The diffusion of violence in the North Caucasus of Russia, 1999-2010

John O'Loughlin

Frank D. W. Witmer

Institute of Behavioral Science

University of Colorado

Boulder, CO 80309-0487

Email: johno@colorado.edu; witmer@colorado.edu

Acknowledgements: The authors thank the National Science Foundation's Human and Social Dynamics program (grants number 0433927 and 0827016) for the financial support that made possible both the fieldwork in the North Caucasus in 2005-2007 and the events data collection and analysis. Sitora Rashidova, Yana Raycheva, Mary Robinson, Katherine Krauland, Ted Holland, and Nadezhda Bogdanova coded and geo-located the events data. Nancy Thorwardson of Computing and Research Services at the Institute of Behavioral Science, University of Colorado prepared the figures for publication. The three reviewers offered helpful comments to improve the paper.

Abstract

Despite an increase in attention to "geography" in civil war research, local dynamics in violence remains poorly understood. To address this gap, we analyze disaggregated violent event data for the North Caucasus of Russia from the start of the second Chechen war, August 1999, to July 2010. We employ a diffusion perspective to examine the spread of the conflict from its Chechen nucleus and we identify the tit-for-tat nature of the conflict between the rebels and the military/police forces as especially significant in understanding the conflict's dynamics and spread to neighboring republics. A space-time analysis shows that violence is concentrated at short temporal intervals and geographic distances. As the insurgents in the violence have changed from a dominantly nationalist to Islamist, the geography of the war has become more diffuse across the Muslim republics of the region, rendering the Russian counter-insurgency efforts more challenging.

1 Introduction

Despite the welcome recent attention to the "geography" embedded in civil wars that is evident in dozens of studies published in political science over the past decade, the range of such geographic analysis is still quite constrained. While there was little discussion or consideration of geographic factors in quantitative international relations during the Cold War (notable exceptions were studies of the effects of territorial disputes and shared borders such as Siverson and Starr, 1991), the study of the spatio-temporal dynamics of disaggregated civil war events has not yet grasped the essential nature of the geographic perspective and remains constrained by a geometric mindset (countries as locations, not as places, and as data-points, not as contexts) that characterized Cold War-era studies. While the new disaggregation approach to civil war study has yielded a spate of data, the methods typically used to analyze this information have remained firmly within the toolbox of non-spatial approaches and frequently do not take full advantage of the locational information embedded in the data

"Geography", as quaintly known in the field of international relations, is usually a perspective that considers distance from key locations and between key actors as explanatory variables in a model; it can also be a summary physiographic measure like "terrain" such as the ratio of territory above a certain height or that area covered by forest, as evident in the well-cited study by Fearon and Laitin (2003). As Hart (1997, 7) said in relation to his study of the 1916-21 Irish rebellion, "to understand the origins and

outcomes of the revolution, and the sources of its violence…we must understand its geography." But what McColl (1969, 614) wrote about rebellions more than 40 years ago is still accurate: "Virtually every aspect of the revolutionary process has undergone intense study. There remains one element, however, that has not received adequate attention. This is the geographic aspect in the evolution ... of revolutionary movement."

This paper is organized in three related analytical parts. First, we contribute to the expanding body of research on the disaggregated study of violence in civil wars through a focus on the multiple connected conflicts in the North Caucasus of Russia that erupted after the collapse of the Soviet Union in 1991. We examine the 11 years of localized violence after the beginning of the second Chechen war in 1999 by a diffusion analysis of violent events enacted by the rebels (a disparate set of actors) and by Russian military and police. Second, as a result of the splintering of rebellion along community, religious, and ideological lines that have been well-documented by political commentators (*Economist*, 2011), a geographic analysis of the rebel groups' actions yields both the mechanisms of conflict diffusion and evidence of governmental responses. Third, we hone methods of interaction derived from crime studies between the actors (rebels and military/police) to check if these interactions demonstrate consistent and predictable pattern of violence diffusions that suggest expectations of the future landscapes of conflict. Our emphasis is on the micro-geography of violence, an approach that is made feasible by the identification of its 14,613 precise.

2 The regional context of post-Soviet violence in the North Caucasus of Russia

The past two decades of North Caucasian conflicts can be divided into five phases. The first phase (1991-1994) were marked by a growing identity mobilization amongst the diverse peoples of the region, most notably, by the Chechens, one of four populations deported by Stalin in 1944 from the region to Central Asia (they were later repatriated in the 1950s). While the Russian government under Boris Yeltsin accepted limited autonomy for other Russian regions (e.g. Tatarstan), it refused to accept Chechen independence demands. The second phase corresponds to the first war, 1994-1996, that effectively allowed the Chechen rebel leadership to control the republic's internal affairs whilst still remaining in the Russian Federation. A weak federal center and an ineffective military campaign by Russian forces permitted the Chechen rebels to achieve most of their demands.

The third phase, 1996-1999, was marked by increased splits within the Chechen leadership, between moderates who dominated the government and more radical elements motivated by Islamic religious beliefs. The Islamists held that the rebellion should be extended beyond the borders of the Chechen Republic to the neighboring Muslim republics of Ingushetia, Dagestan, Kabardino-Balkaria and Karachaevo-Cherkessia (Figure 3). The launching of the attempt to spread Islamist influence and political control to the villages in highland Dagestan bordering on Chechnya in August 1999 marked the start of the fourth phase of the conflict. With the accession to power of President Vladimir Putin in 2000, the determination of the Russian state to resolve the Chechen crisis stiffened considerably. After ending the rebel incursion from the Dagestani mountains with the assistance of local militias, the Russian frontal assault on

the rebels in Chechnya from the north in autumn 1999 succeeded in taking Grozny, the Chechen capital in February 2000, and displaced the main rebel forces to the high mountains of the south of the republic by summer 2000 (Kramer 2005, 212-13).

As insurgent attacks continued despite federal control of Grozny and other key centers in the piedmont and steppes in the central and northern part of Chechnya, the Russian strategy of "Kadyrovization" (named after the Presidency of the Chief Mufti, Akhmad Kadyrov) developed. With the killing of much of the Chechen rebel leadership, both moderate and radical, and switching of former rebels to the Kadyrov camp (Ramzan Kadyrov succeeded his father who was assassinated in 2004), the war in the republic entered the most recent phase, of guerrilla attacks and a much lower level of violence after 2005 (estimates of the total killed in both wars are generally over 100,000). Kramer (2004-05, 12) described the conflict as a stalemate since rebels "continued to inflict enough damage on Russian soldiers to erode their morale and create the appearance of an endless, unwinnable war", but in 2006, the Russian government claimed that the war was won and the rebels routed (Baev 2006).

However, as the war was winding down in Chechnya after 2004, the conflict intensified in the region as a whole (Markedonov, 2010). By 2009, significantly more violent events were occurring in Ingushetia and Dagestan, the republics adjoining Chechnya to the west and to the east (Mendelson, Malarkey and Moore 2010; Howard, 2011; Kuchins, Malarkey, Markedonov, 2011). In a region where the biggest concern of ordinary people is economic insecurity and where corruption is rife and barely concealed (Gerber and Mendelson 2009), many young men have turned to Islam

(Markedonov, 2010). The attacks by the state forces on Islamists has furthered radicalized many and produced a tit-for-tat upsurge in violence by local military *jama'ats* (militant Islamic communities) who have increasingly attacked the organs of the Russian state and its local representatives (police, military, and political figures) (Kuchins, Malarkey, and Markedonov, 2011). By 2008, the Chechen rebel leadership was integrating their separate military campaign with the wider opposition to Russian presence in the region under the aegis of the "Caucasian Front" This latest chapter of the North Caucasian conflicts has not yet reached its dénouement, though predictions of wider and deeper conflicts are common despite President Medvedev's declaration of the end of "counter-terrorism actions" in Chechnya in April 2009 *(North Caucasus Analysis* May 22, 2009; Zhukov 2012).

3 Revolutionary movements and geographic modeling

For almost a decade, disaggregated studies of civil strife have detailed abstract theories about violence at the individual level with many following the individual rational choice model that is criticized by Kaufmann (2004). These theorists then fit their models at the aggregate level, thus generating a mismatch between theory and analysis (Cederman and Gleditsch 2009) and between the micro- and macro-scales of theory and empirics (Kalyvas 2008).

