin et al., 2010; Mims et al., 2010)"

-*Injection at night:*

As mentioned by the reviewer, the occurrence of PyroCb at night was reported by Fromm et al 2010. A paragraph was added in Section 3 to mention nocturnal plume.

"The initial trigger of plume rise being the heat released by the casual fire, InjH are strongly influenced by fire diurnal cycles (Roberts et al., 2009). This leads to lower nocturnal InjH which are amplified by the combination of night time stable atmosphere and lower PBL (Sofiev et al., 2013). However some meteorological conditions can intensify fire activity over night, as for example the Santa Ana foehn wind (Sharples, 2009), and keep them running. Few observations of nocturnal plumes triggered by those intense fires are available (Fromm et al., 2010), and to our knowledge, only Sofiev et al. (2013) tackle the issue of modelling nocturnal InjH. Their approach relies on a simulated diurnal cycle based on the high temporal resolution (∼ 15 min) FRP product of the geostationary orbiting satellite SEVIRI (Roberts and Wooster, 2008) and the parameterization of Sofiev et al. (2012) (further discussed in Sec. 5.2.1). Despite the low resolution of SEVIRI (> 3 km), their empirical diurnal cycle captures the expected fire intensity increase at night, but no effects were found on InjH. Their resulting modelled InjH show a strong diurnal pattern with low nocturnal InjH (e.g. maximum monthly mean nocturnal InjH lower than 2.5 km)."

*-Improvement from the next generation:*

References to satellite of the next generation were added to the discussion in the conclusion.

"For example, GOES-R (Schmit et al., 2005) and Himawari-8 (Kurino, 2012) will provide capabilities similar to MODIS, with a temporal frequency potentially as high as 30 seconds, while Suomi NPP carrying VIIRS (Schroeder et al., 2014), and TET-1/BIRDS (Lorenz et al., 2012) will provide thermal bands with resolution up to 375 m. This will ..."

**Specific comments:**

***Abstract, line 8: change "This characteristics" to "the characteristics"***

Modified. Thanks

***Abstract, lines 17-19: This sentence is disjointed and confusing. Please modify.***

The sentence was edited. Thanks

"... on component of the Earth system. In particular we detail (i) satellite Earth Observation datasets capable of being used to remotely assess wildfire plume height distributions and (ii) the driving characteristics of the causal fires. We also discuss..."

***Intro, p3, lines: 7-10: You mention the acronyms of four global inventories. You should give the full name of each inventory and possibly where it was developed. Some readers may be unfamiliar with these. Also, you only give 3 references for the 4 inventories.***

We corrected this, and included the institute where the inventories were developed.

***Intro, p3, line 19: "transports the fire emissions". Should it be "transports the smoke emissions"? It might be worth changing the terminology within the whole document.***

A sentence was added to make the term fire emission clearer. See Section 1.

"This makes the manner in which the fire emissions are injected into the atmosphere highly variable, and sensitive to the smoke plume dynamics. To follow the terminology commonly used in the literature

(Kaiser et al., 2012, e.g. ), when not specified, the term ”fire emission” refers to the gaseous and aerosols emissions only and not the heat fluxes (e.g. radiation) emitted by the fire.”

***Intro, p4, lines 12-14: What resolution would be required to resolve plume dynamics? Perhaps you should give the reader some idea of the typical resolutions used by current CTMs.***

This was added.

“...where they can fully interact with ambient atmospheric circulation. In a recent study on fire emission transport Gonzi et al. (2015) use the GEOS-Chem CTM with a horizontal resolution of $2^{o}$ x $2.5^{0}$ and 47σ levels forming a vertical stretched mesh with a resolution of 150 – 200 m near the Planetary Boundary Layer (PBL). Since at these resolutions we cannot resolve the plume dynamics ( <~100 m Trentmann et al., 2006), ...”

***Section 2: This is the primary background section. It might be beneficial to give a brief history, starting with the earliest known studies on smoke injection height characterization and 3odelling. Give the reader some idea of how long the injection height topic has been discussed in the literature.***

This was added in the second paragraph of section 2.

“The question of the impact of fire emission injection in the atmosphere was first introduced by Chatfield and Delany (1990) and was later extensively reported in EO data.For example, injections of gases and aerosols emitted from vegetation fires have beenobserved at various heights in troposphere, and occasionally even the lower stratosphere (Fromm et al., 2005).”

***Section 3, p8, lines 6-19: Remember that many fires produce pyroCu, but only a few events produce a full pyroCb. This should be clarified. Also, a very recent study by Peterson et al. (2014) provides more insight on these three types of plumes, especially the dynamics driving pyroCb development, including the potential role of mid-level moisture entrainment. Peterson, D. A., Hyer, E. J., Campbell, J. R., Fromm, M. D., Hair, J. W., Butler, C. F., and Fenn, M. A.: The 2013 Rim Fire: Implications for Predicting Extreme Fire Spread, Pyroconvection, and Smoke Emissions, Bulletin of the American Meteorological Society, 10.1175/bams-d-14-00060.1, 2014.***

The reference was added and the rare occurrence of pyroCb was emphasised.

“... ice formation. They are not frequent but rather extreme scenarios that can be compared in nature to plumes from explosive volcanic eruptions. For example, Fromm et al. (2010) reported 17 events in North America for the year 2002, while for the same time period 73,457 fires were reported only for the US (source: National Interagency Fire Center). PyroCb are usually ...”

***Section 4: FRP is better described as an instantaneous measure (or proxy) of fire intensity. It is usually calculated using a middle infrared (e.g. 4 micron) channel. However, the Dozier-derived FRP does incorporate the thermal IR (e.g. 11 um) channel.***

FRP was not originally designed for measuring fire intensity. The Dozier algorithm is presented in section 4.2.