Unlike research on civil wars that premises its micro-foundational assumptions on rational choices by governments, rebels and civilians, our approach adopts a meso-scale perspective and an aggregate data analysis. We return to the writings of the geographer

Robert McColl (1967, 1969) who closely examined the writings of Mao Tse-tung and other Asian revolutionaries. While McColl's main interest was the identification and mapping of revolutionary strongholds and growth for purposes of counter-insurrectional policies, his theories of rebel territorial strategy guide our models of the diffusion of violence in the North Caucasus.

McColl's reading of the revolutionaries' documents and memoirs led him to conclude that knowledge of the local social, ethnic and physical geographies is crucial to advancement of their movements and successful military campaigns. For revolutionaries who are attempting to take control of the state apparatus, his summary (1969, 616) that "(s)uch a process requires intimate adjustment to the realities of both the physical and human geography of the country" can most effectively be verified with geolocated data and spatial analytical tools.

For McColl, rebels begin their territorial drive by fixing a set of initial, small bases mostly in the countryside, and then try to expand from them. Similar patterns of insurgent expansion in other civil wars have been noted by Kalyvas (2008), by Lyall (2009) for the North Caucasus and by Henriksen (1976) for former Portuguese colonies of Africa. These initial footholds, based on deep knowledge of local socio-economic and ethnic geographies of a region in turmoil, are typically associated with the home province of rebel leaders, and benefit from a network of friends, relatives and neighbors.

McColl (1967) believed that a set of principles that guided insurgent strategies. The most attractive locales for revolutionary activity (where mobilization activities would

have their highest payoff) are in areas with previous unrest, where political stability at the local level is lacking. Choosing rebel base locations should also be predicated on both protective (self-sufficient and located in a favorable terrain) and attack considerations, accessible to key political targets: "(b)ases cannot simply be located where they would be safe due to topography or distance from the enemy" (Mao Tse-tung, *Selected Works* 1954 quoted in McColl 1967,155). Once established, bases should not be abandoned except under the most dire circumstances.

Though not referencing the McColl work, Kalyvas (2006, 2008) also adopted a territorial perspective in a predictive model that scales control on a five-point spectrum (from 1= incumbent control to 5 = insurgent control), and anticipated that conflict would be most intense in the middle zones. Evidence from Greece and Vietnam lend support to the approach and allowed Kalyvas (2008, 417) to conclude that while disaggregation is essential for understanding civil war dynamics, a focus on territorial control is needed for modeling violence. Simple mapping of violence suggests the validity of the territorial perspective but it does not take advantage of the suite of methods developed specifically for analysis of geographic data.

The post-1999 conflict in the North Caucasus differs from the McColl model that assumes a growing and successful insurgency across four stages. In the first stage, "mobile war" is a result of insurgent weakness who move continually to avoid defeat. If a movement is sustainable, the key (second) stage of establishing a rebel base can be achieved. Expanding from these bases, insurgents have the core support to enter the stage of "guerrilla war" in the third phase. If this war is prosecuted successfully, a

parallel state (insurgent state) can be formed, completing the "territorial imperative" (last stage). The Chechen rebels had achieved this "insurgent state" status by 1996. Because the rebel movements ebbed and flowed rather than grew (as in the McColl model), we expect the geography of North Caucasus violence to show more complicated trends – from an "insurgent state" status back to "mobile war". We set out two propositions below that steer our expectations.

Though geography and related disciplines have a long tradition of using the diffusion paradigm to study important social and political topics, such as crime (Cohen and Tita, 1999), disease (Cliff et al, 1981), democracy (O'Loughlin et al, 1998), legislative innovations (Gray, 1973), and housing deterioration (Odland and Barff, 1982), its application to the study of conflict is haphazard. During the Cold War and immediate post-Cold War years, the spread of violence across borders (Most and Starr, 1980, O'Loughlin 1986, Kirby and Ward, 1987) was modeled in a diffusion framework. For the past half-decade, the civil war dynamics of weak states, mostly in Africa, have been mapped but are generally static studies of one (aggregated) time-period. With the growing availibility of geolocated conflict event data for multiple dates, diffusion studies are now possible, as illustrated by the preliminary works by Weidmann and Ward (2010) for Bosnia-Herzegovina and by Schutte and Weidmann (2011) for four pilot sites. Though not adopting a specific diffusion perspective, O'Loughlin and Witmer (2011) suggest that the violence in the region of the North Caucasus up to summer 2007 was beginning to show signs of diffusion in the increased level of hostilities beyond the borders of Chechnya. This paper takes up that theme by

extending the violence data to summer 2010 and by avowedly adopting the diffusion model.

In our analysis, we test two specific propositions that emanate from the literature on civil war dynamics and the North Caucasus political developments.

> **Proposition 1:** As a result of rebel tactics and Russian counter-insurgecy strategy, violence will follow a spatial diffusion pattern from concentration in and near Grozny in 1999-2000 to dispersal over the wider North Caucasus area over the succeeding decade.

To test this proposition, we separate the point-specific data into rebel and military/police violence. (In the region, local and federal police coordinate activities with the various Russian military forces and we combine them into one category). We present measures of geographic concentration or deconcentration for the geolocated events over time to clarify the level of spatial fragmentation and diffusion of the violence. Our expectation is that patterns of violence should reflect the reverse of the changes in rebel and military strategies as described in McColl (1967, 1969) for a resurgent rebel movement.

> **Proposition 2:** The factors that undergird rebel strategy in McColl's review of revolutionary movements are visible in the spatial and temporal trends in the decade-long conflict. By examining the interaction between rebel and

police/military events in a space-time framework, the spread of the violence from its Chechen core will be evident in predictable diffusion trends.

The violence data for this study are a subset of the larger database of 16,613 violent events for the North Caucasus between August 1999 and July 2010. The larger dataset includes four kinds of events – with three sets of actors – the Russian military, federal and local police, and rebel forces. The fourth set is a mass arrests category that recognizes the widespread use of this tactic by Russian forces in the region but because the tactic is all-encompassing, most of the those arrested are civilians and thus, hard to classify as one side or the other in the conflict. In this paper, we focus on rebel, military, and police events only and combine military and police into one category, a total of 14,613 events. Event data were coded from media reports available via Lexis-Nexis for political violent events only (criminal violence was omitted). We do not use casualty figures or other measures of severity since we cannot rely on the accuracy of these numbers due to the highly-inconsistent claims by both sides in the conflict.

4 Violence in the North Caucasus – A space-time perspective

Of the 8,315 military/police actions in the North Caucasus, 1,641 occurred in the peak year of violence (August 2001-July 2002) with the lowest value in 2008-09 with 145 events. (Since the second Chechen war began in August 1999, our yearlong periods run from August 1 to the following July 31). Of the 6,006 rebel events, 832 events occurred

in 2001-02 the highest year and 346 in the lowest year for rebel actions, 2006-07. Though most events were geolocated to the nearest town or village, for some, the best location was a district (*rayon*) for 1,783 events or republic for 2,001 events. In these circumstances, we allocated events to the respective centroids. For detailed analyses that required a higher spatial resolution, *rayon* and/or republic geocoded events were excluded.

To assess the overall trends in violence, we plot the 25 week running average (about 3 months before and after a given week) for weekly rebel and military/police from 1 August 1999 through 31 July 2010 (Figure 1). Smoothing the weekly data over time illustrates overall trends for the two main types of violence. For a brief period at the onset of the conflict, rebel violence exceeded military/police violence, but the military/police response quickly strengthened and remained dominant through 2006. 2007 was a year of transition as military/police actions increased briefly before declining into 2008 and later. In contrast, rebel violence remained steady overall, and developed a distinct seasonal cycle, with more violence occurring in summer months than in winter. In the latter two years of the series, rebel violence is at its highest point in nearly a decade.

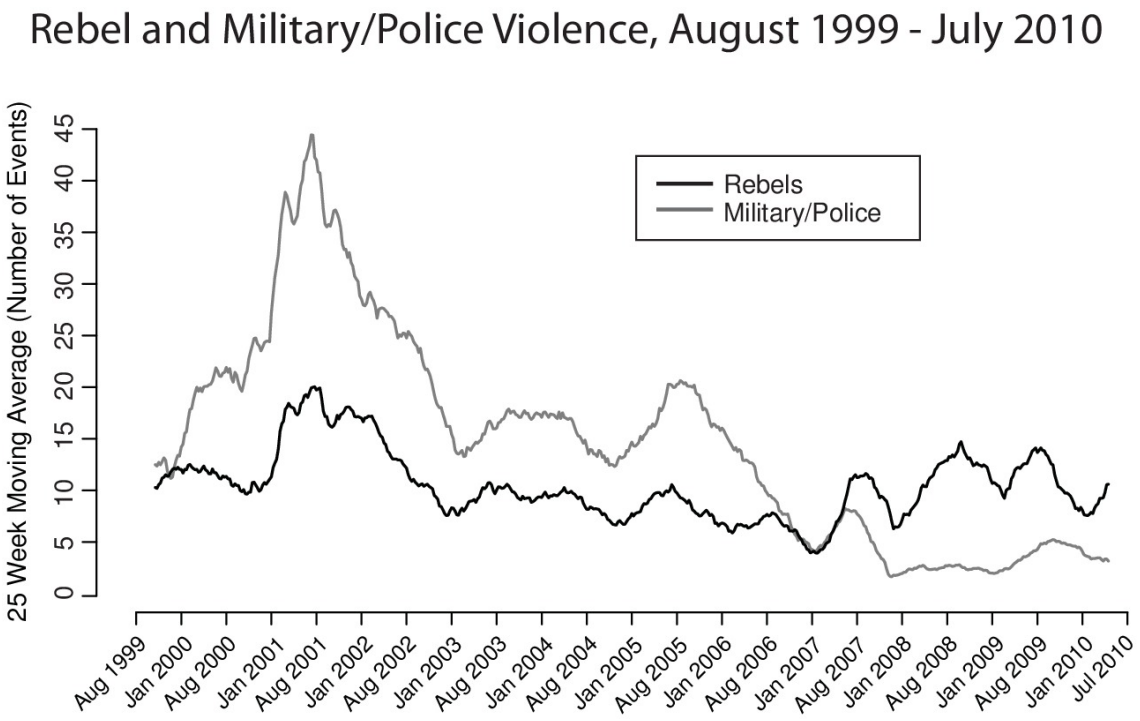

Figure 1. Rebel and Military/Police Violence in the North Caucasus, August 1999 – July 2010.

To measure temporal dependence (events in one period related to events in previous periods), we calculated the autocorrelation (ACF) and partial autocorrelation functions (PACF) for weekly rebel and military/police violence for lags up to twenty weeks. After a lag of one week, the ACF plot drops off dramatically, though remains statistically significant out to twenty weeks (graphs not shown). The ACF/PACF analyses show military/police events much more time-autocorrelated than rebel events.

To visualize the distribution of violence over space and time, we aggregate violence to a set of 25km x 25km grid cells (292 in total, shown on Figures 2 and 7).

By mapping the grid cell by the year when the monthly maximum violence occurred, the diffusion of violence from Chechnya to the adjoining ethnic republics over the past decade is evident (Figure 2). Simultaneously, the cumulative plots of violence by type

(rebel or military/police) for the grids of the capital cities of the four most violent republics shows the leveling off of both types in Grozny after 2005, the sharp uptick in rebel attacks in Nazran' (Ingushetia) after 2005 but not in the military/police actions, the closely parallel steady rise in both kinds of violence in Makhachkala (Dagestan) and the small but noticeable upward trend in Nal'chik (Kabardino-Balkaria) in the 2006-10 period.

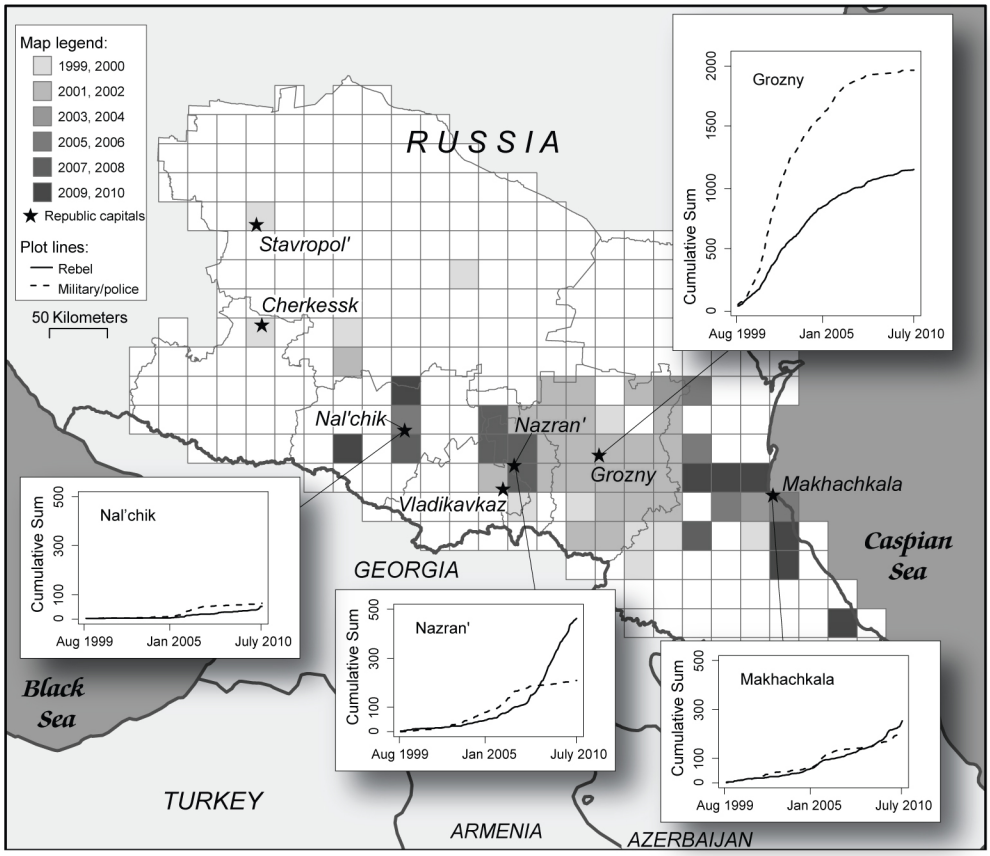

Figure 2. Year of maximum grid-month violence and cumulative plots of rebel and military/police violence for key cities.

We simplify the complex spread of violence over time by collapsing the point locations to a single dimension defined by a dominant west-east axis that is aligned in the same way as the main federal highway of the region (O'Loughlin and Witmer, 2011). The axis begins north of Cherkessk (Karachaevo-Cherkessia), runs through Grozny (Chechnya), and continues south of Makhachkala (Dagestan) (Figure 3). Violent events were placed on the axis at the closest perpendicular point. The orientation of the west-east axis also mirrors the overall distribution of events north of the Caucasus mountains running west-east along the Russian borders with Georgia and Azerbaijan. Figures 4 and 5 show changes in the distribution of violence over time along this straight-line west-east axis

Figure 3. The North Caucasus region with the republics and their capitals and the East-West baseline for constructing the spatial histograms in Figure 4.

. In Figure 4, the dashed line represents the one-dimensional spatial histogram along the west-east axis for all violent events during the eleven year period. Each yearly plot shows the spatial distribution by 20 kilometer units and the solid line plots its normal distribution. Using the dashed line as the reference distribution for all the plots, it is clear that the violence started just east of the center in 1999, was highly concentrated in and around Grozny (Chechen capital) during 2002 and 2003, and shifted west of center in 2006 - 2009. The flattened distribution of the later years reflects the increasingly scattered and irregular nature of the conflict as violence increases in Ingushetia (to the west of Chechnya) and in Dagestan (to the east). This is also evident in higher values in the bar graphs for cities other than Grozny after 2007.