***Section 4.1.1, p9, lines 25-26: I believe the full name for CALIOP is “Cloud-Aerosol Lidar with Orthogonal Polarization”. Please check.***

This is right and was corrected.

***Section 4.2, paragraph 1, "can be trigger" should be "can be triggered"***
Corrected.

***Section 4.2, p14, line 12: I think "infra red" should be "infrared" or "infra-red"***
Corrected.

***Section 5, paragraph 1: change "it also have effects on" to "it may also affect***
Corrected.

***Section 5.2.1, paragraph 1: CMAQ has not been defined. Also, "originally build" should be "originally built".***
Corrected.

***Page 5.2.1: Rio et al. Description: Many small grammar errors within.***
This paragraph was re-edited to correct the grammar.

***Section 5.2.2: WF-ABBA has not been defined. Perhaps it should be mentioned in section 4, along with the fire detection and the FRP discussion.***
WF-ABBA is defined in section 5.2.1 in the presentation of PRMv0.

***Section 5.2.2: last sentence: "MSIR" should be "MISR"***
Corrected.

***Section 5.2.3: second sentence: this is confusing and disjointed.***
The sentence was made clearer.
"PRMv0 has been coupled with the the Weather Research and Forecasting (WRF) Model (Sessions et al., 2010; Grell et al., 2011; Pfister et al., 2011), the Coupled Aerosol and Tracer Transport model to the Brazilian developments on the Regional Atmospheric Modelling System (CATT-BRAMS Freitas et al., 2009; Longo et al., 2010). And pyro-EDMF is present in the Mesoscale Non Hydrostatic model (MesoNH Strada et al., 2012) and the general circulation model LMDZ (Rio et al., 2010)."

***Section 5.3: I think the overall message here is that statistical models for plume height would require two equally weighted components: (1) accurate fire characterization from satellite, likely aided by the Dozier technique and (2) accurate meteorology, especially in the vertical (e.g. stability profile). This section could be streamlined to get those points across.***
The need of a good learning data set for the set up of statistical models was already mentioned in the last sentence of section 5.3. Specifying point 1 and 2 mentioned above is not bringing any added value to the discussion, as all parameterization development rely on the correctness of those input information.

***Section 6: There are many grammar errors within. The last paragraph is actually a single, very long sentence that should be broken into at least two sentences.***
The sentence was modified according to the reviewer comment.

“Despite these difficulties, the range of relevant data provided on actively burning fires and their smoke plumes by EO satellites continues to grow (eg Ichoku et al., 2012). These improving capabilities, together with continuing advances in the extent to which plume rise models can be parameterised and incorporated into large-scale atmospheric CTMs (Peterson et al., 2014; Paugam et al., 2015), can be expected to continue to advance the accuracy of smoke plume injection estimates and the resulting impact on long-range atmospheric transport of these globally important emissions.”

***Section 6, discussion of Figure 11: An FRP of 6 GW? That’s 6000 MW, which is a large FRP value. Please see the Giglio et al., Peterson et al., Schroeder et al, and Ichoku et al. papers. Additional information is required here. For example, how many pixels were used in that calculation? Where are they located in the figure? Is this high smoke plume actually a pyroCu ... it looks like it might be? Is there an estimate of how many plumes in the MISR dataset may have pyroCu?***
According to the FRP distribution of Figure 10, 6GW is not part of the most intense fire of the Northern American MISR dataset. We have value reaching 50GW.
We include the optical cloud phase product of the MODIS cloud product in Figure 12 to show the presence of ice in the plume to infer the presence of a PyroCb.
The calculation of the FRP was also better described and referenced to the companion paper where one section is dedicated to this subject.

“As an example, we note that the fire from the Northern American MISR plume height data set observed with the highest plume height of 12 km (see Figure 10c) is reported to have a relatively low total FRP of 6 GW , when compare with the FRP distribution of the whole MISR dataset (see Figure 10a). The FRP is here determined as in Paugam et al. (2015): it is the FRP of the strongest cluster in the vicinity of the plume, in this case the top cluster in Figure 12a. Figure 12b shows the optical cloud phase properties of the MODIS cloud product(Platnick et al., 2003) for this same fire. A large part of the plume is formed of ice, which let us assume that we are in the presence of a PyroCb event. This means, that the plume is formed of liquid water and ice particles that could be absorbing part of the MIR signal emitted by the fire.A close inspection of the MODIS MIR band (Fig. 12c ) shows that in this particular event, the fire detection algorithm of the MOD14 product miss a part of the fire front. Note that this underestimation is even further accentuated in the official MISR data set as the plume contour set by the MINX operator is including only a part of the detected fire pixels (see Figure 11). An even more extreme scenario is shown in Figure 14 of Kahn et al. (2007), where no fire pixel were found for a high plume (marked P2 in their figure) which occurred in Quebec on 6 th of July 2002. In these particularly extreme fire cases”

***Figure 4: The color bar text is hard to read. Also, it might be worth cropping the imagesto zoom in on the plumes.***
This Figure was completely modified.

***Figure 7: Can you use the same scale on the x and y axes? Also, panel b might be more informative as a density (shaded) plot. There are too many data points for a standard scatter plot.***
Modified.

***Figure 9: The land cover types should be defined. For example, the reader probably doesn't know what "SA" and "EF" stand for.***

This was added. Thanks.

***Figure 10: Perhaps you should label and reference the four panels as a, b, c, d?***

This was added the figure.

***Figure 11: Same comments as Figure 4. Is this a pyroCu? The extreme altitude and overall appearance suggests it's some form of pyroconvection***

The images of Fig. 11 were modified and split in two different images. The MODIS optical cloud phase product was added. The presence of ice in the plume confirms the development of a PyroCb.