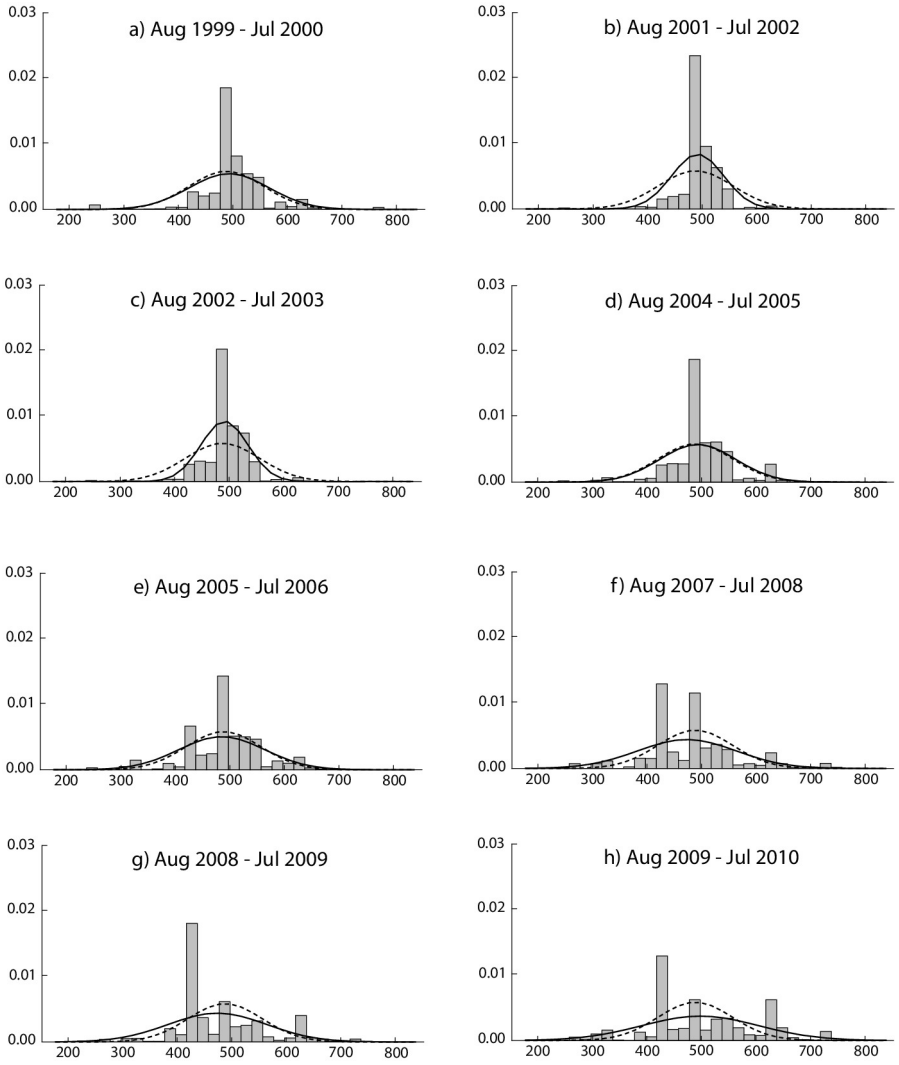

Figure 4. Annual west-east axis distribution of violence with probability on the x-axis, and distance (km) from west to east on the y-axis (Grozny = 480 kms). Black dashed line represents the distribution for all years and is consistent across all graphs.

Using the same west-east axis of Figure 3, the mean center and standard deviational of violence trends on a monthly basis are plotted in Figure 5. Given the evident inter-monthly variation, a third degree polynomial fit to the data helps to visualize the regional trend in violence over time. As seen in Figure 4, violence is initially centered towards the east on the Chechnya/Dagestan border (km. 530) but quickly shifts

westward and remains concentrated just east of Grozny through 2004. After summer 2007, the mean center moves even further east, weighted by the increased violence of Dagestan. During the heaviest fighting in 2001 and 2002, two-thirds of violence was within about 50 km of Grozny.

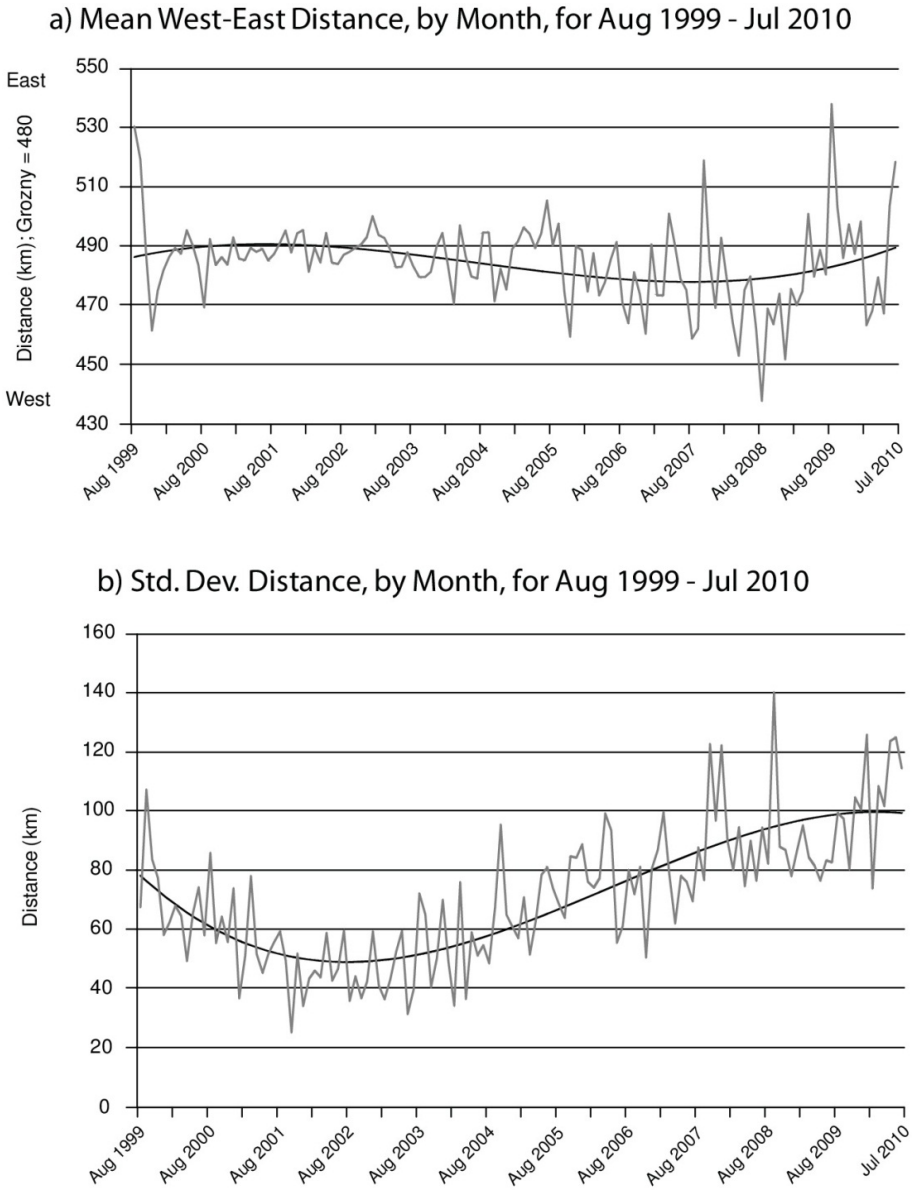

Figure 5. Monthly mean and standard deviational west-east distance.

Extending McColl's territorial model of revolutionary violence to the North Caucasus demonstrates the reverse of his expectation; a weakened rebel movement lost its main base (Chechnya) and was forced to more inaccessible and scattered locations. Though Chechnya overall accounts for 64.7 percent of rebel actions and 81.4 percent of military/police actions in the database, its importance diminishes over time. The success of the "Kadyrovtsi" strategy means that rebels are again forced into stage 1 of McColl's model, that of mobile war. From the government side, the tactic is both hard to anticipate and to counter since rebels have been able to find support well beyond their original Chechen bases.

5 Tit-for-tat violence in the North Caucasus: Rebel and military/police interactions

The tit-for-tat nature of irregular warfare is well documented in studies, from the Irish war of independence 1919-1921 (Hart 1999) to the Greek civil war (Kalyvas 2006) and to a quasi-experimental study of rebel actions in response to Russian shelling of Chechen villages (Lyall 2009). Like other works of this genre, the emphasis is on the congruence of spatial (locations) and temporal (dates) actions. If the action-reaction mode of conflict is dominant in the region, one would expect a significant concentration of subsequent events within a short distance and time span (proposition two). As well documented in diverse contexts of civil war dynamics, violence tends to be unevenly concentrated across urban and rural locations, and has been modeled using the population, physical geographic, transportation and military features of the locations (Dixon 2007; Fearon and Laitin 2003; Hart, 1999; Kalyvas 2006, 2007; Kramer 2004-05;

O'Loughlin and Witmer 2011; Townsley, Johnson and Radcliffe, 2008 and Zhukov, 2012). Our perspective here identifies the dynamics of conflict irrespective of the characteristics of the places.

We explicitly explore the interactive nature of rebel and military/police actions in the North Caucasus by using daily records to consider the distances between rebel and subsequent military/police violence. For each rebel event, the median distance to all military/police events during the subsequent week is calculated (averaged for days with multiple rebel events). Both scholarly work and participant accounts of civil wars indicate that most military/police actions are in response to some prior incident; many events in our data base note this connection. We limit the temporal dimension by setting a conservative upper limit of one week, though some events, especially those that are highly destructive of property or high in casualties, are likely to have repercussions lasting many months or more.

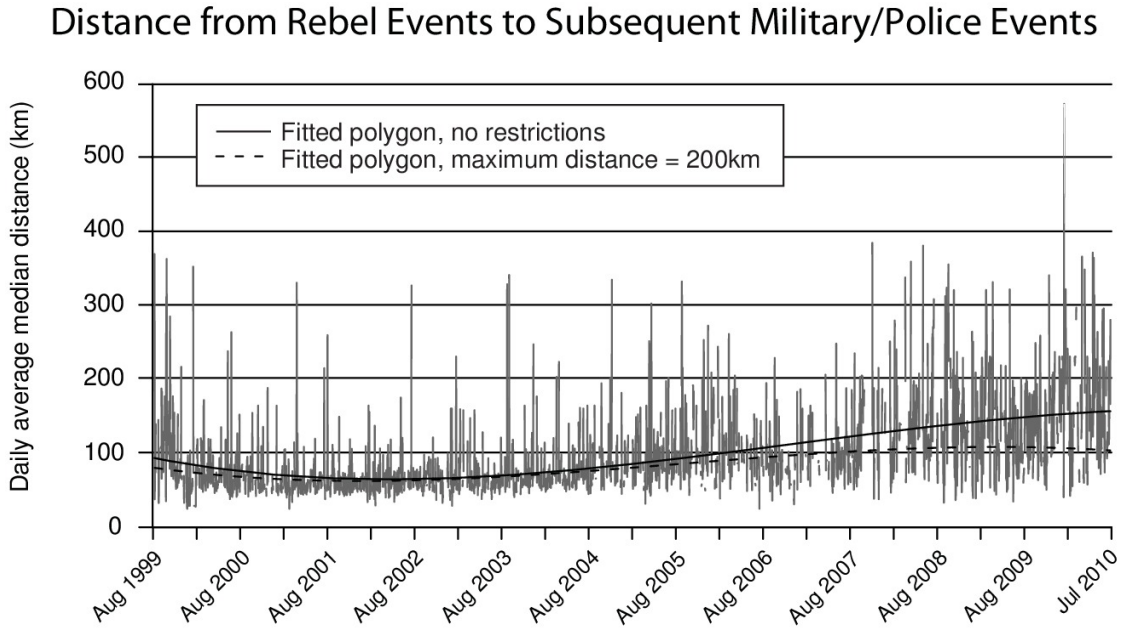

Figure 6. Distance from rebel events to military/police events in the subsequent week.

The results with a fitted third degree polynomial (solid line) to show the trend are found in Figure 6. At the height of the violence in 2001 and 2002, the average median distance from rebel events to subsequent military/police violence was at the lowest, bottoming out at a period when the war was most intense and fought mostly in Grozny and the surrounding districts (*rayoni*) of Chechnya. After the Russian forces took control of the Chechen capital and the conflict devolved to a guerrilla hit-and-run pattern, the distance between an attack and subsequent military/police responses generally rose. In order to preclude the possibility that the distances are disproportionately affected by a few extreme values we imposed a maximum distance restriction of 200km for a violent event to be considered as a reactive one (dashed fit line on Figure 6). Eliminating large distances between rebel and military/police events assumes little connection between an initial rebel event and subsequent military/police action. This restriction has no effect on the overall trend to the end of 2006 (around the time when the Russian government declared victory in the conflict) but the polynomial lines diverge after that date. No longer concentrated in Chechnya, the North Caucasian war is reflected in a dispersed tit-for-tat pattern across a large region that includes the adjoining ethnic Russian territory of Stavropol' where attacks have occasionally occurred. Though impossible to certify any rebel attack as a reprisal for a military action despite sporadic claims by the insurgents through their website (www.kavkazcenter.com), attacks within 200kms are far more likely to be connected to specific previous actions by the other side. The growing gap between the two trend lines in recent years, thus, reflects a widening of the war to outlying republics.

We also explore the relationship between rebel and military/police violence by calculating space-time probabilities of the interactions between events (Table 1). To calculate these probabilities, we create a grid-week (25 km grid cells) space-time unit to aggregate violent events; 1 indicates violence occurred anywhere in the grid cell during the given week, and 0 otherwise. The conditional probabilities are then calculated for time lags up to 8 weeks and space lags up to 3 neighbors away (using the queen contiguity for the geographic grids). For instance, for one or more rebel events in a given grid-week, Table 1a show the probability of at least one military/police event occurring in the same grid-week (t_0, nb_0), in the following grid week (t_1, nb_0), in any of the neighboring grid cells in the same week (t_0, nb_1), etc.

Overall, the probabilities in Table 1 show that violence is more persistent over time than across the space. For both rebel (36.8%) and military/police violence (31.6%) distributions, even after 8 weeks, there remains a good chance of opposing group violence occurring (first column of table 1). By contrast, the probabilities decline rapidly over distance as the number of neighbors away from the original violence cell increases, despite the fact that total grid cells increase from 8, to 16, to 24 for non-boundary grid cells given a distance of 1, 2, or 3 neighbors, respectively (comparisons across the rows of table 1). The probability values for each spatial lag remain almost constant across the time bands.

Comparing the probabilities in Table 1a and 1b shows a consistently higher probability of military/police violence following rebel violence for the same grid cell, as well as for second and third order neighbors. Only for first order neighbors is the

probability of rebel violence following military/police violence slightly greater, possibly direct retaliation in the specific community for military/police killings (Howard, 2011). These comparisons reflect, in part, the overall greater numbers of military/police actions (2.44% non-zero occurrence for all 167,024 grid-weeks) compared to rebel violence (2.15% for all grid-weeks). Because civil wars are highly localized in certain key urban centers, near important targets or by geographically-differential support for rebels, they take on the character of 'hot spots' of violence. In these locales, violence is repetitive, recurrent and entrenched. Our data show that one should expect an overall 4 in 10 chance of a military/police action after a rebel event for each of the following 8 weeks in the same grid and about a 1 in 3 chance of a rebel response. However, these general expectations are strongly differentiated across the region.

Table 1. Space-time conditional probabilities.

Table 1a. Conditional probabilities (%) for Military/ Police violence given Rebel violence

		Spatial Lag (neighbors)			
		nb_0	nb_1	nb_2	nb_3
	t_0	41.79	8.19	4.47	3.02
	t_1	38.87	8.10	4.47	3.00
	t_2	38.47	8.03	4.41	2.96
Time	t_3	37.69	8.03	4.42	3.00
Lag	t_4	36.98	8.01	4.39	2.97
(week)	t_5	36.59	7.89	4.40	2.93
	t_6	37.01	7.97	4.39	2.95
	t_7	36.59	7.92	4.40	2.92
	t_8	36.82	7.85	4.33	2.95

Military/Police overall prob = 2.44%

Table 1b. Conditional probabilities (%) for Rebel violence given Military/Police violence

		Spatial Lag (neighbors)			
		nb_0	nb_1	nb_2	nb_3
	t_0	36.54	8.64	4.90	2.95
	t_1	33.77	8.43	4.83	2.97
	t_2	33.35	8.49	4.89	2.93
Time	t_3	31.39	8.45	4.79	2.89
Lag	t_4	32.42	8.40	4.82	2.90
(week)	t_5	32.39	8.41	4.83	2.93
	t_6	32.15	8.40	4.83	2.88
	t_7	31.39	8.35	4.81	2.92
	t_8	31.58	8.24	4.81	2.92

Rebel overall prob = 2.15%

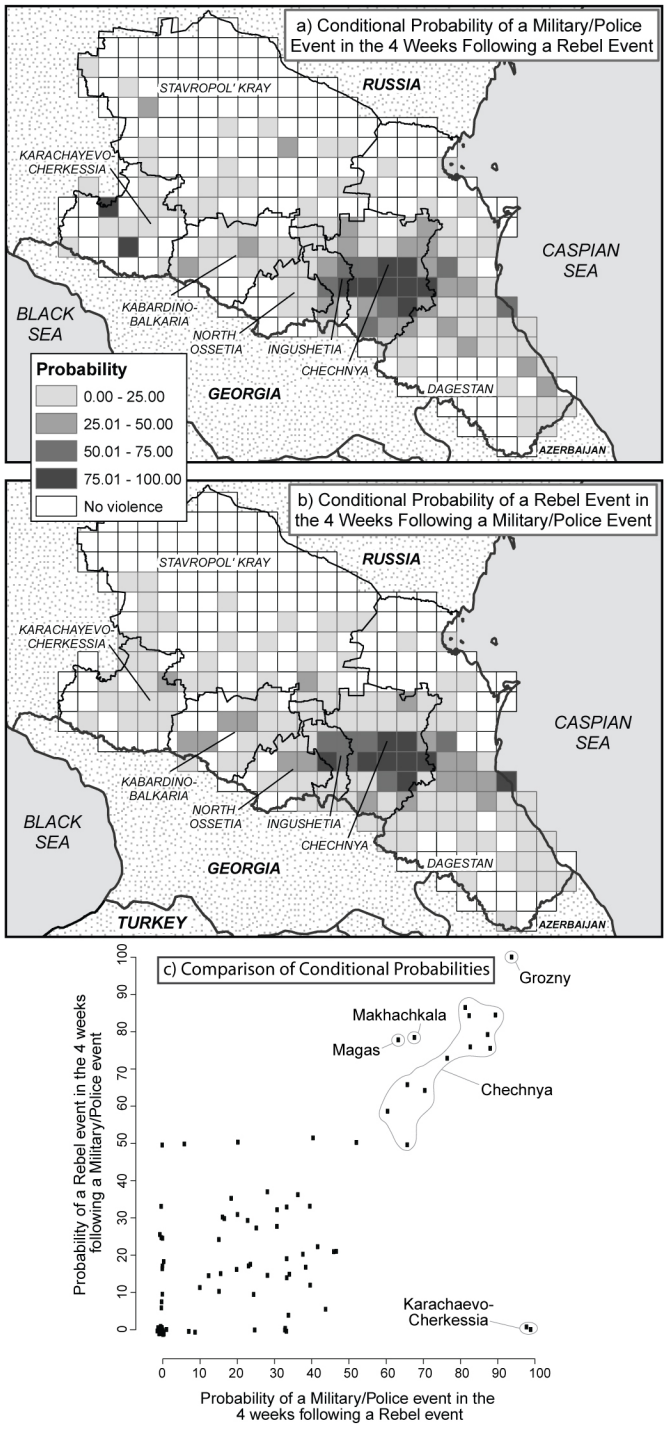

Figure 7. a) Conditional probabilities of a military/police event in the 4 weeks following a rebel action, by grid-cell all years; b) Conditional probabilities of a rebel event in the 4 weeks following a military/police action, by grid-cell all years; c) Grid-cell comparison plot of both types of conditional probabilities.

The distributions by grid-cell of the probabilities indicate the localized concentration of the conflict in key locations (Figure 7a, 7b, 7c). The maps show the conditional probabilities for rebel and military/police violent events in the subsequent four weeks following the opposite category of violence. For instance, grid cell probabilities for Figure 7a were generated by counting the number of weeks experiencing at least one rebel violent event (denominator) and then for those weeks, tabulating the number thatalso had a military/police violent event in the following four weeks (numerator) in that grid. A similar method was used to generate Figure 7b. The overall grid-cell proportions for both types of events are plotted in Figure 7c.

The maps and plot specify the locations that are dominated by rebel violence preceding military/police violence and vice versa. Grozny and several other Chechnya grid cells (12 in total) have high conditional probabilities for both directions of the relationship. In all, 17 of the cells on Figure 7a (a military/police event following a rebel action) and 15 of the cells on Figure 7b (a rebel event following a military/police action) show conditional probabilities of over 50%. The concentration in Chechnya is not surprising since the majority of all violent events (10,654 of 14,613) over the 11 year period occurred in this republic. The borders of Chechnya (with the small republic of Ingushetia to the west and the western parts of Dagestan on the east) also show high conditional probabilities of tit-for-tat responses in both directions. Though these values are unsurprising given the intensity of the war in these hot spots for many years, the two remote grid-cells in Karachaevo-Cherkessia (corresponding to the districts of Karachayevsky and Zelenchuksky) are easily visible in Figure 7a with high probabilities

(near 100%) of military/police responses following rebel actions. This republic saw sporadic activities by an Islamic military *jama'at* that resulted in a strong response by the local authorities (Titova 2008). Similarly, local *jama'ats* are highly active in other scattered locations distant from Chechnya as the cities of Makhachkala and Magas (capitals of Dagestan and Ingushetia, respectively) are also notable in showing higher probabilities of rebel violence following a military/police event on Figure 7b.

The map and plot show the uneven nature of the North Caucasian conflicts, its hot spots and the disparate level of recent rebel action, mobilized under the banner of Chechen independence in early years but increasingly tied by a commitment to the idea of a "Caucasian Emirate" (Kuchins, Malrkey and Markedonov, 2011). Local *jama'at* leaders maintain a great deal of local autonomy under general direction and goals of the "Emirate" leadership. In the districts of most intense violence, especially Chechnya, the specific actions-reactions of both sides of the conflict are difficult to match because of the constant presence of fighting. In outlying districts, such relationships are easier to track and unequivocal public statements by both sides about the motivations for the respective actions emphasize the relationship of the attacks and responses.

6 Space-time interaction dependence in North Caucasus violence

After presenting descriptive ratios and cartographic displays of the conditional probabilities, in this section, we explicitly incorporate the temporal dimension into our spatial analysis to statistically assess the level of space-time interactions for rebel and military/police violence in the North Caucasus. The method we employ was initially

used to detect space-time dependence in leukemia cases (Knox 1964), and more recently in residential burglary in US cities (Johnson et al. 2007) and wartime violence in Iraq (Townsley, Johnson, and Ratcliffe 2008). The Iraq application examined space-time patterns of improvised explosive devices (IEDs) during a 3 month period in 2004 and found that IED attacks are significantly clustered within 2 days and within 1 km of each other.

This method builds on information about space and time distances by identifying all event pairs (n events yields n*(n-1)/2 event pairs). For each pair, we calculate the distance between events in kilometers and the time separation in days and from these pair calculations, construct a two-dimensional histogram of event counts based on space and time bins. For example, the first bin might use a time range of 0-4 days and a distance range of 0-2 km to sum all event pairs that fall within these space-time constraint bins.

Though the counts for each bin are of interest, we focus on the space-time bins that exhibit more violence than expected by chance. Rather than expecting the event pair counts to follow a Poisson distribution with its unrealistic assumption of independent violent event pairs, we opt to use Monte Carlo simulation that does not require such assumptions. This method retains the original event locations and randomly permutes the observed event dates to construct a simulated set of violent events where violence cannot occur in any place (which would be unrealistic given the highly uneven patterns of human settlement in the region), but is instead constrained to where we know violence occurs. We construct 99 such permutations to yield a total distribution of 100

after adding in the counts from the observed data. An empirical p-value is then calculated for each space-time bin based on the rank position of the observed data within this distribution (North, Curtis, and Sham 2002).

We applied the method to both rebel and military/police events, splitting the study time period at the end of July 2006 coinciding with a marked decline in Russian military and police activity (see Figure 1). Figure 8 shows results using a uniform temporal bin of 4 days to a maximum of 80 days and two spatial bins, one of width 2 km to a maximum of 30 km and the other of width 10 km to a maximum of 200 km. Each figure indicates the number of violent events, n, used to generate the event pairs. Given the precise distance calculations required for this analysis, only events geocoded to specific towns were included (11,472 events of the 14,613 total military/police and rebel events).

For both rebel and military/police violence, little space-time clustering occurs beyond 50 kms, whereas for distances less than 2 kms, repeat violence consistently occurs up to 16 days. Indeed, for all but military/police violence after July 2006, higher than expected violence consistently occurs for distances less than 2 kms for at least 80 days confirming the persistence of violence at these short distances. The most intense space-time clustering is for military/police violence through July 2006, reflecting the more coordinated nature of the operations and their concentration in and around Grozny at the height of the war.

Since much of the violence is concentrated in Grozny, it is sometimes possible to detect a 'Grozny-effect' looking at the smaller 2 km bin sizes. For instance, there is a noticeable and significant increase in rebel violence clustering between 14 kms and 16

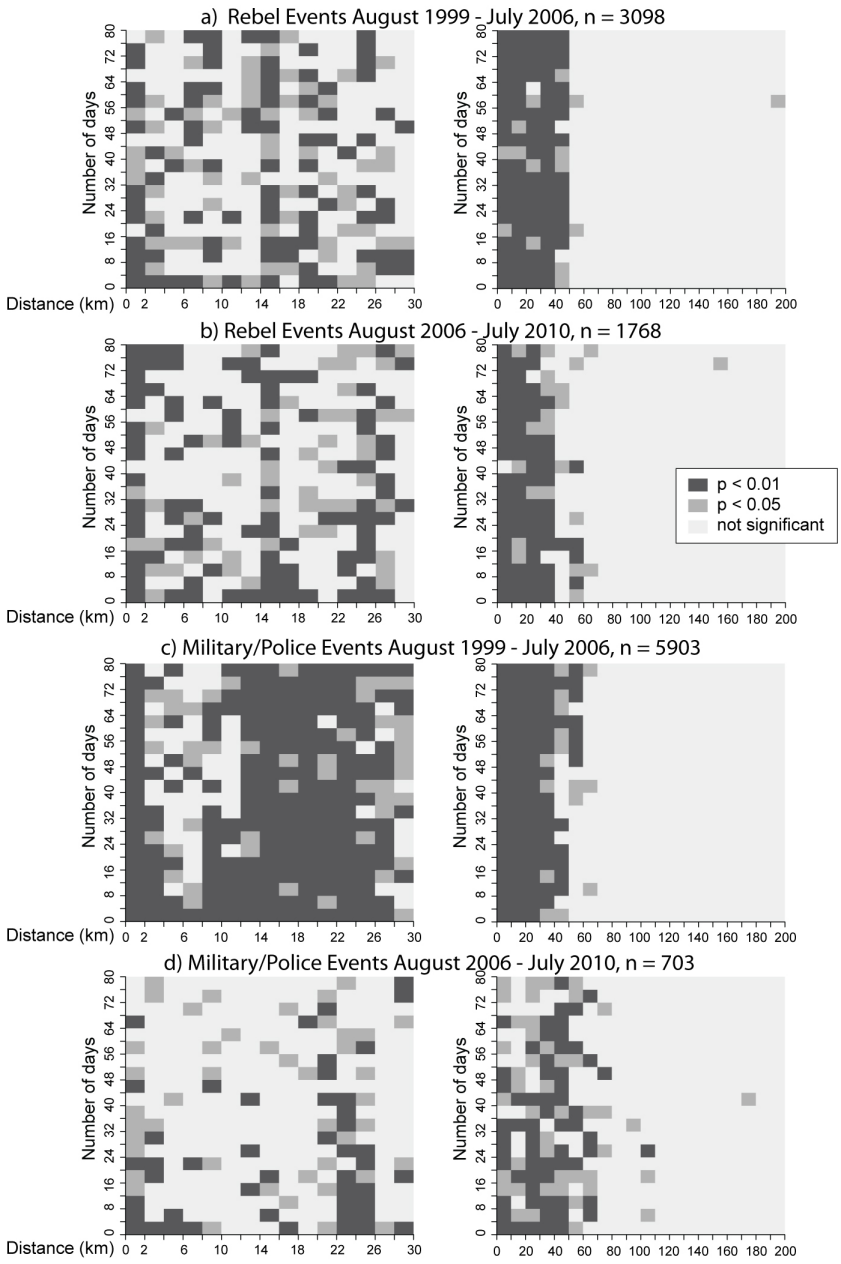

Figure 8. Space-time dependence in rebel and in military/police events, 1999-2010.

kms (Figure 8c). This is due to the higher than expected violent event pairs for Grozny and the town of Argun to the east. Clustering in the 22 km – 26 km range reflects that distance separating towns, such as Grozny and Urus-Martan, Grozny and Shali, and

Khankala and Urus-Martan, all in Chechnya. Like the Iraq study of insurgent violence (Townsley, Johnson and Ratcliffe, 2008), violence in the North Caucasus shows strong space-time dependence at short distances. Whereas the profile of dependence in rebel actions retains its character after August 2006, the military/police dependence is dramatically lowered after that date. Rebel actions reoccur significantly in the same places but military/police actions have become less concentrated. This provides evidence that military/police strategy has changed dramatically since August 2006, while rebel violence has remained concentrated.

7 Discussion and Conclusions

Like previous studies of recent guerrilla wars in Iraq (Townsley, Johnson and Ratcliffe, 2008) and Afghanistan (Benini and Moulton, 2004), we have shown that the interaction between government and rebel forces is predictable and is concentrated over short time and spatial dimensions. The best predictor of the future locations of violence in a civil war is the past pattern as conflict takes on a strongly localized character. Our spatial analysis of this diffusion quantifies a pattern that is widely discussed in media accounts of the North Caucasus violence, but difficult to visualize without the extensive database compiled here. As expected from McColl's (1969) model, rebel strongholds tend to remain 'in situ' and in a period of rebel ascendancy, the conflict spreads from these bases towards governmental centers and strategic targets. In a phase of rebel retrenchment, the strategy for rebels is both to continue to launch attacks from these bases and to disperse and diffuse to other locations from which to continue the fighting.

In the North Caucasian case, the rebel defeat and retreat from Grozny in 2000 and the increased federal control (with local allies) of Chechnya by 2006 pushed the rebels into increasingly isolated positions, in the mountains and in adjoining republics. At the same time, the insurgency took on a (partly) different character, one that appealed to the establishment of a Muslim "Emirate" across the whole North Caucasus. Our maps and graphs, our identification of spatial dependence and our space-time analysis of the probability of recurring violence in response to that of the other side, tracks these developments effectively and clearly shows the diffusion of the violence from its Grozny core over the past decade.

Schutte and Weidmann (2011) have suggested, based on quite preliminary modeling with coarse data for civil wars in Bosnia-Herzegovina, Rwanda, Burundi and Kosovo that these 1990s conflicts took on the character of both expansion (they call it escalation) and relocation diffusion. Based on Monte Carlo simulation, they conclude that these wars are primarily of the expansion type. In this type of diffusion, the locations change little but the agents of diffusion (in our case, rebel and military/police) increase in number over time. The North Caucasus wars since 1999 illustrate both types of diffusion, using Gould's (1969) typology. Expansion is evident in the cumulative plots for key centers, though the logistic curve typical of innovation diffusion processes is found clearly only in Grozny. The other centers are still characterized by early 'adoption' profiles. Relocation diffusion is also visible in the various maps that we have presented, most notably in the margins of the region. As Schutte and Weidmann (2011, 151) note, relocation diffusion should be most apparent in wars with clear front lines,

with expansion diffusion more prominent in civil wars. The North Caucasian conflicts have demonstrated properties of both types, though expansion diffusion is more common.

In this paper, we have argued for a more careful consideration of the so-called geographic factors in the disaggregated study of civil war through an emphasis on the approaches and methods of the diffusion paradigm. The conflicts in the North Caucasus have evolved from a frontline in Grozny, the Chechen republic, in the early stages of the war in 1999-2000 to a scattered pattern of guerrilla warfare on Russian forces and local allies by a myriad of locally-based rebels as this pattern of fragmentation is evident in the local violence density scores and maps after 2006. What remains uncertain though is why this fragmented pattern has developed and is intensifying. What accounts for the fact that one community has produced a mobilized anti-Russian population while adjoining and similar communities remain quiescent? In these differences lie a real aim of disaggregated study of civil war, one that must take the local context of such activity much more seriously.

References

Baev P K, 2006, "Has Russia achieved a victory in its war against terror?" *PONARS* Memo 415 Center for Strategic and International Studies (CSIS), 1800 K Street, NW, Washington, DC

Benini A A, Moulton L H, 2004, "Civilian victims in an asymmetrical conflict: Operation 'Enduring Freedom', Afghanistan" *Journal of Peace Research* **41** 403 – 22

Cederman L-E, Buhaug H, Rød J K, 2009, "Ethno-nationalist dyads and civil war: a GIS-based analysis" *Journal of Conflict Resolution* **53** 496 – 525

Cliff A D, Haggett P, Ord J K, Versey G R, 1981 *Spatial Diffusion: An Historical Geography of Epidemics in an Island Community* (Cambridge University Press, New York)

Cohen J, Tita G, 1999, "Diffusion in homicide: exploring a general method for detecting spatial diffusion processes" *Journal of Quantitative Criminology* **15** 451 – 493

Dixon J, 2009, "What causes civil wars? Integrating quantitative research findings" *International Studies Review* **11** 707 – 735

Economist 2011, "Briefing The North Caucasus: from Moscow to Mecca", 9 April 27 – 29

Fearon J D, Laitin D D, 2003, "Ethnicity, insurgency, and civil war" *American Political Science Review* **97** 75 – 90

Gerber T P, Mendelson S E, 2009, "Security through sociology: the North Caucasus and the global counterinsurgency paradigm" *Studies in Conflict and Terrorism* **32** 831 – 51

Gould P R, 1969 *Spatial Diffusion* Association of American Geographers, Resource Paper no. 4, 1710 16th Street, NW, Washington DC

Gray V, 1973, "Innovation in the states: a diffusion study" *American Political Science Review* **67** 1174 – 1185

Hart P, 1997, "The geography of revolution in Ireland, 1917-1923" *Past and Present* **155** 142 – 176

Hart P, 1999 *The IRA and its Enemies: Violence and Community in Cork, 1916-1923* (Oxford University Press, New York)

Henriksen T H, 1976, "People's war in Angola, Mozambique and Guinea-Bissau" *Journal of Modern African Studies* **14** 377 – 399

Howard G E (ed.) 2011 *Volatile Borderland: Russia and the North Caucasus* (Jamestown Foundation, Washington DC)

Johnson S D, Bernasco W, Bowers K J, Elffers H, Ratcliffe J, Rengert G, Townsley M, 2007, "Space-time patterns of risk: a cross national assessment of residential burglary victimization" *Journal of Quantitative Criminology* **23** 201 – 219

Kalyvas S N, 2006 *The Logic of Violence in Civil War (*Cambridge University Press, New York)

Kalyvas S N, 2007, "Civil wars in Boix C, Stokes S eds *The Oxford Handbook of Comparative Politics* Oxford University Press, New York 416 – 433

Kalyvas S N, 2008, "Promises and pitfalls of an emerging research program: the microdynamics of civil war", in *Order, Conflict and Violence* Eds S N Kalyvas, I Shapiro, T Masoud (Cambridge University Press, New York) pp 397 – 421

Kirby A M Ward M D, 1987, "The spatial analysis of war and peace" *Comparative Political Studies* **20** 293 – 313

Kaufmann C, 2004, "Rational choice and progress in the study of ethnic conflict: A review essay" *Security Studies* **14** 178 – 207

Knox G, 1964, "Epidemiology of childhood leukaemia in Northumberland and Durham" *British Journal of Preventative and Social Medicine* **18** 17 – 24

Kramer M, 2004-05, "The perils of counterinsurgency: Russia's war in Chechnya" *International Security* **29** 5–63

Kramer M, 2005, "Guerrilla warfare, counterinsurgency and terrorism in the North Caucasus: the military dimension of the Russian-Chechen conflict" *Europe-Asia Studies* **57** 209 – 290

Kuchins A C, Malarkey M, Markedonov S, 2011 *The North Caucasus: Russia's Volatile Frontier* Center for Strategic and International Studies (CSIS), 1800 K Street, NW, Washington DC

Lyall J M K, 2009, "Does indiscriminate violence incite insurgent attacks? evidence from Chechnya" *Journal of Conflict Resolution* **53** 331 – 362

Markedonov S, 2010, "The Caucasian cauldron" *Journal of International Security Affairs* **19** 123 – 128

McColl R W, 1967, "A political geography of revolution: China, Vietnam, Thailand" *Journal of Conflict Resolution* **11** 153–167

McColl R W, 1969, "The insurgent state: territorial bases of revolution" *Annals of the Association of American Geographers* **59** 613–631

Mendelson S E, Malarkey M, Moore L, 2010 *Violence in the North Caucasus: A Bloody Year* Center for Strategic and International Studies (CSIS), 1800 K Street, NW, Washington DC

Most B A, Starr H, 1980, "Diffusion, reinforcement, geopolitics and the spread of war" *American Political Science Review* **74** 932 – 946

North B V, Curtis D, Sham P C, 2002, , "A note on the calculation of empirical P values from Monte Carlo procedures" *The American Society of Human Genetics* **72** 498 – 499

Odland J, Barff R, 1982, "A statistical model for the development of spatial patterns: applications to the spread of housing deterioration" *Geographical Analysis* **14** 326 – 339

O'Loughlin J, 1986, "Spatial models of international conflicts: extending current theories of war behavior" *Annals of the Association of American Geographers* **76** 91 – 110

O'Loughlin J, Ward M D, Lofdahl C L, Cohen J S, Brown D S, Reilly D, Gleditsch K S, Shin M, 1998, "The diffusion of democracy, 1946-1994" *Annals of the Association of American Geographers* **88** 545 – 574

O'Loughlin J, Witmer F D W, 2011, "The localized geographies of violence in the North Caucasus of Russia, 1999-2007" *Annals of the Association of American Geographers* **101** 178 – 201

Schutte S, Weidmann N B, 2011, "Diffusion patterns of violence in civil war" *Political Geography* **30** 143 – 152

Siverson R M, Starr H, 1991 *The Diffusion of War: A Study in Opportunity and Willingness (*University of Michigan Press, Ann Arbor, MI)

Titova F, 2008, "Karachaevo-Cherkessia: a small war with big repercussions" *North Caucasus Analyst* **9** January 31

Townsley M, Johnson S D, Ratcliffe J H, 2008, "Space time dynamics of insurgent activity in Iraq" *Security Journal* **21** 139 – 146

Weidmann N B, Ward M D, 2010, "Predicting conflict in space and time" *Journal of Conflict Resolution* **54** 883 – 890

Zhukov, Y M, 2012, "Roads and the diffusion of insurgent violence: The logistics of conflict in Russia's North Caucasus" *Political Geography* 31 forthcoming (http://dx.doi.org/10.1016/j.polgeo.2011.12.002)